Short communication

P 074 - A comparison of foot kinematics in children with clubfeet and healthy controls using the Oxford Foot Model

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ABSTRACT

This study aims to identify kinematic differences between children with Ponseti treated clubfoot and age-matched healthy controls during gait, using the Oxford Foot Model. This pilot is part of a large project comparing gait kinematics between children with Ponseti treated clubfoot with and without relapse and healthy controls. Final results could identify relevant gait parameters which will allow for early detection of a relapse clubfoot.

1. Introduction

The clubfoot is characterized by an equinovarus foot and exists of a three-dimensional deformity namely equinus, varus and adduction (1, 2). Nowadays the Ponseti method is the preferred treatment for clubfeet, aiming to achieve a normal appearing, functional and painless foot (3–5). Foot function, residual deviations in gait or possible relapses in clubfeet patients can be assessed with 3D gait analysis (6–12). However, most studies applying gait analysis focused on the entire foot instead of using a multi-segment foot model while comparing gait kinematics of clubfoot patients to healthy controls. Since the clubfoot deformity is mostly seen in the foot and its different segments, it is highly important to implement multi-segment foot models, such as the Oxford Foot Model, in gait analysis.

2. Research question

This study aims to identify kinematic differences between children with Ponseti treated clubfoot and age-matched healthy controls during gait, using the Oxford Foot Model.

3. Methods

Children, age 4–8 years old, with unilateral or bilateral Ponseti treated clubfeet were recruited by an orthopaedic surgeon at Máxima Medical Centre (Eindhoven, the Netherlands) between September 2017 and April 2018. In addition, age- and gender-matched controls were recruited. A wireless active 3D-system (Charnwood Dynamics Ltd., Codamotion CX 1, sampling rate: 100 Hz), 25 infrared markers and four pointer landmarks were used to determine kinematics of the foot, lower and upper leg and the pelvic. The Oxford foot model was used to identify the different foot segments (13). Participants were instructed to walk in a straight line (8 m) at comfortable speed. Range of motion in the sagittal and transversal plane, the ankle angle at initial contact, during stance and at toe-off were calculated. Difference between groups were analysed by means of Mann-Whitney U test. A p-value ≤ 0.05 was considered significant.

Table 1
Demographic data.

	N	Male	Age (years) Mean (sd)	Height (cm) Mean (sd)	Mass (kg) Mean (sd)	Walking speed (m/s) Mean (sd)	Affected foot
Clubfoot	3	3	6.3 (2.1)	124.0 (14.2)	23.9 (6.3)	1.11 (0.07)	0 bi /3 uni
Control	5	3[a]	5.6 (1.8)	116.5 (14.6)	23.5 (7.7)	1.03 (0.13)	

[a] Other female.

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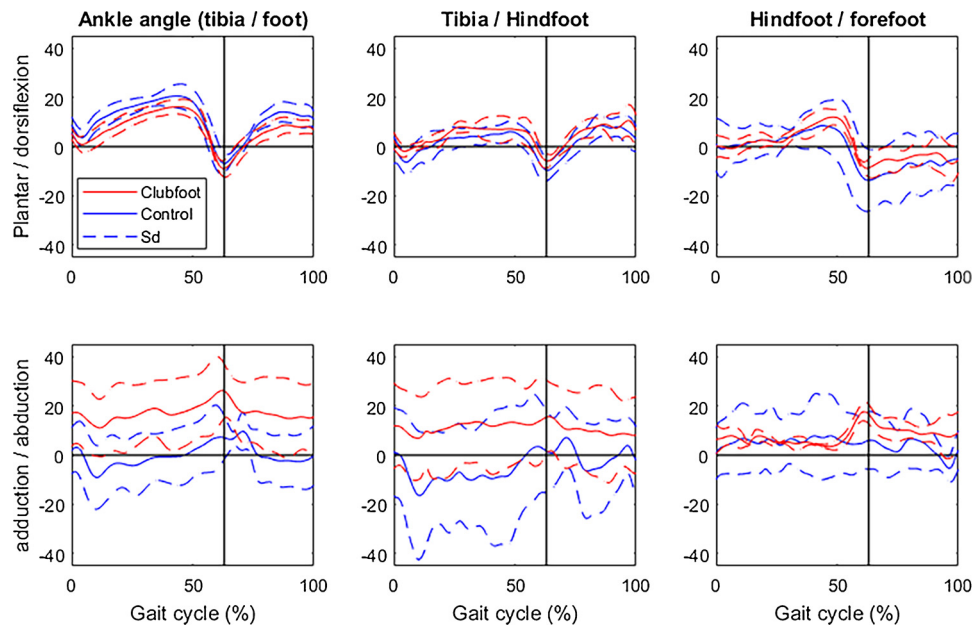 *E-mail address:* l.grin@fontys.nl (L. Grin).

Fig. 1. Ankle and foot kinematics during gait of children with clubfoot (red line) versus control (blue line). Dotted lines (- -) show the standard deviation and the vertical line indicates stance versus swing. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

Table 2
Ankle kinematics at initial contact, during stance and at toe off.

	Ankle angle at TO (degree) Mean (sd)	Ankle angle at IC (degree) Mean (sd)	Max. dorsal flexion during stance (degree) Mean (sd)
Clubfoot	− 9.6 (4.4)	5,1 (2.2)	173 (2.5)
Control	− 7.6 (4.2)	8.8 (3.3)	22.4 (3.7)

Negative value means plantar flexion, positive value means dorsal flexion. IC = initial contact, TO = toe off.

4. Results

Currently, data of 5 healthy controls and 3 children clubfeet patients could be analysed (Table 1). By September 2018, 10 participants in each group will be analysed. Results (Fig. 1) show decreased dorsiflexion during stance (ankle angle) and increased adduction during the gait cycle (ankle angle and tibia versus hindfoot) in clubfoot children. Furthermore, less dorsiflexion at initial contact and lower maximum dorsiflexion during stance are found (Table 2).

5. Discussion

Pilot results are in line with literature (6, 11, 14, 15). Additionally, results of the Oxford foot model show interesting differences between healthy and children with clubfeet. However, due to the limited sample size and large variations between subjects, more participants are necessary. This pilot is part of a large project comparing gait kinematics between children with Ponseti treated clubfoot with and without relapse and healthy controls. Final results could identify relevant gait parameters which will allow for early detection of a relapse clubfoot.