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The Gait Profile Score and Movement Analysis Profile

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ABSTRACT

The Gait Deviation Index (GDI) has been proposed as an index of overall gait pathology. This study proposes an interpretation of the difference measure upon which the GDI is based, which naturally leads to the definition of a similar index, the Gait Profile Score (GPS). The GPS can be calculated independently of the feature analysis upon which the GDI is based. Understanding what the underlying difference measure represents also suggests that reporting a raw score, as the GPS does, may have advantages over the logarithmic transformation and z-scaling incorporated in the GDI. It also leads to the concept of a Movement Analysis Profile (MAP) to summarise much of the information contained within kinematic data.

A validation study on all children attending a paediatric gait analysis service over 3 years (407 children) provides evidence to support the use of the GPS through analysis of its frequency distribution across different Gross Motor Function Classification System (GMFCS) and Gillette Functional Assessment Questionnaire (FAQ) categories, investigation of intra-session variability, and correlation with the square root of GGI. Correlation with GDI confirms the strong relationship between the two measures.

The study concludes that GDI and GPS are alternative and closely related measures. The GDI has prior art and is particularly useful in applications arising out of feature analysis such as cluster analysis or subject matching. The GPS will be easier to calculate for new models where a large reference dataset is not available and in association with applications using the MAP.

1. Introduction

Instrumented three-dimensional gait analysis generates kinematic measurements of a wide range of variables across the gait cycle. These span different joints and different planes. Clinical decisions are generally based on an interpretation of the complex information contained in these highly interdependent data. It can often be useful, however, to have a single measure of the 'quality' of a particular gait pattern. Such a measure can quantify the overall severity of a condition affecting walking, monitor progress, or evaluate the outcome of an intervention prescribed to improve the gait pattern.

Although other measures have been proposed, the only one to have widespread clinical acceptance is the Gillette Gait Index [1] (GGI, originally referred to as the Normalcy Index), which quantifies the difference between data from one gait cycle for a particular individual and the average of a reference dataset from people exhibiting no gait pathology. The GGI, however, has several shortcomings. These have been well documented and largely overcome in a recent paper proposing an alternative, the Gait Deviation Index [2] (GDI). The GGI incorporates temporal spatial as well as kinematic parameters. The GDI uses only kinematic variables, and might thus be taken as a cleaner reflection of gait quality. The entire variability in kinematic variables across the gait cycle is used, rather than a small number of discrete parameters, thereby removing much of the subjectivity in choosing those parameters. Selection of the parameters for the GGI was specific to children with cerebral palsy whereas the GDI would appear to be a more general measure of gait pathology.

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