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Congenital Fibular Deficiency (Fibular Hemimelia) with Terminal Foot Deformity: A Case Report with Radiological and GAITRite Gait Analysis

Elmajidi Meryem[1*], Ouider Kenza[1], Naciri M. Mehdi[1], Kouadssi M. Mehdi[1], Elhanafi Asma[1], Abdelfettah Younes[1]

[1]Department of Physical Medicine and Rehabilitation, University Hospital Mohamed VI, Faculty of Medicine and Pharmacy, Cadi Ayyad University, Marrakech, Morocco

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***Corresponding author:** Elmajidi Meryem
Department of Physical Medicine and Rehabilitation, University Hospital Mohamed VI, Faculty of Medicine and Pharmacy, Cadi Ayyad University, Marrakech, Morocco

Abstract **Case Report**

Congenital fibular deficiency, also known as fibular hemimelia, is a rare lower-limb malformation. We report the case of a 7-year-old boy presenting with right lower-limb deformity, limping, gait instability, difficulty wearing shoes, and an 8-cm limb-length discrepancy. Clinical and radiological assessment showed a shortened tibia, a proximally visible hypoplastic fibula, and severe terminal foot deformity. GAITRite analysis revealed abnormal gait without prosthesis and improvement after fitting a new tibio-pedal prosthesis. This case highlights the value of combining clinical, radiological, and instrumented gait assessment, and emphasizes the importance of regular prosthetic adaptation in growing children.

Keywords: Fibular deficiency; Fibular hemimelia; Terminal foot deformity; Limb-length discrepancy; GAITRite, Prosthetic rehabilitation.

INTRODUCTION

Congenital fibular deficiency, also known as fibular hemimelia, is a rare lower-limb malformation and one of the most common longitudinal deficiencies affecting the leg [1]. It belongs to the spectrum of postaxial longitudinal limb deficiencies and is frequently associated with fibular hypoplasia, foot deformity, and limb-length discrepancy [1]. Severe forms may include terminal foot deficiency, which can further impair gait and functional ambulation [2]. Careful clinical, radiographic, and functional assessment is therefore essential for treatment planning[1]. GAITRite provides valid spatiotemporal gait parameters and is useful for documenting walking abnormalities and treatment-related changes [3].

CASE PRESENTATION

A 7-year-old boy was referred to our Department of Physical Medicine and Rehabilitation for evaluation of a congenital deformity of the right lower limb associated with limping, gait instability, and difficulty wearing shoes. The deformity had been present since birth. There was no relevant personal or family history of congenital malformations, and no similar case was reported in the family. The condition limited daily activities, school attendance, and sports participation. No previous surgery or structured rehabilitation had been performed. The child had previously used a prosthesis, which had become inadequate because of growth.

Clinical examination revealed marked shortening of the right lower limb, with an estimated limb-length discrepancy of approximately 8 cm, mainly involving the leg and foot. The right leg appeared thin and hypoplastic, with a severe terminal deformity of the right foot (**Figure 1**).

Radiographs showed a shortened tibia with distal deformity and a markedly shortened, hypoplastic fibula, mainly visible proximally, associated with severe terminal foot deformity and rudimentary distal skeletal elements (Figure 2). These findings were consistent with congenital fibular deficiency with terminal foot deformity, corresponding to a postaxial longitudinal deficiency according to the Swanson/IFSSH classification [4]. According to the Achterman and Kalamchi classification, the case was most consistent with type IA congenital fibular deficiency, given the presence of a proximally preserved but markedly shortened hypoplastic fibula [5].

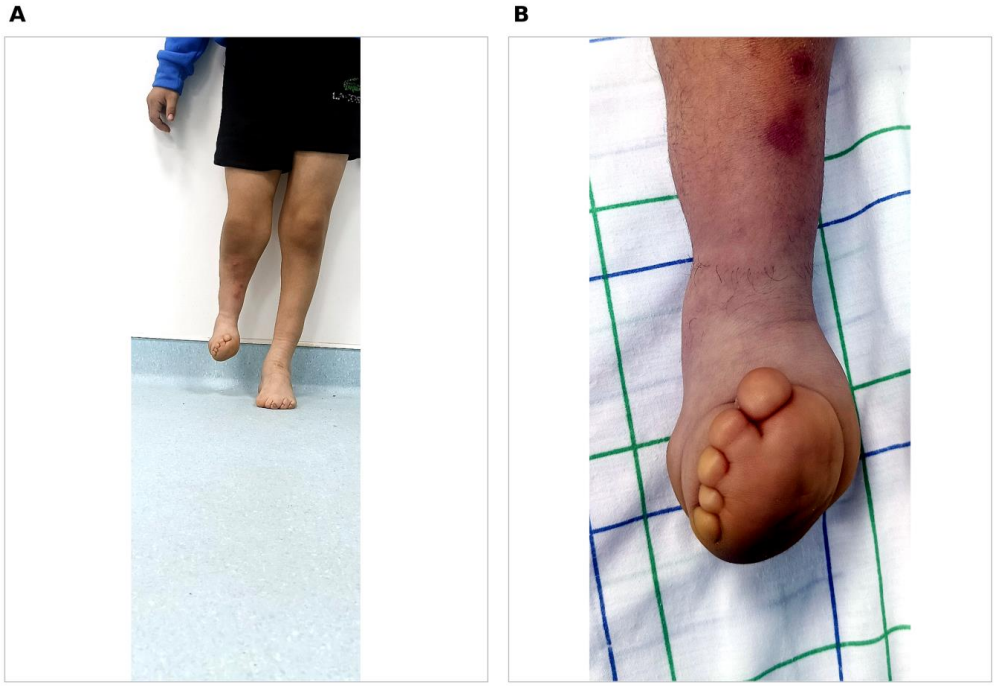

Figure 1: Clinical appearance of the right lower limb in congenital fibular deficiency
(A) Standing view without prosthesis showing marked limb-length discrepancy
(B) Close-up view of the terminal foot deformity with rudimentary distal digits

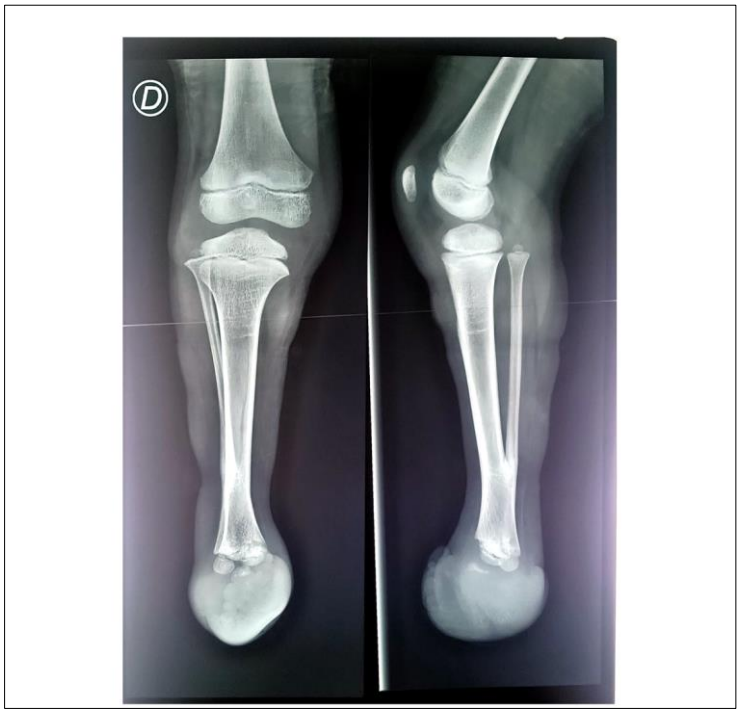

Figure 2: Radiographic evaluation of the right lower limb: Anteroposterior and lateral views showing a shortened fibula, shortened tibia, and severe terminal foot deformity with rudimentary distal skeletal elements

Functional evaluation using the GAITRite system showed abnormal gait without prosthesis and progressive improvement with prosthetic management. Visual analysis of the gait progression pattern suggested a more regular and reproducible trajectory with the new prosthesis (Figure 3).

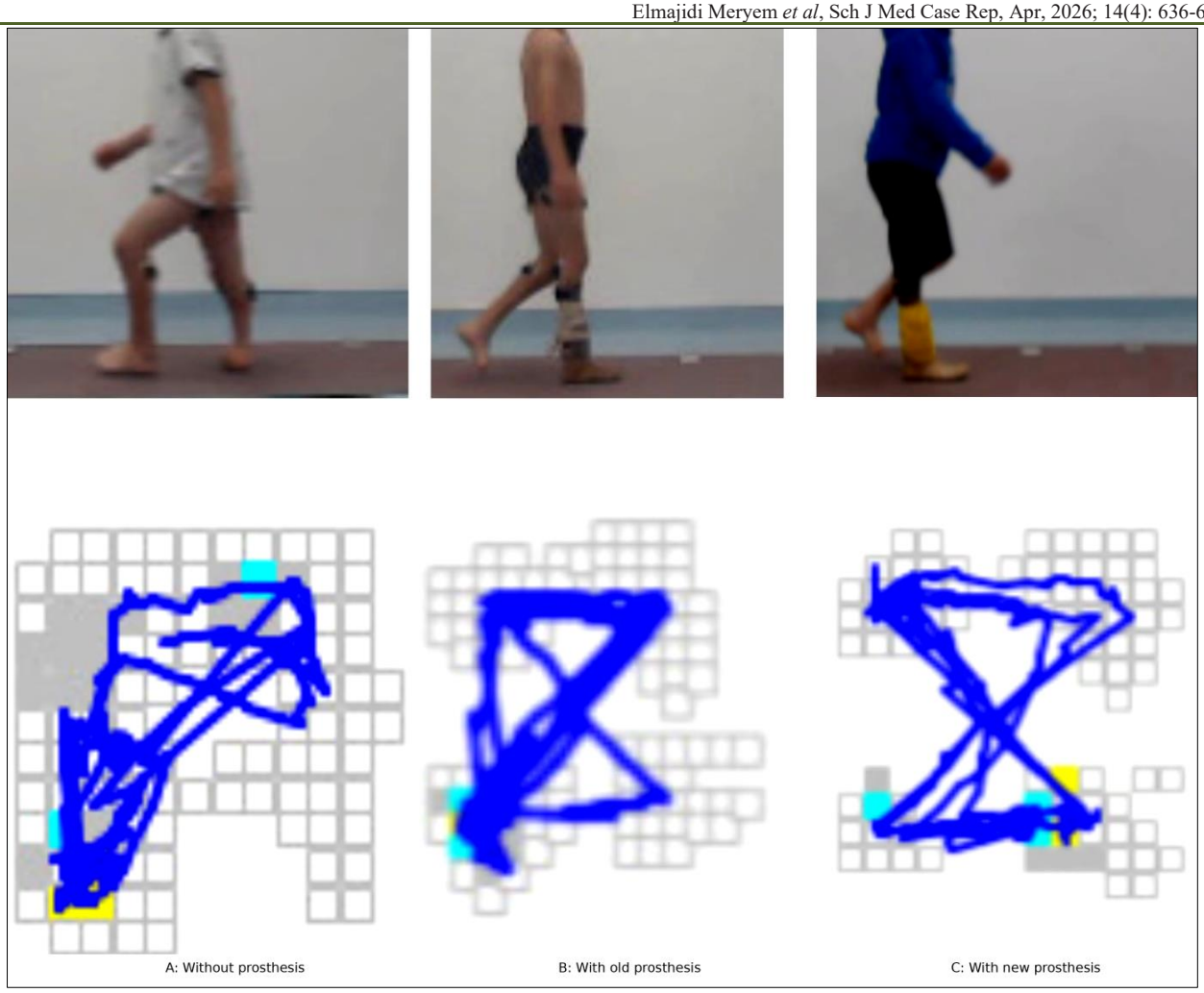

Figure 3: Gait pattern under three conditions

Spatiotemporal gait parameters also improved overall with prosthetic use, with better gait performance and stability with the new prosthesis (Table 1). The patient was fitted with a new tibio-pedal prosthesis with a total-contact encompassing socket, resulting in functional improvement in gait.

Table 1: Comparison of the Main Spatiotemporal Gait Parameters Without Prosthesis, With the Previous Prosthesis, and With the New Prosthesis

Parameter	Without prosthesis	Previous prosthesis	New prosthesis
Walking speed (cm/s)	64.9	75.5	74.7
FAP score	73	78	80
Left step length (cm)	29.0	33.2	40.0
Right step length (cm)	30.7	40.0	46.4
Left stride length (cm)	59.8	73.3	85.9
Right stride length (cm)	60.5	74.0	86.0
Left double support (%)	26.2	20.4	17.1
Right double support (%)	26.0	19.7	16.5

DISCUSSION

The present case illustrates a severe but partial form of congenital fibular deficiency, combining marked fibular hypoplasia, tibial shortening, terminal foot deformity, and significant limb-length discrepancy.

These findings support the view that congenital fibular deficiency is not only an isolated fibular abnormality, but a postaxial developmental disorder involving the whole lower limb [1,6,7]. The associated foot deformity is particularly important because it contributes to both limb shortening and abnormal distal support during walking [5,6].

Management depends on the severity of shortening, foot morphology, joint stability, and expected functional outcome [5,6,8]. In mild or moderate

forms, reconstruction and limb-lengthening strategies may be considered when the limb is functional and the joints are stable [5,6,8]. In more severe forms with major foot deformity, prosthetic-oriented treatment may be more appropriate, especially when the distal segment provides poor support for ambulation [5,6,8]. In our patient, the presence of severe terminal foot dysplasia and marked functional impairment supported a prosthetic rehabilitation approach.

An important contribution of this report is the objective demonstration of gait change after prosthetic adaptation. Clinical observation can identify limping and instability, but instrumented gait analysis adds measurable functional information [3,9]. In our case, GAITRite documented abnormal gait without prosthesis and overall improvement after prosthetic management, particularly in step length, stride length, FAP score, and double-support time. These findings provide objective support for the clinical benefit of prosthetic correction [3,9,10].

This case also underlines the importance of regular prosthetic reassessment in growing children. Even when a prosthesis is initially effective, growth may progressively alter alignment, effective length, and socket fit, leading to functional decline [11,12]. The better gait pattern observed after fitting the new tibio-pedal prosthesis reflects this principle and confirms that follow-up should be continuous in pediatric rehabilitation [11,12].

The main value of this report lies in its combined clinicoradiological and functional approach. Although limited by the single-case design and the absence of long-term follow-up, it highlights an important practical message: in children with congenital fibular deficiency and severe terminal foot deformity, treatment should be guided not only by anatomical findings, but also by functional assessment and growth-related prosthetic needs [1,6,11,12].

CONCLUSION

This case highlights the value of combining clinical examination, radiological assessment, and instrumented gait analysis in congenital fibular deficiency with terminal foot deformity. In a growing child, appropriate prosthetic adaptation can improve gait performance and stability. Regular follow-up is essential to optimize functional outcomes and support daily participation.

Conflicts of Interest: The authors have no conflicts of interest to declare.

Patient Consent: Written informed consent was obtained from the patient's parents for the publication and accompanying images.

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