

ABSTRACT

Global effects on lower extremity biomechanics as joint health declines

Sébastien Lobet^{1,2,3} Christine Detrembleur¹ Cedric Hermans²

email: sebastien.lobet@uclouvain.be

1. Université catholique de Louvain, Secteur des Sciences de la Santé, Institut de Recherche Expérimentale et Clinique, *Computer Assisted Robotic Surgery (CARS)*, Avenue Mounier 53, B-1200 Brussels, Belgium. 2. Cliniques universitaires Saint-Luc, Service d'hématologie, Avenue Hippocrate 10, B-1200 Brussels, Belgium. 3. Cliniques universitaires Saint-Luc, Service de médecine physique et réadaptation, Avenue Hippocrate 10, B-1200 Brussels, Belgium

Quantifying the extent of joint damage in patients with hemophilia (PWH) is critical to prevent disease progression and compare the efficacy of treatment strategies. In PWH the long-term consequences of repeated haemarthrosis include cartilage damage and irreversible arthropathy, resulting in severe impairments in locomotion. Quantifying the extent of joint damage is therefore important in order to prevent disease progression and compare the efficacy of treatment strategies. This presentation endeavors to improve our knowledge of the biomechanical consequences of multiple arthropathies on gait pattern in adult patients with haemophilia using gait analysis. The more economical mode of walking is an intermediate strategy in centre of mass (CoM) displacement between extreme flatness and bouncy walking, that is, a CoM sinusoidal pathway of 3-4 cm amplitude. This intermediate strategy in CoM displacement associated with relatively straight-legged walking is achieved by peculiar movements in the lower limb joints that enable our legs to behave neither as stiff struts nor as compliant ones. These peculiar limb joint movements are called “gait determinants” because they were considered paramount in human bipedalism, as they enable a smooth progression of the body through small fluctuations of the CoM displacement to conserve energy. In PWH, with the loss of some of the major determinants as a result of multiple joint arthropathies, the strategy of vertical CoM displacement reduction is compromised leading indirectly to increase in metabolic expenditure, that is, increase of metabolic cost. This theory is confirmed as metabolic cost was dramatically increased in PWH and highly correlated to a loss in joint range of motion at ankles, knees, and hips level. In PWH with isolated ankle arthropathy, the increase in metabolic cost is proportional to ankle dysfunction, that is, the less the ankle power is generated, the more the metabolic energy is consumed and more efficiency of walking is impaired. The disruption to the normal walking process by an orthopedic disorder in PWH thus appears to generate mechanical and metabolic changes that follow a continuum linked to the progressive loss of mobility into the joints.