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Fundamental Evaluation of a Single Inertial Sensor in Trunk Angle Measurement During Patient Repositioning

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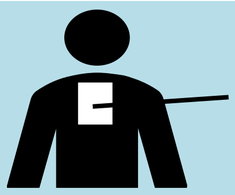
INTRODUCTION & AIM

Trunk Flexion in Patient Handling
➡ Cause of **Lower Back Pain (LBP) [1]**

Wearable Single Inertial Sensor
➡This can measure trunk flexion anywhere for preventing LBP [2].
➡Accuracy was not evaluated.



Aim of this study was **to evaluate** the accuracy of a **single inertial sensor** for **trunk flexion** measurements during **patient handling.**

METHOD

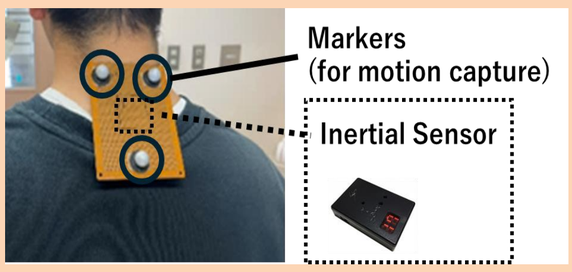
Experiment

Participants:
10 young males

Patient Handling Task:
Repositioning on the Chair
(10 trials for each participant)

Measurement

Sampling Rate: 100 Hz



❶ **Inertial Sensor**:
➡ The Madgwick filter [3] was applied to calculate the trunk flexion angle from acceleration and gyro data.
(magnetic adjustment was not used for robustness in environment)

❷ **Optical Motion Capture System (Ground Truth)**:
➡ This device was used as ground truth.

Evaluation

- Pearson's **Correlation** Coefficient
- **RMSE** (Root Mean Squared Error)

RESULTS & DISCUSSION

Table 1 Results of Comparison

Mean ± S.D.	
Correlation	RMSE[deg]
0.978 ± 0.0262	17.6 ± 4.55

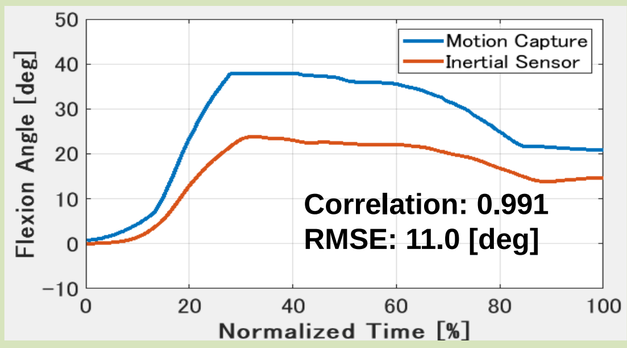


Fig.1 Example of Time Waveform

Correlation
There is high correlation **more than 0.9** between the **inertial sensor and ground truth**.

➡ Inertial sensor **could measure temporal changes in trunk flexion** during patient handling.

RMSE
- RMSE with ground truth is **more than 15 degrees.**
- Trunk flexion angles **differ by 10 degrees** between lifting motions **with different lumbar loads [4]**.

➡ Absolute **error** of an inertial sensor **should be improved** for monitoring lumbar loads.

Future Works
- **Error** of trunk angle calculation will be **improved** by further signal processing such as **machine learning**.
- **Inertial sensor should be evaluated** for **various patient handling** tasks and caregivers.

CONCLUSION

This study **evaluate** the accuracy of a **single inertial sensor** for **trunk flexion** measurements during **patient handling.**

The results showed that inertial sensor **could measure temporal changes in trunk flexion** during patient handling.

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Conflict of Interest : The authors declare no conflict of interest.

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