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HEMIEPIPHYSIODESIS IN PEDIATRIC ORTHOPAEDICS AS A TREATMENT OF KNEE DEFORMITIES

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Abstract: Hemiepiphysiodesis is a growth modulation technique widely used in pediatric orthopaedics to correct coronal plane deformities of the knee, including genu valgum and genu varum. The procedure involves temporary tethering of one side of the growth plate (physis) to harness the remaining growth potential and gradually realign the limb. Compared to osteotomies, hemiepiphysiodesis is less invasive, associated with fewer complications, and allows for gradual correction with minimal discomfort. This review outlines the anatomical principles, biomechanical rationale, surgical techniques, patient selection criteria, and postoperative follow-up protocols. Additionally, it addresses the limitations and potential complications of the procedure, emphasizing the importance of surgical timing and precise deformity analysis for optimal outcomes.
Keyword: Pediatric orthopaedics, hemiepiphysiodesis, growth modulation, genu valgum, genu varum, physeal tethering, 8-plate, coronal deformity correction, guided growth surgery.

Angular deformities of the knee joint, particularly genu valgum (knock-knee) and genu varum (bow-leg), are among the most common orthopaedic conditions in children. While many cases of physiologic deformity correct spontaneously with growth, persistent or progressive deformities may impair gait, induce pain, and predispose to patellofemoral maltracking, joint instability, and early-onset osteoarthritis. Surgical correction is indicated when the deformity is symptomatic, progressive, or exceeds physiological norms for age.

Historically, corrective osteotomies were the standard of care; however, they are invasive, carry significant morbidity, and often require prolonged rehabilitation. In contrast, **hemiepiphysiodesis**, a procedure that modulates growth by asymmetrically arresting one side of the growth plate, offers a less invasive and reversible means of correction. This approach capitalizes on the child's remaining growth potential and has evolved from early staple fixation to modern tension-band plating systems, such as the 8-plate, which provide more controlled and safer correction.

The growth plate (physis) is a cartilaginous structure responsible for longitudinal bone growth in children. Angular deformities can arise due to asymmetrical growth from either intrinsic physeal abnormalities or external mechanical stresses. Hemiepiphysiodesis works by inhibiting growth on one side of the physis, allowing the contralateral side to grow freely. Over time, this results in angular correction toward the mechanical axis.

This principle was first established by Phemister and further refined by Blount and Stevens, who introduced guided growth using flexible plating systems. The correction rate depends on:

- Patient age (younger children correct faster)
- Remaining growth potential
- Location of deformity (distal femur vs. proximal tibia)
- Etiology of deformity (idiopathic, metabolic, post-traumatic)

Hemiepiphysiodesis is primarily indicated in skeletally immature patients presenting with coronal plane deformities of the knee, such as genu valgum or genu varum, that are symptomatic, progressive, or exceed normal physiological alignment for age. Early

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intervention is particularly valuable in cases with significant deformity likely to result in mechanical axis deviation, which can lead to gait disturbances, patellofemoral instability, pain, and early degenerative joint changes if left untreated. Ideal candidates are typically children with at least 12–18 months of growth remaining, in whom gradual correction through growth modulation is feasible. Underlying etiologies may range from idiopathic deformities to pathological causes such as Blount disease, rickets, skeletal dysplasias, and post-traumatic physeal disturbances. It is critical to differentiate between physiologic variants and pathologic deformities, with the latter often requiring closer monitoring and more aggressive management.

The decision to proceed with hemiepiphysiodesis must account for the site of the deformity (distal femur, proximal tibia, or both), the degree and direction of angular deviation, and skeletal maturity. Long-standing anteroposterior standing radiographs of the lower limbs are essential for precise preoperative planning, enabling calculation of the mechanical lateral distal femoral angle (mLDFA) and medial proximal tibial angle (MPTA), which inform the level and side of the intervention. Deformities affecting both the distal femur and proximal tibia may require dual-level hemiepiphysiodesis. Additionally, growth prediction tools such as the Green-Anderson growth remaining chart or the Paley multiplier method assist in determining the optimal timing of intervention to achieve full correction without overcorrection.

Once surgical indication is confirmed, the operative procedure of hemiepiphysiodesis using a tension-band plate system, such as the widely used 8-plate or peanut plate, involves a minimally invasive approach. Under general anesthesia and fluoroscopic guidance, a small skin incision is made over the physis on the convex side of the deformity. The periosteum is gently elevated, and a two-hole plate is centered over the physis, with screws placed in both the epiphyseal and metaphyseal segments without crossing the physis itself. The tension-band construct functions by tethering one side of the growth plate, allowing the contralateral side to grow uninhibited, gradually realigning the limb over time. The choice of implant size and screw length must be age-appropriate and individualized based on bone size and quality. Both unilateral and bilateral procedures can be performed simultaneously, depending on the symmetry and extent of the deformity.

Postoperative management focuses heavily on structured follow-up and radiographic monitoring. Patients are typically allowed full weight-bearing immediately after surgery, and return to normal activities, including sports, is often rapid. The key to successful correction lies in regular clinical and radiographic evaluation, usually every 3 to 6 months, to track the rate of angular correction and detect potential complications early. Radiological assessment includes full-length standing films to determine mechanical axis alignment and angular measurements. The expected correction rate ranges from approximately 0.5° to 1.5° per month, depending on the anatomical site (correction is faster at the distal femur than the proximal tibia), patient age, and etiology. Implant removal is indicated once the desired mechanical alignment is achieved, to prevent overcorrection. Delays in hardware removal may result in rebound deformity, especially in cases of metabolic bone disorders or when intervention is performed at a very young age. Thus, precise timing of both implantation and explantation is crucial for optimal outcomes.

Conclusion

Hemiepiphysiodesis represents a cornerstone in the management of coronal plane deformities of the knee in growing children. By harnessing the natural growth potential of the physis, this

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minimally invasive technique allows for gradual, controlled, and reversible correction of angular misalignments such as genu valgum and genu varum. Compared to traditional osteotomies, hemiepiphysiodesis offers several advantages, including shorter recovery time, reduced surgical morbidity, and the ability to fine-tune correction through close monitoring. Success relies heavily on appropriate patient selection, accurate timing based on remaining growth, precise implant placement, and diligent postoperative follow-up. While complications such as rebound deformity or overcorrection can occur, these are largely preventable with proper surgical technique and monitoring protocols. Ultimately, hemiepiphysiodesis exemplifies the principle of guided growth and serves as a safe, effective, and patient-friendly approach in the pediatric orthopaedic surgeon's armamentarium for deformity correction.

References:

1. Stevens PM. Guided growth for angular correction: a preliminary series using a tension band plate. J Pediatr Orthop. 2007;27(3):253–259.
2. Boero S, Michelis MB, Catagni MA. Hemiepiphysiodesis by tension band plates for coronal plane deformities of the knee. J Child Orthop. 2011;5(3):209–216.
3. Burghardt RD, Herzenberg JE, Standard SC. Temporary hemiepiphysiodesis with the eight-Plate for angular deformities: mid-term results. J Orthop Sci. 2010;15(5):699–704.
4. Shabtai L, Specht SC, Herzenberg JE. Adolescent idiopathic genu valgum correction using tension-band plating. J Pediatr Orthop. 2016;36(8):844–850.
5. Hennrikus WL, Gorenflo BW. Hemiepiphysiodesis in children: indications, surgical techniques, and outcomes. Orthop Clin North Am. 2020;51(1):27–38.
6. Zajonz D, Wojan M, Edel M, et al. Hemiepiphysiodesis for the treatment of angular deformity of the knee joint in children: a retrospective analysis. BMC Musculoskelet Disord. 2017;18(1):399.
7. Canavese F, Marengo L. Guided growth: indications, limits, and complications. Curr Opin Pediatr. 2021;33(1):85–93.