Comparative Outcomes of Distraction Osteogenesis and Epiphysiodesis in Pediatric Leg Length Discrepancy: A Systematic Review and Meta-Analysis

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INTRODUCTION: Leg length discrepancy (LLD), most notably in children and adolescents, is a common issue that, if untreated, can result in scoliosis, gait abnormalities, and long-term functional impairments. Two surgical techniques, distraction osteogenesis (DO) and epiphysiodesis are frequently employed to treat clinically significant LLD. Although these procedures are both well documented, these approaches have not yet been directly compared in terms of safety and residual discrepancy for the lower extremities. The aim of this systematic review and meta-analysis is to compare the complication rates and correction accuracy of DO and epiphysiodesis in the treatment of pediatric LLD.

METHODS: This systematic review examines 9 studies across 6 databases: PubMed, Embase, Web of Science, Google Scholar, Scopus, and Cochrane Library. Included studies reported outcomes of distraction osteogenesis or epiphysiodesis for pediatric and adolescent leg length discrepancy. Eligible studies included residual mismatch data and complication rates for revision procedures that had a minimum patient cohort of n=10 and an average patient age ≤18 years.

RESULTS SECTION: A total of 413 patients (mean age=14.3 years) were included, with 204 undergoing distraction osteogenesis and 209 undergoing epiphysiodesis. DO achieved near-total correction with a pooled mean residual LLD of 3.52mm (95% CI: 0.01-7.03), demonstrating a postoperative correction within a few millimeters of the target length. Epiphysiodesis was found to have an expanded pooled residual mismatch of 8.15mm (95% CI: 2.2-14.1), indicating a larger discrepancy remained postoperatively. Subgroup analysis approached statistical significance (p=0.055), suggesting that DO provides a more precise correction than epiphysiodesis. Complication rates were similar between groups, with an overall pooled incidence of 17.1% (95% CI: 11.7%–24.4%). Subgroup analysis showed complication rates of 12% (95% CI: 3%–37%) for DO and 16% (95% CI: 10%–26%) for epiphysiodesis, with no statistically significant difference (p = 0.63).

DISCUSSION: While both procedures sufficiently reduced limb length discrepancy, distraction osteogenesis showed greater precision, accomplishing alignment close to the predicted correction. Complication rates did not vary significantly, supporting the use of both techniques in clinical practice; while distraction osteogenesis may provide superior alignment, epiphysiodesis remains a reasonable option. Limitations within our study include variation in follow-up duration and heterogeneity across surgical techniques.

SIGNIFICANCE/CLINICAL RELEVANCE: This study directly compares two surgical techniques for pediatric leg length discrepancy. These findings are clinically relevant as they may serve to inform surgical decision-making and may improve long-term functional outcomes for children with LLD.

REFERENCES:

1. Frommer A, Roedl R, Gosheger G, et al. What Are the Potential Benefits and Risks of Using Magnetically Driven Antegrade Intramedullary Lengthening Nails for Femoral Lengthening to Treat Leg Length Discrepancy?. *Clin Orthop Relat Res*. 2022;480(4):790-803. doi:10.1097/CORR.0000000000002036
2. Vogt B, Roedl R, Gosheger G, et al. Tibial lengthening using a retrograde magnetically driven intramedullary lengthening device in 10 patients with preexisting ankle and hindfoot fusion. *Acta Orthop*. 2020;91(6):761-769. doi:10.1080/17453674.2020.1807222
3. Vogt B, Biermann C, Gosheger G, et al. Simultaneous correction of leg length discrepancy and angular deformity of the distal femur with retrograde Precice nails: a retrospective analysis of 45 patients. *Acta Orthop*. 2024;95:364-372. Published 2024 Jul 15. doi:10.2340/17453674.2024.40947
4. Iliadis AD, Palloni V, Wright J, Goodier D, Calder P. Pediatric Lower Limb Lengthening Using the PRECICE Nail: Our Experience With 50 Cases. *J Pediatr Orthop*. 2021;41(1):e44-e49. doi:10.1097/BPO.0000000000001672
5. Laufer A, Frommer A, Gosheger G, et al. Antegrade Intramedullary Femoral Lengthening and Distal Temporary Hemiepiphysiodesis for Combined Correction of Leg Length Discrepancy and Coronal Angular Deformity in Skeletally Immature Patients. *J Clin Med*. 2023;12(8):3022. Published 2023 Apr 21. doi:10.3390/jcm12083022
6. Siedhoff M, Ridderbusch K, Breyer S, Stücker R, Rupprecht M. Temporary epiphyseodesis for limb-length discrepancy. 8- to 15-year follow-up of 34 children. *Acta Orthop*. 2014;85(6):626-632. doi:10.3109/17453674.2014.960646
7. Kemnitz S, Moens P, Fabry G. Percutaneous epiphysiodesis for leg length discrepancy. *J Pediatr Orthop B*. 2003;12(1):69-71. doi:10.1097/01.bpb.0000043564.17315.7f
8. Niedzielski K, Flont P, Domżalski M, Lipczyk Z, Malecki K. Lower limb equalization with percutaneus epiphysiodesis of the knee joint area. *Acta Orthop Belg*. 2016;82(4):843-849.
9. Song MH, Choi ES, Park MS, et al. Percutaneous epiphysiodesis using transphyseal screws in the management of leg length discrepancy: optimal operation timing and techniques to avoid complications. *J Pediatr Orthop*. 2015;35(1):89-93. doi:10.1097/BPO.0000000000000214