Effect of position on precision within the recording field of a markerless motion capture system

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Introduction

Markerless motion capture systems are relatively new devices that can significantly speed up capturing full body motion.

A precision of the assessment of the finger's position with this type of equipment was evaluated at 17.30 ± 9.56 mm when compare to an active marker system [1].

The Microsoft Kinect was proposed to standardized and enhanced clinical evaluation of patients with hemiplegic cerebral palsy [2].

Markerless motion capture systems have the potential to be used in a clinical setting for movement analysis, as well as for large cohort research. However, the precision of such system needs to be characterized.

Global objectives

- To assess the precision within the recording field of the markerless motion capture system Openstage 2 (Organic Motion, NY).
- To compare the markerless motion capture system with an optoelectric motion capture system with active markers.

Specific objectives

- To assess the noise of a static body at 13 different location within the recording field of the markerless motion capture system.
- To assess the smallest oscillation detected by the markerless motion capture system.
- To assess the difference between both systems regarding the body joint angle measurement.

Methods

Equipment

- OpenStage® 2 (Organic Motion, NY)
    - Markerless motion capture system
    - 16 video cameras (acquisition rate : 60Hz)
    - Recording zone : 4m * 5m * 2.4m (depth * width * height)
    - Provide position and angle of 23 different body segments
- VisualeyezTM VZ4000 (PhoeniX Technologies Incorporated, BC)
    - Optoelectric motion capture system with active markers
    - 4 trackers system (total of 12 cameras)
    - Accuracy : 0.5~0.7mm

Protocol & Analysis

- Static noise:
    - Motion recording of an humanoid mannequin was done in 13 different locations
    - RMSE was calculated for each segment in each location
- Smallest oscillation detected:
    - Small oscillations were induced to the humanoid mannequin and motion was recorded until it stopped.
    - Correlation between the displacement of the head recorded by both systems was measured. A corresponding magnitude was also measured.
- Body joints angle:
    - Body motion was recorded simultaneously with both systems (left side only).
    - 6 participants (3 females; 32.7 ± 9.4 years old)
- Tasks: Walk, Squat, Shoulder flexion & abduction, Elbow flexion, Wrist extension, Pronation / supination (not in results), Head flexion & rotation (not in results), Leg rotation (not in results), Trunk rotation (not in results)
    - Several body joint angles were measured with both systems.
    - RMSE was calculated between signals of both systems.

Results

Fig. 1: Mean magnitude of the noise of 13 locations within the recording field of the OpenStage

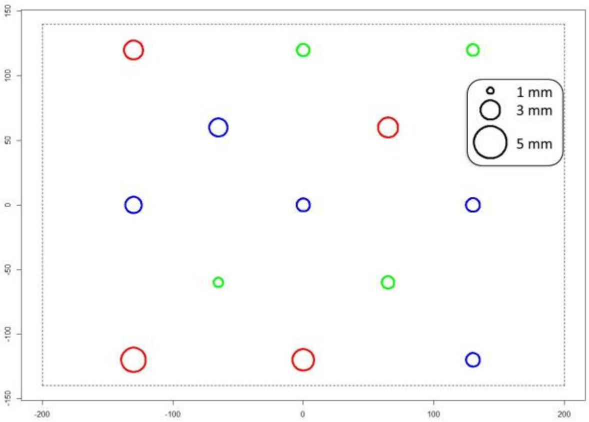
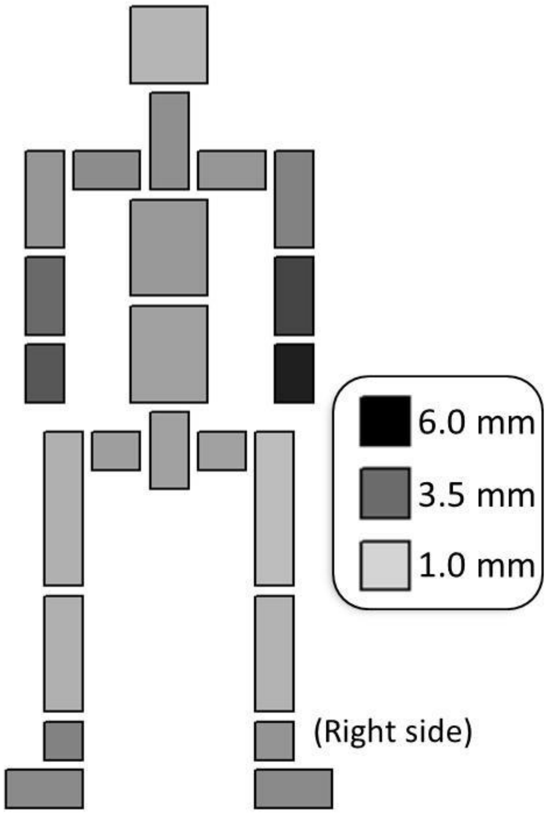


Fig. 2: Mean magnitude of the noise of each segment measure with the OpenStage



Conclusion

Results show that the Organic Motion markerless system has the potential to be used for assessment of clinical motor symptoms or motor performances

However, the following points should be considered:

- Precision of the Openstage system varied within the recording field.
- Precision is not constant between limb segments.
- The error seems to be higher close to the range of motion extremities.

References

[1] Tung JY et al(2015) Evaluation of a portable markerless finger position capture device: accuracy of the Leap Motion controller in healthy adults. Physiol Meas

[2] Rammer JR, Krzak JJ, Riedel SA, Harris GF (2014) Evaluation of upper

extremity movement characteristics during standardized pediatric functional assessment with a Kinect(R)-based markerless motion analysis system. Conf Proc IEEE Eng Med Biol Soc