

Comparison of Gait with and without an Orthosis in a Patient Undergoing Knee Endoprosthesis for Distal Femoral Osteosarcoma: A Case Report

Vinicius Taboni Lisboa¹, Julia Silva e Lima Schleder¹, Bruno de Paula Leite Arruda¹, Maria Laura Rezende Pucciarelli² Bruna Silva Serravallo, Maurício Etchebehere¹, Alberto Cliquet Jr¹

¹Department of Orthopaedics, Rheumatology and Traumatology, Universidade Estadual de Campinas (Unicamp), Campinas, Brazil

²Ottobock do Brasil Técnica Ortopédica LTDA

Email: y253549@dac.unicamp.br

Summary

Osteosarcoma is a rare bone tumor treated with surgery and, when necessary, endoprosthesis. This study evaluated orthosis as a viable option to improve the patient's gait mechanics. We conducted a gait biomechanical assessment, followed by a familiarization process with the orthosis, and then re-evaluated the gait to determine if this device truly benefits the patient.

Introduction

Osteosarcoma is a rare type of primary bone neoplasm, predominantly diagnosed in children and young adults. It is characterized by the uncontrolled growth of bone cells, which form a tumor mass, typically located in the distal region of the femur. The recommended treatment for most cases is the surgical removal of the tumor, as it is a high grade malignant tumor, with high metastatic risk. In cases where the tumor mass spreads to a significant portion of the bone tissue, the use of a endoprosthesis may be necessary to ensure the functionality of the affected limb or joint.[1][2]

Methods

We opted for the DTO (Diagnosis Test Orthosis) for C-BRACE from the manufacturer OTTOBOCK to evaluate the efficacy of the gait improvements. We conducted a study with the DTO to investigate whether the orthosis would address the patient's concerns and generate significant changes in his gait mechanics. During his 12-month post-surgery follow-up, we conducted a gait evaluation without the orthosis. After this, the patient underwent a familiarization session with the DTO lasting approximately 60 to 90 minutes, during which he performed straight walking, direction changes, standing and sitting, as well as walking up and down ramps and stairs. After this familiarization, we re-evaluated his gait with the device. Gait analysis was performed using a 12-camera Vero Vicon motion capture system (Vicon, Oxford, United Kingdom) at 100 Hz. Three-dimensional (3D) reconstruction and data analysis were performed using The Motion Monitor xGen system (Innovative Sports Training Inc., Chicago, IL, USA). Seven four-marker sensor clusters were used for data collection, and a stylus was used to digitize anatomical landmarks for the 3D reconstruction. The participant was then asked to walk at a comfortable pace over a 10-meter fixed walkway for 60 seconds.

Results and Discussion

The orthosis seems to be a good option for improving the patient's gait mechanics, as it significantly improved almost

all aspects of the gait (Table 1) both for the limb that was using the device (right) and for the limb that was not (left). Additionally, these data were obtained after a 1-hour familiarization period. The trend is that the patient will be able to adapt and integrate further with the device, and we will likely observe better results. In the table below, we highlight with * the results that were significant ($p < 0.05$) in the comparison before and after the orthosis, and we highlight in bold the results that were not significant.

	PRE-ORTHOSIS				POST-ORTHOSIS			
	ROM-R (°)	DP-R (°)	ROM-L (°)	DP-L (°)	ROM-R (°)	DP-R (°)	ROM-L (°)	DP-L (°)
PT	9,3	2	-	-	3*	2,2	-	-
PI	6,3	1,7	9,1	1,8	5,9	0,5	13,3*	17,4
HF	28,8	3,9	44,8	3,6	31,8*	17,6	49,2*	1,5
HE	13,4	2,9	6,4	2,5	14,5	2,9	7	0,8
HABD	4,6	1,8	6,8	4,3	2,2*	1,2	21,6*	10,2
HADD	7,4	1	18,7	3,4	1,8*	1	20,9	0,8
EHR	13,4	3,9	13,6	4,4	28,4*	2,2	9*	7,9
IHR	8,5	1,8	17,9	8,4	23,9*	1,3	29,1*	8,7
KF	46,4	12	69,5	9,7	42,8	3,5	77,7*	1,6
PF	17	6,8	19,1	7,9	10,4*	1,7	23,9*	2,1
DF	13,3	3,3	11,3	3,6	10*	1,4	9,6*	8,7

Table 1. Values of Range of Motion Pre and Post Orthosis.

PT: Pelvic Tilt; PI: Pelvic Inclination; HF: Hip Flexion; HE: Hip Extension; HABD: Hip Abduction; HADD: Hip Adduction; EHR: External Hip Rotation; IHR: Internal Hip Rotation; KF: Knee Flexion; PF: Plantar Flexion; DF: Dorsiflexion. ROM-R: Range of Motion of Right Side; ROM-L: Range of Motion of Left Side; SD-R: Standard Deviation of Right Side; SD-L: Standard Deviation of Left Side.

Conclusions

We can observe that although the DTO is not custom-made for the patient, it was effective in improving almost all biomechanical aspects of gait, and it could be an excellent option for patients with severe loss of function.

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