A Framework for (Tele-) Monitoring of the Rehabilitation Progress in Stroke Patients

Mobile Instrumented Stroke Rehabilitation in Ambient Assisted Living to Support Longterm Success and Independent Living
Motivation

➢ Gait deficits in stroke survivors
  - Affect up to 75% of patients (Duncan et al., 2005)
  - 5% of patients gain walking independence at discharge (Paolucci et al., 2008)
  - can lead to impaired social life and falls

➢ Rehabilitation after discharge?
  - Cumbersome equipment
  - Limited possibilities and motivation
Goals

➤ **Rehab@Home**
  - Extend existing mobile gait analysis tool (eSHOE)

➤ **Increase eSHOE robustness**
  - new sensors
  - optimize algorithms

➤ **Validity** check (against gold standard)
  - Healthy Subjects (n=30)
  - Pathological (n=30), including progression

➤ **Feasibility** study (n=5)
Reha@Home

- Tablet-PC + App
- eSHOE insoles

- Thorough introduction
- Individual instructions
- Support (if needed)
- Evaluation at the end
Concept for instrumented Assessment & Training

➢ **Scientific quality criteria**

➢ **Feasibility**
  - @ home
  - without supervision

➢ **Therapy-related**
  - Posturography

➢ **Different areas**
  - mobility, balance, strength
## Concept for instrumented Assessment & Training

<table>
<thead>
<tr>
<th>Measures</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobility</strong></td>
<td>Timed „up and go“ Test (TUG)</td>
</tr>
<tr>
<td>(in general)</td>
<td></td>
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<tr>
<td><strong>Leg Power</strong></td>
<td>Sit-to-Stand Test</td>
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<tr>
<td></td>
<td>Five Repetition (STS5)</td>
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<tr>
<td></td>
<td>30 Second (30sSTS)</td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td>Weight Shifting Exercise, STS variation</td>
</tr>
</tbody>
</table>
Concept for instrumented Assessment & Training

in close Cooperation with Experts from NRZ Rosenhügel

- **Level design**
  - Increasing difficulty

- **Scoring system**
  - Abstraction of results
  - Easy-to-understand
  - Consistency
Timed „up and go“ Test

- Test Duration = Measure for Mobility
  - Diagnostically conclusive

- Automated extraction possible

- Separation into distinct phases for detailed analysis
Sit-to-Stand Test

- Different Variations
  - 5 repetitions + time
  - 30 sec + counting of repetitions
  - Combination with Balance

- Automated Evaluation
Home Screen

Reha@Home App
+
eSHOE
Exercises & Tests

Reha@Home App + eSHOE
Weight Shifting Exercise

Reha@Home App
+
eSHOE
STS Variation

Reha@Home App
+ eSHOE
Results (Overview)

Reha@Home App

+ eSHOE
Results (Progress)

Reha@Home App + eSHOE
Log Data
Exercise Configuration

Web-Interface
Lessons Learned

Challenges

- **Communication** in case of errors
  - Phone call rather than built-in communication channel
  - No fear to call

- **Internet connection**
  - App’s performance highly dependent

- **Navigation**
  - Clicking in Icons
Lessons Learned

➢ Positives
   – Commitment
   – Motivation because it’s new
   – Intuitive usability
Thank you for listening

Questions?