

# Study of Effects of Femoral Lengthening on Hip

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## Abstract

**Introduction:** Lower limb length discrepancy commonly occurs due to shortening of tibia or femur alone or shortening in both the bones. Congenital Proximal focal femoral deficiency (CPFFD) is one of the commonest causes of femoral shortening followed by post infective arthritis of hip leading to shortening of femur. Femoral lengthening in children needs to be done meticulously after proper planning.

**Material and methods:** This retrospective study was done on 14 patients taking treatment between 2009 and 2015 at a tertiary care hospital for femoral shortening, to study the effects of femoral lengthening on Hip. The cases were studied on the basis of their treatment records, clinical and radiological examination findings and personal interview.

**Observations and results:** The two common causes of femoral shortening were CPFFD in 64% and post infective arthritis of hip in 28.5%. Left femur shortening was seen in 9 cases. The total lengthening achieved was 62cm, the average being 4.4cm. Length equalization was achieved in 3 cases, while 2 cases had significant shortening due to fracture of regenerate. One patient developed hip dislocation followed by knee dislocation after 8cm. of femur lengthening. One case each developed hip and knee dislocation after 6 cm. of femur lengthening. All the patients had mild to moderate knee stiffness.

**Conclusion:** Femur lengthening more than 6 cm. may lead to hip dislocation, hence be avoided or done very slowly with repeated clinico radiological examination of hips.

**Key Words:** femoral lengthening; hip; proximal focal femoral deficiency

## Introduction

Limb length discrepancy is a common orthopedic problem arising from either shortening or overgrowth of one or more bones in the limb. Lower limb length discrepancy leads to difficulty in weight bearing and ambulation. Limb length correction or limb lengthening procedures require preoperative planning, surgical skills, proper execution, follow up and meticulous rehabilitation. Treatment of limb length discrepancy depends on its etiology, bones involved and amount of discrepancy. Causes of femur shortening are Proximal femoral focal deficiencies (PFFD), post traumatic loss of bone, post infective growth disturbance or loss of bone due to sequestration. Bowen ET al [1] emphasized the need of avoiding hip subluxation and dislocation during femoral lengthening in patients with unilateral femoral shortening. During prolonged treatment period joint deformities and muscle contractures may develop. Hence limb lengthening procedure should not be taken lightly

Complications related to ankle and knee joint deformities and contractures have been studied widely. Effects of femur lengthening on hip have not been studied much. In cases of

femur lengthening arches are applied in the proximal thigh near greater trochanter. Multiple Schnaz pins/ tensioned wires are passed across the muscles and bones at various levels. The lengthening process may last for 6-12 months. The distractive forces applied at corticotomy site may also lead to abnormal stresses at hip joint bones and muscles leading to changes in the joint anatomy and function.

Gradual distraction techniques are more reliable alternative for isolated limb length discrepancy correction. These are being used since 1921 [2]. Ilizarov [3, 4] devised and popularized his Distraction Osteogenesis technique and principle very effectively and used it for various indications in many bones. The present study aims to find out the effects of femoral lengthening on hip joint function and anatomy.

## Material and methods

This retrospective study was done during the period of July 2015 to April 2016 on cases that were undergoing femur lengthening or had completed the treatment at the tertiary care hospital attached to a medical college.

A total of 11 patients' records could be obtained from medical record section of the hospital. Details of three patients from two other orthopedic hospitals were also obtained, thus making the sample size 14. All these patients had taken treatment from 2009 to 2015. All the important details of the patients were noted down from the case records. The patients were then called for clinicoradiological examination by telephonic communication and were motivated by social workers operating in their area for physical follow up. The

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Length gained	Cases	Percentage
Upto 2cm	3	21.4%
2cm to < 4cm	5	35.8%
4cm to <7cm	4	28.5%
7cm to 10cm	2	14.3%

Table 1- table showing lengthening achieved in various cases

responding patients were subjected to detailed history taking along with surgery details and details of limb length discrepancy prior to and at the end of treatment. They were clinically examined with emphasis to function of hip and knee and limb length discrepancy, total and in femur and tibia separately. X ray examination of pelvis with both hips and the affected side thigh was done in all cases.

Non reporting patients' details were taken by telephonic interview. All the information was tabulated and analyzed in respect of age, sex, etiology, type of treatment, length gained in femur, hip function, complications and xray abnormality.

clinoradiological follow up was possible in 5 cases while telephonic details were taken in another 5 cases. No follow up was possible in 4 patients. Treatment was completed in 9 cases while 5 patients were continuing with the lengthening procedure. There were 8 females and 6 males. Male female ratio was 1:1.3. Age of patients ranged from 3 to 30 years, the average age being 12.5 years. Left femur was involved in 9 cases and right femur in 5 cases, Left to Right ratio being 1.8:1

The most common etiology seen was congenital proximal focal femoral deficiency in 9 cases (64.3%) followed by sequel of post infective arthritis of hip in 4 cases (28.5%) and one case of post traumatic infected nonunion. Total length gained was 62cm, the average length gain being 4.4cm. 5 cases (35.8%) had lengthening more than 2cm to less than 4cm, while 4 cases (28.5%) had lengthening more than 4cm to less than 7cm. 3 cases (21.4%) had lengthening up to 2cm while 2 cases (14.3%) had lengthening more than 7cm (Table 1). Equalization of limb length was achieved in 3 cases whereas lengthening was abandoned in 2 cases due to hip dislocation and fracture of regenerate.

Knee stiffness was seen in all 14(100%) cases. Hip dislocation was noted in 2(14.3%) cases and knee dislocation was also noted in 2(14.3%) cases. One patient developed hip dislocation after 6cm of femoral lengthening

**Observations and Results**

Among 14 patients treated between 2009 to 2015



Figure1: 5year old child of CPFFD right hip with 6cm shortening treated by femoral osteotomy and gradual distraction using a limb reconstruction system fixation (LRS)

Figure 2: x- ray shows poor quality of regenerate at distraction site and subluxation of hip

Figure 3: Removal of LRS system, stabilization of lengthened segment with plate and screw and attempted hip reduction and stabilization using multiple k wires and hip spica in order to correct dislocated hip

Figure 4- x- ray showing knee dislocation after femoral lengthening which initially had caused hip dislocation which was successfully managed. The patient subsequently developed knee dislocation. Knee movement was 0-60° and patient accepted the deformity.

which was corrected by removal of fixator, open reduction and multiple k wire fixation (Figure 1,2,3). Another patient had developed hip dislocation after 8cm of femoral lengthening and later on developed knee dislocation also on correction of hip dislocation (Figure 4). One more case had developed knee subluxation after 6cm of femoral lengthening.

Functional status assessment could not be done properly as 5 cases were continuing with the treatment. Telephonic questioning was not considered flawless about functional status. Assessment as per Harris Hip Scoring system was possible in 5 cases where the score ranged from 39 to 88.

### Discussion

Codivilla [5] documented the first femoral lengthening in 1905 by using osteotomy of femur and calcaneal pin traction. Wagner [6] popularized his technique of lengthening using a uniplanar external fixator and noted common complications of infection, refracture, compartment syndrome, nerve palsy, joint subluxation and dislocation. Suzuki ET al [7] showed that hip dislocation occurred in the hips that had poor acetabular coverage due to hip disease or diseases related to the hip joint.

Effects of femoral lengthening on near by joints have been known for a long time. Stiffness of joints can be prevented by keeping the muscles at its maximum length while passing the Ilizarov wires or Schnaz pins, maintaining proper joint position and doing active and assisted mobilization of joints. Use of night splints helps contracture prevention. Maintaining at least 0 to 70 range of motion at knee during the phase of femoral lengthening helps avoid knee stiffness.

Complications of tibial lengthening are relatively few. Coleman S. ET al [8] noted 1.33% complications per tibia on lengthening of tibia up to 41% of its original length. Effects of femur lengthening on hip joint have not been studied much. Stainski DF ET al [9] carried out 83cm femoral lengthening in 30 patients in average treatment time of 6.4 months. He noted knee subluxation in 2 cases besides complications of premature consolidation, malunion and residual limb length shortening. Rose [10, 11] studied 10 patients of femoral lengthening from 2001 to 2008. 70% of his patients were female and average age of patients was 20 years. Lengthening was discontinued in 1 case due to hip

dislocation and in 2 cases due to gross knee movement restriction in his study. In the present study lengthening was discontinued in 1 case due to hip dislocation and fracture o regenerate and in 1 case due to hip and knee dislocation. Rose had concluded "Generally, the number of complications and failures of lengthening increase in proportion to the length of distraction and the severity of preoperative problems"

In the present study 2 of our cases had dislocation of hip after gaining lengthening of 6cm or more approximately 30% of the original femur length. Dhawale AA et al [12] had noted hip dislocation during lengthening of congenitally short femur after average lengthening of 9cm. In personal communication with many surgeons doing limb lengthening it is suggested that femoral lengthening more than 25% of its original length is likely to lead to hip subluxation or dislocation of hip. In general, femoral lengthening more than 6-7cm should not be done in one phase of treatment. 6-7cm is considered to be red flag sign for possible hip dislocation. In both our cases undergoing hip dislocation femoral lengthening achieved was 8cm and 6cm respectively.

### Conclusions

1. Femoral lengthening of 6cm or more (more than 25-30% of original femoral length) may cause gradual subluxation or dislocation of hip. Femoral lengthening more than this should be done carefully, doing frequent clinico-radiological examination of hip and knee.
2. Knee subluxation may also occur following femoral lengthening either along with hip subluxation or in isolation.
3. Hip function in femoral lengthening cases is affected due to etiological factor of femoral shortening and hip joint subluxation or dislocation.

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