



# Correction Rate: An Alternative Assessment of Epiphysiodesis for Lower Limb-Length Discrepancy

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## Abstract

**Purpose:** Results in epiphysiodesis for lower limb-length discrepancy are always reported as residual discrepancy at end of growth. This criterion alone does not, in our view, reflect the expected correction to be achieved by surgery.

**Methods:** Correction rate, being the ratio between obtained and expected correction, on the other hand, represents the quality of the actual epiphysiodesis. The objective of this technical note is to propose a new method for analyzing results, using correction rate as a criterion.

**Results:** We report results in a series of patients undergoing curettage epiphysiodesis, with correction rate as assessment criterion.

**Conclusion:** Correction rate is an original and useful approach for interpreting the results of the treatment of lower limb-length discrepancy by epiphysiodesis.

**Keywords:** Lower limb-length discrepancy; Surgery; Correction rate

## Introduction

Results in percutaneous epiphysiodesis for lower limb-length discrepancy are always reported as residual discrepancy at end of growth. This criterion, although important, does not reflect the planned correction. Correction rate, being the ratio between obtained and expected correction, on the other hand, represents the quality of the actual epiphysiodesis, enabling comparison between different epiphysiodesis techniques [1-4]. It represents a new way of thinking and of assessing the results of the various possible surgeries. To illustrate this, we report results in a series of patients undergoing percutaneous curettage epiphysiodesis, with correction rate as assessment criterion.

## Technical Analysis

Percutaneous curettage epiphysiodesis [5-6] was performed after collecting the following data in consultation: Gender, age, and bone age on the Sauvegrain and Nahum technique [7-15]. Preoperative lower limb-length discrepancy was calculated according to etiology from Hechard and Carlioz curves [1] and the expected correction according to Green and Anderson tables [16]. At end of growth, residual discrepancy and correction rate were calculated.

## Results

A single-center retrospective study assessed results of percutaneous curettage epiphysiodesis, performed in 23 patients (6 girls, 17 boys) between April 2010 and July 2016. In girls, mean age at surgery was 12 years (range, 10 years 8 months to 13 years 4 months) and bone age was 11 and a half years (range, 10 years 5 months to 12 years 5 months). In boys, age at surgery was 14 years 2 months (range, 12 years 7 months to 16 years 1 month) and bone age 13 years 11 months (range, 12 years 5 months to 16 years). Mean preoperative discrepancy was 28.8 mm (range, 16 mm to 49 mm), with predicted discrepancy at bone maturity of 30.7 mm (range, 16 mm to 50 mm). Lower limb-length discrepancy was acquired in 26% of cases and congenital in 74%. Mean expected correction was 21.2 mm (range, 8 mm to 40 mm). Mean correction rate was 72% (range, 25% to 150%) (Figure 1). Residual discrepancy was 15.4 mm (range, 5 mm to 32 mm).

## Discussion

The various studies reporting the results of percutaneous epiphysiodesis assess the quality of the result in terms of residual limb-length discrepancy. Thus, Kemitz et al. [13] considered that

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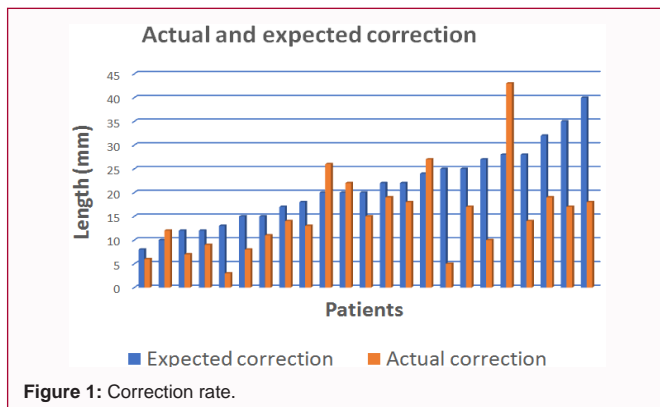


Figure 1: Correction rate.

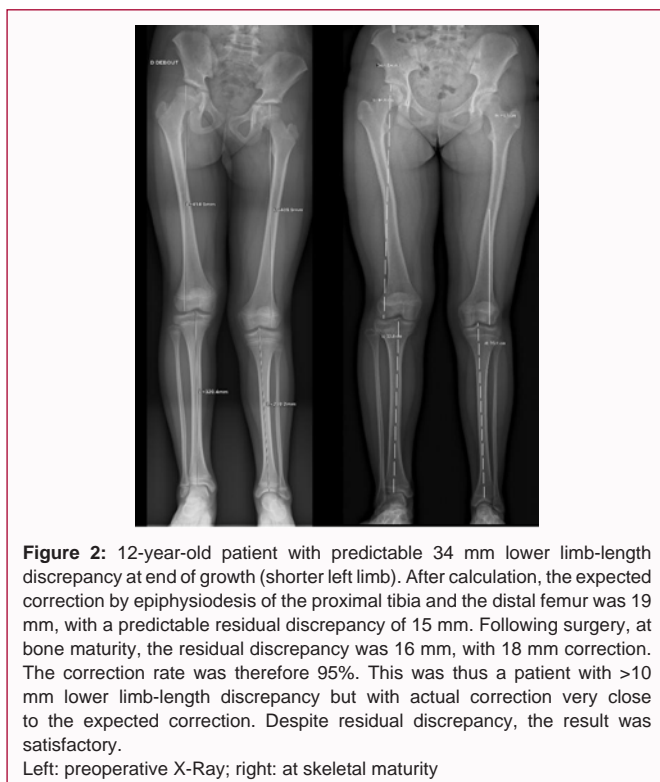


Figure 2: 12-year-old patient with predictable 34 mm lower limb-length discrepancy at end of growth (shorter left limb). After calculation, the expected correction by epiphysiodesis of the proximal tibia and the distal femur was 19 mm, with a predictable residual discrepancy of 15 mm. Following surgery, at bone maturity, the residual discrepancy was 16 mm, with 18 mm correction. The correction rate was therefore 95%. This was thus a patient with >10 mm lower limb-length discrepancy but with actual correction very close to the expected correction. Despite residual discrepancy, the result was satisfactory.

Left: preoperative X-Ray; right: at skeletal maturity

<15 mm discrepancy is a good result. These criteria were taken up by Niedzielski et al. [11] in 2016. In 2014, Babu et al. [14] compared two percutaneous epiphysiodesis techniques, using residual limb-length discrepancy to decide which was more effective. This criterion, although interesting, does not allow a perfect evaluation of the quality of the epiphysiodesis or certain comparison of the effectiveness of one technique compared to another. We believe that the effectiveness of a technique is defined by the amount of epiphysiodesis actually obtained compared to that expected, rather than by residual length discrepancy. This is particularly true in cases where the final predictable discrepancy is greater than residual growth potential. In these situations, the criteria of Kemnitz et al. [13] to define a good result would automatically lead to “failure”. To illustrate this, Figure 2 shows a patient who had a predictable lower limb-length discrepancy of 34 mm, with a correction potential of 19 mm. Complete correction of the discrepancy by epiphysiodesis was therefore impossible. However, epiphysiodesis was still performed, and achieved a correction of 18 mm. We can therefore consider

that the result was excellent, despite a final limb-length discrepancy exceeding 15 mm, as the correction rate was 95%. Conversely, there are patients whose initial discrepancy is small (<25 mm) and, despite a low correction rate (<15%), present a perfectly acceptable residual discrepancy of less than 10 mm. Such a result can be judged good, despite epiphysiodesis being only partially effective. We therefore propose that correction rate should henceforth be the main criterion for judging the quality of percutaneous epiphysiodesis, especially for studies comparing effectiveness between techniques. This will clarify the actual effectiveness of the different epiphysiodesis techniques. Correction rate is an original and useful approach for interpreting the results of the treatment of lower limb-length discrepancy by epiphysiodesis.

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