

Predicting Falls In Older Persons Using Simple Visual Reaction Times.



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Background

- Falls by multiple fallers associated with more injuries, longer hospital stays, greater admissions to residential care and increased risk of dying (Vassallo, Sharma, & Allen, 2002, Donald & Bulpitt, 1999).
- Mechanisms in multiple fallers are different (Chan, Pang, Ee, Ding, & Choo, 1997).
- ❖ *How do we determine who will fall again?*

Simple Reaction Time

- SRT is most accurate measure of CNS processing speed.
(Hasselkus, 1974; Huxham, Goldie, & Patla, 2001).
 - Represents how efficiently the sensory systems and effector systems are integrated within the CNS to maintain postural control.
 - Not routinely tested in clinical practice.
- *Is an important factor potentially being missed by clinicians?*

Why not?

- Strong evidence that SRT scores contribute significantly to the prediction of falls (Lajoie, Girard, & Guay, 2002; van den Bogert, Pavol, & Grabiner, 2002)
 - Reported SRT cut-off score in predicting falls with very high sensitivity and specificity (Lajoie & Gallagher, 2004)
- BUT
- Expensive and complex computerised platform equipment

Why not?

- Physiological Profile Assessment (PPA) uses SRT to accurately predict fallers. (Lord, Allen, Williams, & Gandevia, 2002; Lord, Castell et al., 2003; Lord, Menz, & Tiedemann, 2003).

BUT

- SRT testing procedure and cut-off scores have not been published for clinical replication.
- PPA may be too expensive for many clinics.

Aims

Aim #1: To determine whether SRT will distinguish between single fallers and multiple-fallers within a sample of older persons using a simple, standardised measurement protocol.

Aim #2: To provide an accurate “cut-off” score for SRT, with high sensitivity and specificity for association with falls.

Research Design

- A case-control study design
- Participants or their carers reported the participant's falls history from the previous 12 months.
- Participants were recruited from within the sub-acute satellites of Northern Health Service in Victoria, facilitated by treating physiotherapists.

Inclusion/Exclusion Criteria

- "Older Adults", defined as those over 65 years of age (Campbell, Reinken, Allan, & Martinez, 1981).
- A history of one or more previous falls.
- Only excluded if unable to undergo testing (trial and error based), e.g.
 - inability to concentrate for more than 10 minutes
 - inability to understand at least two-stage commands
 - insufficient lower limb movement to lift off pedal
 - insufficient vision to see light display

Apparatus

- Lafayette Reaction Timer (Model 63017, Lafayette Instruments, Lafayette, IN) with:

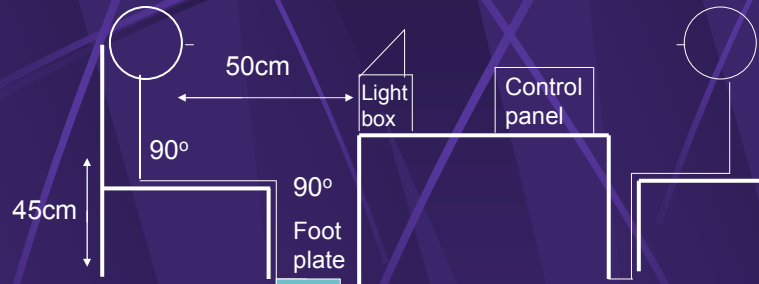
1: A light box with separate warning and testing stimulus lights – variable pre-set delay

Apparatus cont...

2: A hinged footplate (placed under subjects' dominant/ least impaired foot).

3: An examiners panel containing an operator switch and clocks.

SRT Test Protocol



- Four trials, two practice and two testing trials.
(Parker, 2004)
- The mean score of testing trials determines the final score.
- Standardised instructions

Collected Data

- Gender
- Age
- Number of medical pathologies
- Number of medications
- Presence of medications contributing to falls (CNS – acting medications)
- Orientation-Memory-Concentration (OMC) Test score
- Falls Category – Single or Multiple
- Simple reaction time score (milliseconds)

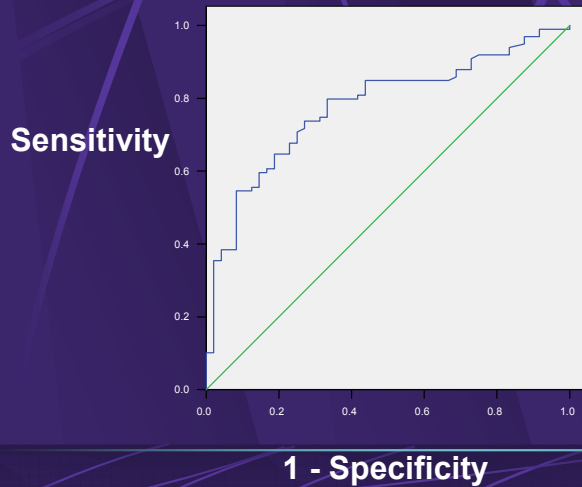
Results

- The total time for SRT testing took up to 10 minutes in total (incl. 5 mins set-up)
- Only one patient could not perform the test due to poor vision.
- Total participants – 147
 - **Single fallers - 48**
 - **Multiple fallers - 99**

Group Differences

- No differences for Age, Gender, OMC, number of medications or Presence of CNS-acting medications.
- Groups were significantly different for number of pathologies ($p = 0.04$) and SRT score ($p = 0.00$).
- Discriminant Functional Analysis revealed Wilk's lambda of .89 ($p = .05$) where all variables correctly classified 66% of the cases.
 - Number of pathologies (CDFC = 0.46)
 - SRT score (CDFC = 0.89)

Diagnostic Accuracy of the SRT Test



The area under the curve showed good diagnostic accuracy at 0.78.

Provision of a Cut-Off Score for SRT Testing

- The cut-off score of 394.5ms was determined taking the intersection point where the best balance of sensitivity (0.73) and specificity (0.73) was obtained.
- Dichotomized data revealed:
 - Odds Ratio= 7.18
 - 74% Sensitivity
 - 69% Specificity
 - 84.5% Positive Predictive Value

Discussion Points

- Supports other studies which determined SRT to be a significant and independent risk factor for falls (Lord et al, 2003, Mayo, et al, 1990 and Lord and Dayhew, 2001).
- SRT was the strongest predictive variable in determining faller type.
- SRT should be tested in clinical practice.
- May be an effective use of budget resources.

Conclusion

- Clinically feasible SRT protocol that is a useful tool for distinguishing between single and multiple fallers
- Cut-off score of 394.5ms provides good predictive ability to determine multiple fallers
- May be a useful screening tool