



Short communication

The influence of estimated body segment parameters on predicted joint kinetics during diplegic cerebral palsy gait[☆]D. Kiernan^{a,b,*}, M. Walsh^a, R. O'Sullivan^a, T. O'Brien^a, C.K. Simms^b^a Gait Laboratory, Central Remedial Clinic, Clontarf, Dublin 3, Ireland^b Trinity Centre for Bioengineering, Parsons Building, Trinity College Dublin, Dublin 2, Ireland

ARTICLE INFO

Article history:

Accepted 14 October 2013

Keywords:

Anthropometry

Kinetics

Diplegic cerebral palsy

Gait

ABSTRACT

Inverse Dynamic calculations are routinely used in joint moment and power estimates during gait with anthropometric data often taken from published sources. Many biomechanical analyses have highlighted the need to obtain subject-specific anthropometric data (e.g. Mass, Centre of Mass, Moments of Inertia) yet the types of imaging techniques required to achieve this are not always available in the clinical setting. Differences in anthropometric sets have been shown to affect the reactive force and moment calculations in normal subjects but the effect on a paediatric diplegic cerebral palsy group has not been investigated. The aim of this study was to investigate the effect of using different anthropometric sets on predicted sagittal plane moments during normal and diplegic cerebral palsy gait. Three published anthropometric sets were applied to the reactive force and moment calculations of 14 Cerebral Palsy and 14 Control subjects. Statistically significant differences were found when comparing the different anthropometric sets but variability in the resulting sagittal plane moment calculations between sets was low (0.01–0.07 Nm/kg). In addition, the GDI-Kinetic, used as an outcome variable to assess whether differences were clinically meaningful, indicated no clinically meaningful difference between sets. The results suggest that the effects of using different anthropometric sets on the kinetic profiles of normal and diplegic cerebral palsy subjects are clinically insignificant.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Inverse dynamic analysis during gait allows for the estimation of joint forces and moments (Davis et al., 1991; Kingma et al., 1996). It is a procedure routinely used in gait laboratories where measured kinematic and ground reaction data are combined with estimated body segment parameters (BSP), such as mass, centre of mass and moments of inertia (MoI), to determine intersegmental forces and net joint moments during gait. The various concerns associated with the use of estimated BSPs have been widely discussed throughout the literature, in particular when subject age and sex fall outside the population originally used to estimate the BSPs (Damavandi et al., 2009; Kingma et al., 1996; Pearsall and Costigan, 1999; Rao et al., 2006). Some authors have shown inverse dynamic calculations to be sensitive to the BSP set used (Chen et al., 2011; Jensen, 1989; Rao et al., 2006), while others report the effect to be negligible (Ganley and Powers, 2004). Concerns have also been raised for pathological groups where limb asymmetry is common such as cerebral palsy (CP) (Chen

et al., 2011; Damavandi et al., 2009; Niiler and Riad, 2012). Asymmetries that may exist within this subject group, such as limb length discrepancy or reduced muscle volume (Lampe et al., 2006; Moreau et al., 2009; Shortland, 2009), could result in significantly altered reactive forces and moments during gait when different BSPs are applied. However, no study has examined the effects of different BSP sets on the kinetic profiles of a CP population. Ideally, when dealing with a pathological group such as CP, the BSPs specific to the subject would be directly measured. However, it is not always feasible for most gait laboratories to access the types of imaging techniques required to achieve this. For this reason the use of published BSP sets acts as an acceptable compromise. Following from this, the aim of this study is to determine whether any clinically meaningful difference may exist in the predicted kinetic profiles of a cohort of CP subjects when different published BSP sets are used in the reactive force and moment calculations during gait.

2. Materials and methods

2.1. Subjects

Fourteen subjects ($n=28$ limbs) presenting for routine gait analysis with a diagnosis of diplegic cerebral palsy and 14 healthy controls ($n=28$ limbs) participated in the study (Table 1). Informed written consent was obtained from all

[☆]All authors were fully involved in the study and preparation of the manuscript and the material within has not been and will not be submitted for publication elsewhere except as an abstract.

* Corresponding author at: Central Remedial Clinic, Gait Laboratory, Vernon Avenue, Clontarf, Dublin, Ireland. Tel.: +353 1 8542467; fax: +353 1 8542570.

E-mail address: dkiernan@crc.ie (D. Kiernan).

^a Statistically significant at $p < 0.01$.

Download English Version:

<https://daneshyari.com/en/article/872187>

Download Persian Version:

<https://daneshyari.com/article/872187>

[Daneshyari.com](https://daneshyari.com)