

BrainTest (electronic Self-Administered Gerocognitive Examination (eSAGE)) for Smartphone Use: Equivalency Validation Study

Vrettos N, Nagaraja HN, Spencer N, Scharre DW



BACKGROUND

- ❖ BrainTest® (BrainTest), the digital version of the Self-Administered Gerocognitive Examination (eSAGE), is a valid and reliable digital cognitive assessment tool that is designed to be used unsupervised for the purpose of identifying individuals with mild cognitive impairment (MCI) or early dementia
- ❖ We evaluated the administration and performance of the four versions of BrainTest taken on a smartphone (SP-BrainTest) compared to using a tablet (T-BrainTest) and established its association with clinical assessments of cognitive impairment.

DESIGN / METHODS

- ❖ Participants aged over 49 were recruited from community and clinic settings and classified as dementia, MCI, or cognitively normal based on standard clinical criteria
- ❖ The T-BrainTest and SP-BrainTest were administered using a crossover design
- ❖ SP-BrainTest scores were compared to clinical diagnosis
- ❖ Associations were investigated using Spearman correlations, linear regression, and sensitivity and specificity measures.

RESULTS

Table 1: Subject Demographics

n = 59	Mean ± SD	Range
Age (years)	72.9 ± 7.0	57-88
Greater than 12 years of education	83%	
Sex, female	54%	
Race, White	93%	
Experience with tablet or smartphone	100%	
SP-BrainTest score, age and education adjusted	17.64 ± 3.6	9-22
T-BrainTest score, age and education adjusted	18.41 ± 3.15	10-22

Fig 1. Linear Fit of BrainTest (SP-T) Score Differences By T-BrainTest Score

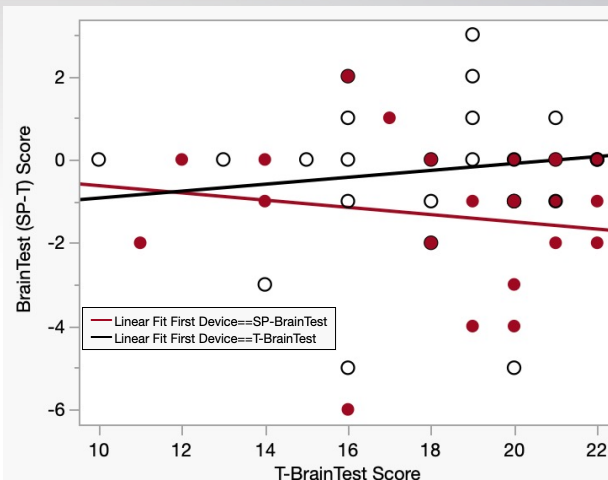


Table 2: SP-BrainTest, and T-BrainTest scores (Mean ± SD) with Ranges of Normal, MCI and Dementia Participants, and their Effect Sizes

n = 59	SP-BrainTest (max 22) mean ± SD (range)	T-BrainTest (max 22) mean ± SD (range)
Normal (n=28)	19.9 ± 1.9 (15-22)	20.5 ± 1.4 (18-22)
MCI (n=26)	16.0 ± 3.5 (9-22)	17.2 ± 2.9 (11-22)
Dementia (n=5)	13.4 ± 2.7 (10-17)	13.2 ± 2.4 (10-16)
Common SD Estimate	2.82	2.22
Effect Size d* (normal vs MCI)	1.39	1.51
Effect Size d* (Normal vs dementia)	2.32	3.29

- ❖ Spearman correlation between SP-BrainTest and T-BrainTest is 0.8342 ($p < 0.0001$); they are related by the formula: SP-BrainTest score = $-0.55 + 0.9883 \times \text{T-BrainTest score}$
- ❖ There was no statistically significant score differences across any of the four test versions whether using the smartphone or tablet
- ❖ There was a statistically significant device effect (tablet scores, on average, were 0.8 points higher than smartphone scores) but this is less than one point and does not meet clinical significance
- ❖ ROC of SP-BrainTest based on clinical diagnosis showed an area under the curve (AUC) of 0.86 in detecting cognitive impairment (MCI and dementia, $n=31$) from normal subjects ($n=28$); a cut-off of 19 points yielded 90% sensitivity and 71% specificity.

CONCLUSIONS

- ❖ SP-BrainTest shows strong association and clinical equivalency with T-BrainTest. Both have the advantage of digital assessment, self-administration, brevity, four interchangeable forms, and high sensitivity and specificity in detecting cognitive impairment from normal subjects
- ❖ Having both tablet and smartphone platforms will allow for increased accessibility and convenience and help to overcome the many obstacles in identifying early cognitive changes.

REFERENCES

1. Scharre DW, Chang S-I, Murden RA, Lamb J, Beversdorf DQ, Kataki M, et al. Self-administered Gerocognitive Examination (eSAGE): A brief cognitive assessment instrument for Mild Cognitive Impairment (MCI) and early dementia. *Alzheimer Dis Assoc Disord* 2010;24:64-71
2. Scharre, D. W., Chang, S. I., Nagaraja, H. N., Vrettos, N. E., & Bornstein, R. A. (2017). Digitally translated Self-Administered Gerocognitive Examination (eSAGE): relationship with its validated paper version, neuropsychological evaluations, and clinical assessments. *Alzheimer's Research & Therapy*, 2017;9(1):44-57

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