

## Clinical gait analysis of a 16 years old patient with walking difficulties after surgery

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In this paper we present a procedure to improve the gait disorder in sixteen years old boy after the surgery due to mild CP.

A male patient 16 y/o has CP, spastic diplegia. In 2018 JUN was operated, B-Femur distal extension osteotomy, patellar tendon shortening Before the operation, he was walking so cold crouch gait with flexed knees 60 degrees, excessive dorsiflexion and hip flexion, early heel rises on the left side. And as result, he has pathological moments in knees.

*Treatment Surgery:* 2010 B-s/c hell cord lengthening

2016 Ulzibad fibrotomys quadriceps, biceps, gracilise, AD.

2018 JUN B-Femur distal 3rd extension osteotomy, patellar tendon shortening

Time series of the movement of patient were produced and a pair of shoes and orthoses were designed based on numerical computations to optimized the movement of the patient.

The gait of the patient after the surgery was studied by a group of orthopaedic surgeons, rheumatologists and biomechanicians (Fig. 1).



Fig. 1. Gait analysis of the patient with bare foot

Based on analysis of numerical results, the lower limb orthoses were designed manufactured and used (Fig. 2).



Fig. 2. Gait analysis of the patient with orthoses and shoes

Tables 1 and 2 are the results of the motions captured by 8 cameras during the gait of the patient

Table 1. Spatial temporal parameter of gait after surgery (bare foot)

SPATIAL-TEMPORAL PARAMETERS			06/04/2018		
	LEFT	RIGHT	NORM~		
↑	Cadence	121 steps/min	125 steps/min	116.06 ± 3.13	↑
↓	Stride Time	0.99 s	0.96 s	1.04 ± 0.03	↓
↓	Walking Speed	0.83 m/s	0.83 m/s	1.34 ± 0.06	↓
↓	Stride Length	0.83 m	0.80m	1.38 ± 0.05	↓
↓	Step Length	0.42 m	0.39 m	0.71 ± 0.07	↓
↓	Step Time	0.48 s	0.48 s	0.6 ± 0.05	↓
↓	Single Support	0.29 s	0.30 s	0.42 ± 0.01	↓
↓	Double Support	0.40s	0.37 s	0.21 ± 0.01	↓
↑	Foot Off	69.8 %	70.1 %	60.21 ± 0.72	↑
↑	Opposite Foot Contact	51.6 %	50.0 %	49.92 ± 2.39	↑

Table 2. Spatial temporal parameter of gait after surgery (with orthoses and shoes)

SPATIAL-TEMPORAL PARAMETERS					
	LEFT	RIGHT	NORM~		
↓	Cadence	115 steps/min	117 steps/min	116.06 ± 3.13	↓
↓	Stride Time	1.04 s	1.02 s	1.04 ± 0.03	↓
↓	Walking Speed	0.91 m/s	0.92 m/s	1.34 ± 0.06	↓
↓	Stride Length	0.95 m	0.94m	1.38 ± 0.05	↓
↓	Step Length	0.50 m	0.42 m	0.71 ± 0.07	↓
↓	Step Time	0.50 s	0.53 s	0.6 ± 0.05	↓
↓	Single Support	0.40 s	0.28 s	0.42 ± 0.01	↓
↑	Double Support	0.36s	0.36 s	0.21 ± 0.01	↑
↑	Foot Off	73.5 %	61.8 %	60.21 ± 0.72	↑
↑	Opposite Foot Contact	52.1 %	48.7 %	49.92 ± 2.39	↑

Fig. 3 (a) shows the pelvic obliquity in left and right foot. Fig. 3 (a) shows the pelvic obliquity in left and right foot. We can see the improvement by comparing the curve with normal gait Left and right foot.

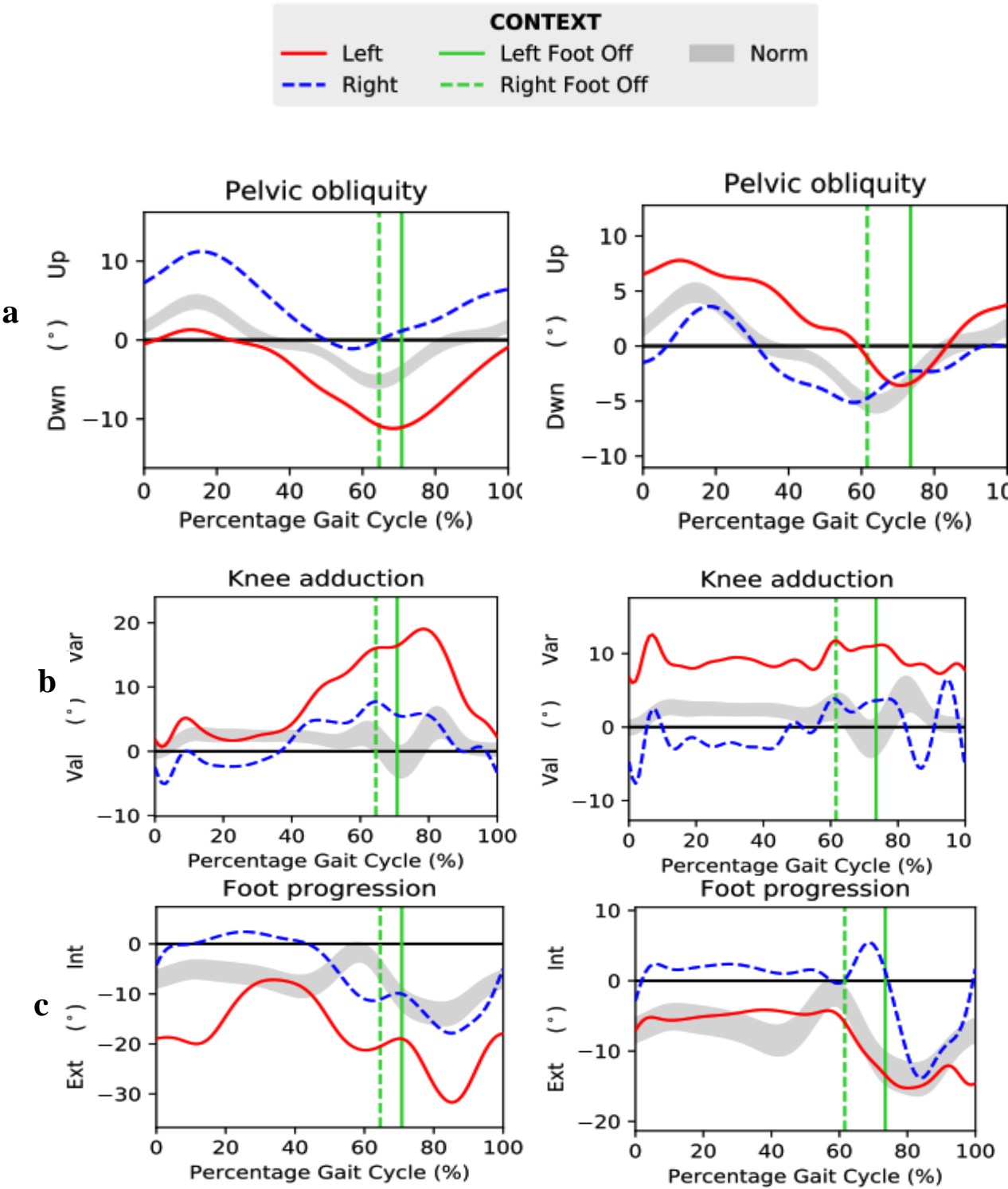


Fig. 3. Gait analysis of the patient with bare foot (Left) and with orthoses and shoes (Right)

## **Conclusion**

After the operation, The patient has improvement in all levels: 20-30 degrees in knees, 10 degrees in ankles, heel-toe gait restored on both sides. Also, he has improvement in step length: The patient still needs feet stabilization. We see that with more stable feet which orthoses provide, he walks faster and better with them. So he is much better after the operation, but he needs rehabilitation and second stage operation for feet stabilization.

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## **References**

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