Exploration of Timed Up and Go scores with and without a Cognitive Challenge in People with MS and a Healthy Reference Group

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Objectives

• Provide sample TUG and TUG-C data for pwMS and a healthy reference group
• Examine within group differences in these populations for these measures
• Examine differences between these populations in these measures
• Examine differences between people with MS who fall and those who do not in these measures
• Present preliminary results of instrumented TUG and TUG-C data from a healthy reference group
Contents

Background
Methodology
Results
Key Points

Background
Falls in People with MS

• 56% in a 3 month period (Nilsagård et al 2014)
• Effect on the individual
  – Injurious Falls (Peterson et al 2008)
  – Fear of Falling (Peterson et al 2007)
  – Activity Curtailment (Peterson et al 2007)

• Balance impairment and falls
  – Pooled OR 1.07 (95%CI 1.04-1.10) (Gunn et al 2013)

• Gait, Turning, Postural Transitions
  – Gunn et al 2014
  – Matsuda et al 2012
  – Nilsagård et al 2009

Why Choose the TUG?

• Timed Up and Go
  – Objective/Quick to administer
  – Elicits dynamic activity
  – MS Evaluation Database to Guide Effectiveness
  – IMSFPRN (Cattaneo et al 2014)

• Timed Up and Go-Cognitive
  – PwMS dual tasking difficulties (Sosnoff et al 2011)
  – Dual task cost

• Predictive Validity?
Methodology

Study Recruitment

- Healthy Reference Group
  - University of Limerick
  - Undergraduate Physiotherapy Students
  - N=50
- People with MS
  - St Vincent’s University Hospital
  - MS Society of Ireland
  - N=51

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
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</thead>
<tbody>
<tr>
<td>EDSS 3.0-6.5</td>
<td>Unable to provide consent</td>
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<tr>
<td>Over 18 years of age</td>
<td>Pregnant Women</td>
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</table>
**TUG Administration**

- Seated on a standard armchair with back rested against chair
- Permitted to use usual aid
- Walk as quickly and as safely as possible to the line
- Turn, walk back and sit down again
- 1 Practice trial and 3 timed trials performed
- **TUG-Cognitive**: Subtracting out loud backwards in 3s from random numbers between 20 and 100
- **Follow Up**: Three months of prospective falls diaries
  - Fortnightly Text/Email Reminders

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**Smartphone Falls Prediction**

- **App Development**
  - University of Limerick 2014
- **Smartphone Variables**
  - 4 Parameters in 3 Dimensions
  - 12 Summary Statistics
  - 5 Phases in 2 Conditions
  - 960 Variables
Statistical Analysis

- Frequency analysis
  - Mean, Standard Deviation
  - Median, Interquartile Range
- Tests of Normality
  - Skewed Data
- Non-Parametric Tests
  - Wilcoxon Signed Rank
  - Mann-Whitney U

Results
Study Population

<table>
<thead>
<tr>
<th></th>
<th>Healthy Reference (n=50)</th>
<th>People with MS (n=51)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Age</strong></td>
<td>22.8±4.96</td>
<td>53.26±10.19</td>
</tr>
<tr>
<td><strong>Males: Females</strong></td>
<td>14:36</td>
<td>16:35</td>
</tr>
<tr>
<td><strong>Mean TUG</strong></td>
<td>5.78±0.78</td>
<td>13.55±7.59</td>
</tr>
<tr>
<td><strong>Mean TUG-C</strong></td>
<td>5.98±1.0</td>
<td>16.44±9.83</td>
</tr>
<tr>
<td><strong>Mean Disease Duration</strong></td>
<td>N/A</td>
<td>13.67±8.99</td>
</tr>
<tr>
<td><strong>Walking Aid Users</strong></td>
<td>N/A</td>
<td>35/51 (69%)</td>
</tr>
<tr>
<td><strong>Retrospective Fallers</strong></td>
<td>N/A</td>
<td>22/51 (43%)</td>
</tr>
<tr>
<td><strong>Prospective Fallers</strong></td>
<td>N/A</td>
<td>9/27 (33%)</td>
</tr>
</tbody>
</table>

**Within Group TUG and TUGC Difference**

- **Mean TUG**: Healthy Ref (n=50) 5.78±0.78 vs. PwMS (n=51) 13.55±7.59 (p=0.004)
- **Median TUG**: Healthy Ref (n=50) 5.76 (1.18) vs. PwMS (n=51) 11.36 (5.94) (p=0.004)
- **Mean TUG-C**: Healthy Ref (n=50) 5.98±1.0 vs. PwMS (n=51) 16.44±9.83 (p<0.001)
- **Median TUG-C**: Healthy Ref (n=50) 5.98 (1.51) vs. PwMS (n=51) 13.5 (5.79) (p=0.001)
### TUG Difference Healthy Ref Vs PwMS

<table>
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<tr>
<th></th>
<th>Healthy (n=50)</th>
<th>PwMS (n=51)</th>
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</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>5.78±0.78</td>
<td>13.55±7.59</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>5.76 (1.18)</td>
<td>11.36 (5.94)</td>
</tr>
<tr>
<td>Mann-Whitney U</td>
<td>p&lt;0.001</td>
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### TUGC Difference Healthy Ref Vs PwMS

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<th>PwMS (n=51)</th>
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<tbody>
<tr>
<td>Mean±SD</td>
<td>5.98±1.0</td>
<td>16.44±9.8</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>5.98 (1.51)</td>
<td>13.5 (5.79)</td>
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<td>Mann-Whitney U</td>
<td>p&lt;0.001</td>
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</table>
Dual Task Cost% Difference Healthy Ref Vs PwMS

Normal Population  People with MS

Healthy (n=50)  PwMS (n=51)

Mean±SD  97.5±9.2  86.6±17.7

Median (IQR)  97.16 (8.90)  86.66 (19.18)

Mann-Whitney U  p<0.001

TUG Difference Fallers Vs Non Fallers

Non-Faller  Faller

Faller (n=22)  Non-Faller (n=29)

Mean±SD  13.24±4.5  13.79±9.4

Median (IQR)  12.95 (5.82)  11.06 (5.14)

Mann-Whitney U  p=0.403

Retrospective Recall
TUGC Difference Fallers Vs Non Fallers

- Faller (n=22)
- Non-Faller (n=29)

<table>
<thead>
<tr>
<th></th>
<th>Faller</th>
<th>Non-Faller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>14.82±6.3</td>
<td>17.66±11.8</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>13.66 (4.31)</td>
<td>12.99 (11.02)</td>
</tr>
<tr>
<td>Mann-Whitney U</td>
<td>p=0.955</td>
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Retrospective Recall

TUG Difference Fallers Vs Non Fallers

- Faller (n=9)
- Non-Faller (n=18)

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<thead>
<tr>
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<th>Non-Faller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>17.46±5.2</td>
<td>11.77±9.7</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>18.44 (8.89)</td>
<td>8.96 (3.15)</td>
</tr>
<tr>
<td>Mann-Whitney U</td>
<td>p=0.001</td>
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Prospective Monitoring
**TUGC Difference Fallers Vs Non Fallers**

<table>
<thead>
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<th>Faller (n=9)</th>
<th>Non-Faller (n=18)</th>
</tr>
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<tbody>
<tr>
<td>Mean±SD</td>
<td>25.48±12.4</td>
<td>13.74±9.96</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>25.53 (19.11)</td>
<td>11.22 (5.38)</td>
</tr>
<tr>
<td>Mann-Whitney U</td>
<td>p=0.004</td>
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**Prospective Monitoring**

**DTC% Difference Fallers Vs Non Fallers**

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<thead>
<tr>
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<th>Non-Faller (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>80.56±32.4</td>
<td>85.59±12.8</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>88.73 (50.21)</td>
<td>85.44 (18.39)</td>
</tr>
<tr>
<td>Mann-Whitney U</td>
<td>p=0.860</td>
<td></td>
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**Prospective Monitoring**
Preliminary Smartphone Data

- 50 University Students
- Mean Age 22.8±4.96
- Cognitive Challenge
  - Walk 1 Length (mean 0.11, p<0.001)
  - Go Phase (mean 0.07, p=0.004)

- PwMS data collection ongoing
- Creation of multivariate TUG/TUGC dataset

Key Points
Summary

- Significant Differences in TUG and TUGC exist between healthy populations and pwMS
- Limited sample sizes suggest significant differences exist between fallers and non-fallers when prospective falls diaries are used
  - Research ongoing
- Instrumented TUG/TUGC data may be useful in identifying pwMS at risk of falls
  - Research ongoing

Prospective Falls Monitoring

- Retrospective Vs Prospective
- Falls Diaries IMSFPRN (Coote et al 2014)
  - 3 Months
- Small sample size (n=27)
- Ongoing study
- ROC and AUC analysis
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• Gillian Quinn, SVUH

• UL MS Research Team (www.msresearch.ie)
• Study Participants

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Questions

References

References


