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Gait & Posture 5 (1997) 251–255

GAIT POSTURE

Technical note

Comparison of the performance of 3D camera systems II

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Accepted 15 April 1996

Abstract

The accuracy and processing time of 11 commercially available 3D camera systems were tested to evaluate their performance in clinical gait evaluation. The systems tested were Ariel APAS, Dynas 3D/h, Elite Plus, ExpertVision, PEAK5, PRIMAS, Quick MAG, VICON 140, VICON 370, color Video Locus and reflective Video Locus. The 3D locations of markers on both ends of a rigid bar were determined. The distance between these markers was calculated from these data and compared with the true value, which was measured with a slide caliper prior to the measurement. For the estimation of noise, 3D coordinates of the markers were measured while the same rigid bar was placed on the floor, and the standard deviations were calculated. The processing time for calculating 3D coordinates from data obtained during normal gait was measured.

Keywords: 3D camera systems; Comparison; Standardized condition; Gait measurements

1. Introduction

In 1993, the accuracy and processing time of eight 3D camera systems were measured and the data were reported in this journal [1,2]. Since recent progress on these systems has been significant in terms of both hardware and software, these data must be updated. The purpose of this technical note is to update old data in order to compare and evaluate the basic performances of each system. The data will be useful to users who want to purchase a 3D camera system for clinical rehabilitation use.

Because the 3D camera system is utilized in the analysis and evaluation of a patient's gait in a clinical situation, it is important to evaluate the performance of each system from such a viewpoint. However, it is too difficult to deal with this kind of performance in a technical note. Here, we defined basic performances in terms of the accuracy of data and user friendliness in obtaining data. Two accuracy tests were performed. First, the relative distance between two markers on a rigid bar was calculated and compared with the true value while moving the bar in the field of view. Next, the noise of marker data was measured. The same bar was placed on the floor and the standard deviation of the coordinates of each marker was calculated. This test was effective because noise in data could be canceled out in the calculation of the distance between two markers when the noise of the markers was synchronized. Accuracy and noise estimations were performed using the final 3D data, not intermediate data, because clinical users are concerned only with the final data. All data were obtained in an environment which simulated real gait laboratory conditions.

User friendliness entails many aspects. However, since it is impossible to consider all these aspects, we considered the processing time required to obtain final results. Therefore, the time required for calculating 3D coordinates and for displaying 3D stick figures on the monitor after gait measurement was determined.

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0966-6362/97/$17.00
PII S0966-6362(96)01093-4