The treatment of gait abnormalities in persons with cerebral palsy is challenging. Theoretically, gait abnormalities can be diminished by decreasing the muscle forces that disrupt normal movement (e.g. via muscle–tendon lengthenings or tone-altering medications) and/or increasing the muscle and ground reaction forces that have the potential to improve movement (e.g. via strengthening exercises, orthoses, or derotational osteotomies). However, different patients exhibit varying degrees of neurologic impairment, spasticity, weakness, and bone deformity, suggesting that gait deviations arise from a variety of sources, each of which requires a different treatment. Treatment planning is further complicated because there is currently no scientific basis for determining how patients’ neuromusculoskeletal impairments contribute to abnormal movement. This paper describes how biomechanical models can be used, in combination with experimental data, to enhance our understanding of gait abnormalities and to provide a theoretical basis for planning treatments. Two examples are presented, and suggestions for future work are discussed.

Keywords: Modeling; Treatment planning; Weakness; Bone deformity

1. Introduction

The management of gait abnormalities in children with cerebral palsy is challenging. Musculoskeletal surgeries and other treatments, such as tone-altering medications, orthoses and physical therapy are often prescribed in an effort to improve the alignment of patients’ limbs, prevent the progression of bone deformities, and increase walking ability. However, different patients with cerebral palsy exhibit varying degrees of neurologic impairment, spasticity, weakness, muscle contracture, and bone deformity, suggesting that gait deviations arise from a variety of sources, each of which requires a different treatment. Treatment planning is further complicated because there is currently no scientific basis for determining how patients’ neuromusculoskeletal impairments contribute to abnormal movement (figure 1). This paper describes how biomechanical models can be used, in combination with experimental data, to enhance our understanding of gait abnormalities and to
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