

Validation of Automated Timed Up-and-Go Test Using a Vision-Based Motion Analysis

Soo Jeong Jo^{1,2}, Hyun Ho Kong^{1,2}

Chungbuk National University Hospital, Department of Rehabilitation Medicine¹

Chungbuk National University College of Medicine, Department of Rehabilitation Medicine²

INTRODUCTION

- Assessment of mobility is an important component of the older adults' body function measurement. The **timed up-and-go (TUG) test** simultaneously evaluates the gait and balance of older adults, and the TUG test is well-related to the risk of falls in older adults.
- We used the Smart devices composed of Care Vision (motion recognition using a 2D camera) and Care Pad (measurement of foot pressure and recognizing rotation function) to assess frailty in older adults.
- In this study, the validity of our smart device assessment, the TUGO test, was measured.

METHOD

- The RCT study design : prospective, single-center (from October 2022 to December 2022)
- Population**
 - Aged 65 years or older **female**
 - 49 patients** who could walk without assistance
 - Mean age of **72.1 ± 6.0 years**.
- Outcome and measurement**
 - Manually evaluated the TUG test** by trained tester (mTUG; rising from an armchair, walking 3 meters, turning, walking back, and sitting down again)
 - Automated TUG test(aTUG)** by trained tester using a vision-based geriatric assessment device.
- The correlation between the two tests was analyzed.

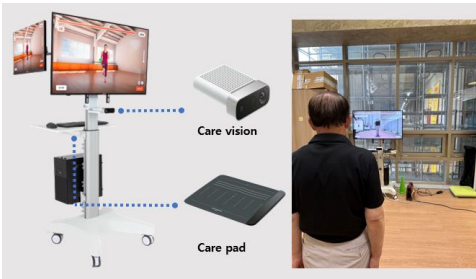


Figure 1. Smart device(left) and screen during exercise with real-time feedback(right)

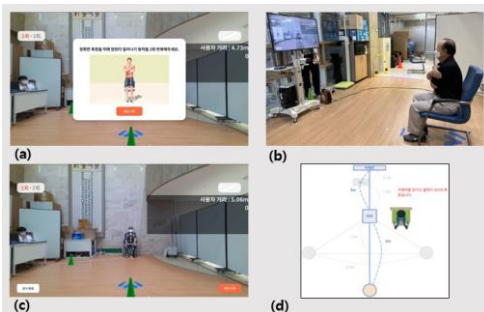


Figure 2. Augmented-reality-based test program (a) Configuration of the contents of Timed Up and Go test by trained tester; (b) content execution and safety management by trained tester during exercise; (c) testing situation monitoring on monitors; and (d) diagram of TUG test.

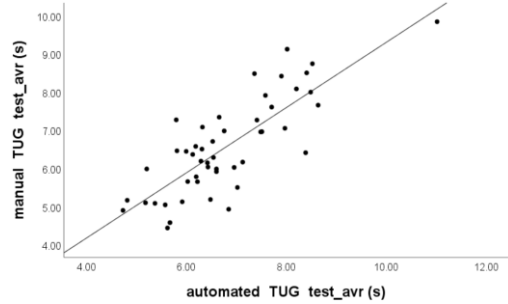


Figure 3. Association Between manual TUG test and automated TUG test

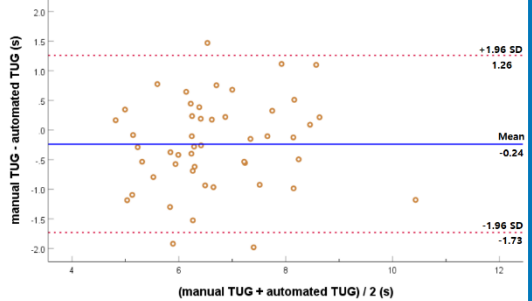


Figure 4. Bland and Altman plots with three values by participants corresponding to the test duration according to the manual and automated

RESULTS

- Forty-nine females** living in the community were included in the analysis, with a **mean age of 72.1 ± 6.0 years**.
- The subjects' performance time was measured as a mean of **6.6 ± 1.3 seconds** in the mTUG test, and a mean of **6.8 ± 1.2 seconds** in the aTUG test.
- The concurrent validity between the mTUG and the aTUG test showed high validity with an intraclass correlation coefficient of 0.89 ($p < 0.001$).

CONCLUSION

- The aTUG test using the newly developed vision-based motion analysis device showed high validity with the mTUG test.
- By evaluating the older adults' physical function using a smart device, it is possible quantitatively monitor the frailty among the elderly living in the community.

ACKNOWLEDGEMENT

This work was supported by the Medical Device Technology Development Program(20014701, Modular quantitative aging assessment and care service based on multiple sensors for aging-in-home) funded by Ministry of Trade, Industry and Energy(MOTIE, Korea)