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## Lengthening of Femur by Combined Osteosynthesis: A Case Report

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### Abstract

Femur lengthening for correction of limb length discrepancy in a child with neurological defect (hemiparesis) was showed in the paper. In this case we used distraction osteosynthesis method by Ilizarov (external fixator) with elastic stable intramedullary nailing (ESIN) method. Lengthening rate was 0.95 mm/day (total 3.5 cm), healing index was 34 days/cm. After 6 month of our treatment patient was satisfied for result and had initial Range of Motion (ROM) of hip and knee joints. Currently we are continuing our way of combined bone lengthening in patients with neurological defects in research project and recommend this plan.

**Keywords:** Femur; Lengthening; Ilizarov; External fixator; Intramedullary nailing

### Introduction

The Ilizarov distraction osteosynthesis method is the best introducing for orthopaedic correction of axial deformities and limb length discrepancies [1]. Nowadays the problem of length discrepancies is solved by Ilizarov original device, different hexapod external fixators, lengthening over an intramedullary nail or epiphysiodesis contralateral extremity [2-5]. Unfortunately, in practice you can meet a lot of complications such as infections, longer period of fixator treatment, non-union of bone, contractures of joints, and fractures after frame removal [6-8]. For example, according to Kocaoglu et al. [9] complications in treatment of patients by lengthening over an intramedullary nail occurred in 38% segments. In some colleagues papers period of external fixation treatment was noted more than 400 days with healing index until 62.7 days/cm [10]. The ESIN is a mini-invasive intramedullary osteosynthesis method in association with the Ilizarov external fixator for limb lengthening is showed reducing a bone regenerate healing time and external fixation treatment period [11]. In this article the example of our approach in question of bone lengthening was presented.

### Case Presentation and Technical Report

Patient X, 16 years old, female, entered in our department with complaints of a shortening of left lower extremity, backache after walking. There was patient with left-sided mixed hemiparesis (cerebral palsy) (Figure 1).



**Figure 1:** Photo and X-ray picture of low extremities of patient before orthopaedic intervention.

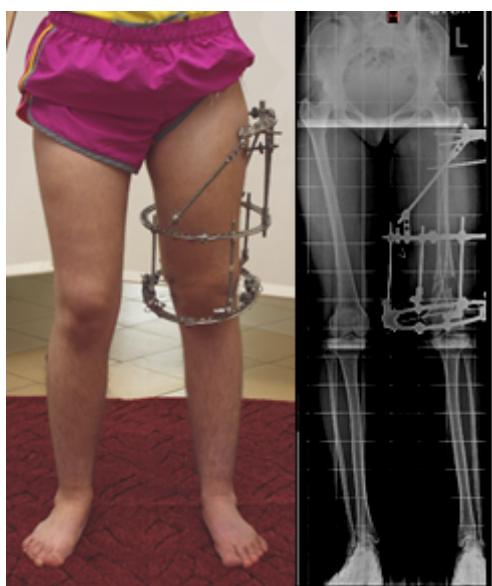
In 2011 she received surgical treatment on the left hip joint in the St. Petersburg clinic (about subluxation in hip joint). During a growth of the child, parents began to notice a shortening of the left leg. Child was examined clinically and by X-ray. She had shortening of femur in 3.5 cm, low range of rotational motion in hip joint (external-internal rotation motion was 20|0|20) and full ROM in knee and ankle joints. Changes related to motor function (ambulation) were evaluated according to the Gillette Functional Assessment Questionnaire (FAQ) [12]. We used video recordings to assess patient's gait (ability to walk independently with or without

walking aids). Recordings were made using two simultaneous cameras positioned in orthogonal projections.

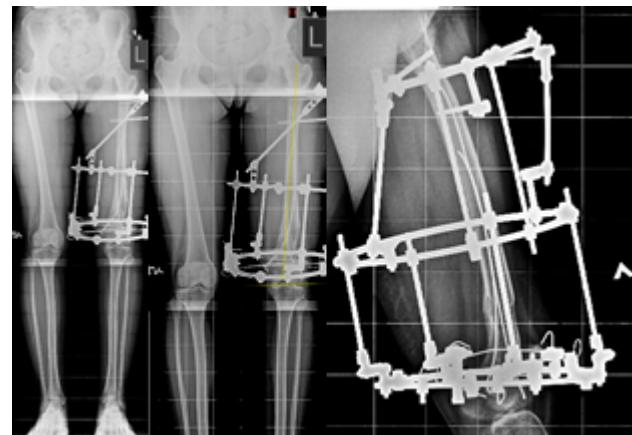
Operative orthopaedic intervention started in placement Ilizarov original frame with universal joints (hinges). Then we performed percutaneous osteotomy in distal metaphysis zone of the femur. A 1.5 cm incision in the metaphyseal area was made on each side. The ESIN was inserted in a retrograde route from distal metaphysis for elastic and resistant condition of the bone during healing time (using external fixator). We placed 2 nail (2.5 mm) in an oblique direction after making holes through cortical by awl. Maximal curve of nails was located in level of future regenerate. The extraosseous 5 mm ends of the nails were curved over 90°.

Distraction period by Ilizarov device started from 5th day from operation date with X-ray control in each 10 days (**Figure 2a**). Patient was allowed to walk with gradually increasing weight-bearing on this extremity and with crutches. Lengthening rate was 0.95 mm/day. Duration of lengthening period was 37 days (8.75% of initial bone length).

After our treatment length of the lower limbs was aligned (**Figure 2b**). Ilizarov frame was removed if 3 of 4 cortices could be seen by X-ray pictures (AP and ML) and performed after clinical test. During distraction period patient was observed each day in our department by physiotherapist. Period of fixation by the Ilizarov frame was 82 days and healing index was 34 days/cm. There were no complications during our treatment.



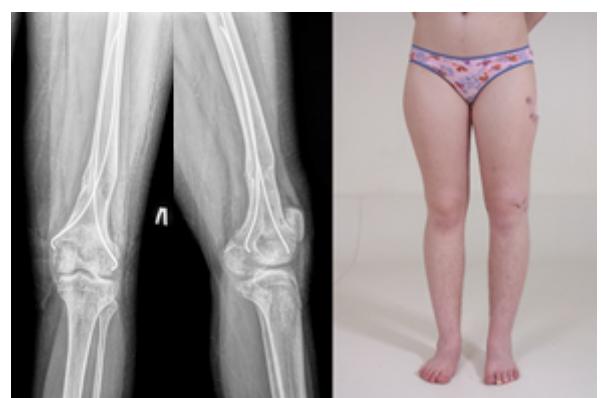
**Figure 2a:** Photo and X-ray pictures during Ilizarov frame treatment: during period of distraction.



**Figure 2b:** Photo and X-ray pictures during Ilizarov frame treatment: before removing the Ilizarov frame.

After removal of the Ilizarov frame, patients left extremity was immobilized with a plaster bandage from the upper part of femur to ankle joint with fixation of knee joint during 6 weeks. Patient was allowed to walk with gradually increasing weight-bearing on this extremity with or without crutches. After removal of the plaster bandage patient was getting restorative treatment in the domiciliary clinic including physiotherapy and restoration of the range of motions of hip and knee joints, swimming pool, and limb immobilization with an orthosis (knee and ankle) for 6 months for the night. Amplitude of motions of interested joints (hip, knee) was restored up to initial one in 4 weeks after the beginning of the active exercises.

In 6 month follow-up patient was satisfied for result for result and had initial Range of Motion (ROM) of hip and knee joints (**Figure 3**). According to data received from the Gillette FAQ survey impairing of motor functions was not reported.



**Figure 3:** Photo and X-ray pictures of low extremities, in 6<sup>th</sup> month follow-up.

Applying the combined methods of osteosynthesis demonstrated a considerably lower level of healing index (34.0 days/cm) than the results of our colleagues studies: Donnan et al. [8] healing index was noted 54 days/cm, Aktuglu et al. [10] -

62,8 days/cm, Dammerer et al. [13]-57 days/cm, Blondel et al. [14]-38.2 days/cm. Absence of infections complications, secondary fragment displacement during correction and no deformity at the osteotomy after frame removal showed the advantages of this combined approach.

## Conclusion

Therefore, combined osteosynthesis of the bone by external Ilizarov frame and ESIN in management of limb length discrepancy and adherence to the methodical principles of this methods and rational management in postoperative period allow reducing external fixator time, preventing of possible complications and achieving to the desired result of treatment.

## Conflict of Interest

There are no conflicts of interest.

## Consent

The patient has provided informed consent for the case report to be published.

## Authors' Contributions

Leonchuk SS is the sole contributor of the submission and has approved the final manuscript.

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