

## The Use of Five Times Sit-To-Stand Test in Ambulatory People with Spinal Cord Injury When Tested with or without Hands

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**Abstract :** The five times sit-to-stand test (FTSST) has been widely used to quantify lower extremity motor strength (LEMS), dynamic balance ability, and risk of falls in many individuals. Recently, it has been used in ambulatory patients with spinal cord injury (SCI) but variously using with or without hands according to patients' ability. This difference might affect the validity of the test in these individuals. Thus, this study assessed the concurrent validity of the FTSST in ambulatory individuals with SCI, separately for those who could complete the test with or without hands using LEMS and standard functional measures as gold standards. Moreover, the data of the tests from those who completed the FTSST with and without hands were compared. A total of 56 ambulatory participants with SCI who could complete sit-to-stand with or without hands were assessed for the time to complete the FTSST according to their ability. Then they were assessed for their LEMS scores and functional abilities, including the 10-meter walk test (10MWT), the walking index for spinal cord injury II (WISCI II), the timed up and go test (TUGT), and the 6-minute walk test (6MWT). The Mann-Whitney U test was used to compare the different findings between the participants who performed the FTSST with and without hands. The Spearman rank correlation coefficient ( $\rho$ ) was applied to analyze the levels of correlation between the FTSST and standard tests (LEMS scores and functional measures). There were significant differences in the data between the participants who performed the test with and without hands ( $p < 0.01$ ). The time to complete the FTSST of the participants who performed the test without hands showed moderate to strong correlation with total LEMS scores and all functional measures ( $\rho = -0.71$  to  $0.69$ ,  $p < 0.001$ ). On the contrary, the FTSST data of those who performed the test with hands were significantly correlated only with the 10MWT, TUGT, and 6MWT ( $\rho = -0.47$  to  $0.57$ ,  $p < 0.01$ ). The present findings confirm the concurrent validity of the FTSST when performed without hands for LEMS and functional mobility necessary for the ability of independence and safety of ambulatory individuals with SCI. However, the test using hands distort the ability of the outcomes to reflect LEMS and WISCI II that reflect lower limb functions. By contrast, the 10MWT, TUGT, and 6MWT allowed upper limb contribution in the tests. Therefore, outcomes of these tests showed a significant correlation to the outcomes of FTSST when assessed using hands. Consequently, the use of FTSST with or without hands needs to consider the clinical application of the outcomes, i.e., to reflect lower limb functions or mobility of the patients.

**Keywords :** mobility, lower limb muscle strength, clinical test, rehabilitation

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