Case Study
RTAA –
Return to Activity Algorithm
Assess lower limb performance and symmetry after injury
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Summary
1. Task
Perform complete Return to Activity Algorithm - RTAA

2. Subjects
1 amateur athlete, 10 weeks after injury of left leg

3. Relevance
Assess performance and symmetry of lower limbs

4. Study Design Summary

Type
- Longitudinal
- Cross Sectional
- Single Subject
- Multi Subjects
- Intervention
- Observation

Purpose
- Prevention
- Training
- Rehabilitation
- Observation

Exercise
- Gait
- Jump
- Balance
- Other

Skill
- Endurance
- Strength
- Speed
- Coordination
- Flexibility

5. Results

<table>
<thead>
<tr>
<th>Skill</th>
<th>Left leg (injured)</th>
<th>Leg Symmetry</th>
<th>Right leg (healthy)</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endurance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>95% 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Take Off Velocity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ground Contact Time</td>
<td></td>
</tr>
<tr>
<td>Coordination</td>
<td>126%</td>
<td></td>
<td></td>
<td>COP</td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
<td>92%</td>
<td></td>
<td>Y-Balance Amplitude</td>
</tr>
</tbody>
</table>

6. Outcomes

Leg Symmetry
- Good leg symmetry (>90%) for all skills
- For some skills, injured leg is already stronger than healthy leg

Qualitative Tests
- High differences in Moticon LSI between the levels

Quantitative Tests
- Low difference between RTAA LSI and Moticon LSI (9%)
Case Study Design

Type
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- Cross Sectional
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- Multi Subjects
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- Observation

Purpose
- Prevention
- Training
- Rehab
- Other

Exercise
- Gait
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Skill
- Endurance
- Strength
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The study was designed as a cross sectional single subject test – Athlete: runner (32y, 72kg)
The study was carried out to assess individual lower limb performance and symmetry after injury
Return to Activity Algorithm according to OS Institut
All 5 skill types were considered: endurance, strength, speed, coordination, flexibility
Methods – Materials

**Hardware**
Moticon SCIENCE Sensor Insole (Insole2), Size 6 (EU42/43), 50Hz recording rate, operation mode: Record to cloud

**Software**
Moticon Mobile App (version 0.1 for Android), Moticon SCIENCE Pro+ Software (01.11.00)
Methods – Protocol

Level 1
Balance Squat and Y-Balance Test

Level 2
Balance Front Hop and Front Hop Test

Level 3
Balance Side Hop and Side Hop Test

Level 4
Balance Square Hop and Square Hop Test

Overview
Images show the 4 different test levels according to the RTA-Algorithm - each level contains two tests, a qualitative test and a quantitative test.
Tests need to be supervised by an experienced physiotherapist, trainer or sports scientist.
Assessment criteria for qualitative tests are based on movements of feet, legs and truck during the exercise.
Assessment criteria for quantitative tests is the leg symmetry index (LSI) based on ratio of test parameters (distance, repetitions...) between healthy and injured leg.

Photo credits: Phys Med Rehab Kuror 2016; 26: 142-144
Results
1. Injured leg (left) performed better at qualitative test but poorer at quantitative tests compared to healthy leg (right)
2. Qualitative test shows better results (Mean LSI 127%) than quantitative test (Mean LSI 66% / 92%)
3. Higher results with RTAA LSI (92%) compared to Moticon LSI (66%) for quantitative test
Level 2: Balance Front Hop and Front Hop Test

1. Injured leg (left) performed better at qualitative test but poorer at quantitative tests compared to healthy leg (right)

2. Qualitative test shows better results (Mean LSI 198%) than quantitative test (Mean LSI 90% / 108%)

3. Higher results with RTAA LSI (108%) compared to Moticon LSI (90%) for quantitative test
Level 3: Balance Side Hop and Side Hop Test

1. Poorer results for injured leg (left) compared to healthy leg (right) for both, qualitative and quantitative tests

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Qualitative test</th>
<th>Diff</th>
<th>Quantitative test</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>COP Trace L</td>
<td>0.24</td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>LSI</td>
<td>79%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COP Trace R</td>
<td>0.19</td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>COP Velocity L</td>
<td>79.70</td>
<td></td>
<td></td>
<td>mm/s</td>
</tr>
<tr>
<td>LSI</td>
<td>78%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COP Velocity R</td>
<td>62.20</td>
<td></td>
<td></td>
<td>mm/s</td>
</tr>
<tr>
<td>Bounding Box L</td>
<td>1511.04</td>
<td></td>
<td></td>
<td>cm²</td>
</tr>
<tr>
<td>LSI</td>
<td>48%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bounding Box R</td>
<td>692.30</td>
<td></td>
<td></td>
<td>cm²</td>
</tr>
</tbody>
</table>
1. Poorer results for injured leg (left) compared to healthy leg (right) for both, qualitative and quantitative tests.

2. Quantitative test shows better results (Mean LSI 96% / 91%) than qualitative test (Mean LSI 68%).

3. Only 5% difference between RTAA LSI (91%) compared to Moticon LSI (96%) for quantitative test.
Level 4: Balance Square Hop and Square Hop Test

1. Poorer results for injured leg (left) compared to healthy leg (right) for both, qualitative and quantitative tests

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Qualitative test</th>
<th>Diff</th>
<th>Quantitative test</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>COP Trace L</td>
<td>0.27</td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>LSI</td>
<td>81%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COP Trace R</td>
<td>0.22</td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>COP Velocity L</td>
<td>89.80</td>
<td></td>
<td></td>
<td>mm/s</td>
</tr>
<tr>
<td>LSI</td>
<td>83%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COP Velocity R</td>
<td>74.70</td>
<td></td>
<td></td>
<td>mm/s</td>
</tr>
<tr>
<td>Bounding Box L</td>
<td>1082.72</td>
<td></td>
<td></td>
<td>cm²</td>
</tr>
<tr>
<td>LSI</td>
<td>39%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bounding Box R</td>
<td>425.45</td>
<td></td>
<td></td>
<td>cm²</td>
</tr>
</tbody>
</table>
1. Poorer results for injured leg (left) compared to healthy leg (right) for both, qualitative and quantitative tests
2. Quantitative test shows better results (Mean LSI 93% / 89%) than qualitative test (Mean LSI 68%)
3. Only 4% difference between RTAA LSI (89%) compared to Moticon LSI (93%) for quantitative test
Discussion
Discussion

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Qualitative test</th>
<th>Diff</th>
<th>Quantitative test</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 Moticon LSI</td>
<td>127%</td>
<td>61%</td>
<td>66%</td>
<td></td>
</tr>
<tr>
<td>L1 RTAA LSI</td>
<td></td>
<td></td>
<td>92%</td>
<td></td>
</tr>
<tr>
<td>L2 Moticon LSI</td>
<td>198%</td>
<td>108%</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>L2 RTAA LSI</td>
<td></td>
<td></td>
<td>108%</td>
<td></td>
</tr>
<tr>
<td>L3 Moticon LSI</td>
<td>68%</td>
<td>28%</td>
<td>96%</td>
<td></td>
</tr>
<tr>
<td>L3 RTAA LSI</td>
<td></td>
<td></td>
<td>91%</td>
<td></td>
</tr>
<tr>
<td>L4 Moticon LSI</td>
<td>68%</td>
<td>25%</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>L4 RTAA LSI</td>
<td></td>
<td></td>
<td>89%</td>
<td></td>
</tr>
<tr>
<td>Mean Moticon LSI</td>
<td>115%</td>
<td>29%</td>
<td>86%</td>
<td></td>
</tr>
<tr>
<td>Diff</td>
<td></td>
<td></td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Mean RTAA LSI</td>
<td></td>
<td></td>
<td>95%</td>
<td></td>
</tr>
</tbody>
</table>

1. Higher differences in Motion LSI between the single levels in qualitative tests compared to quantitative tests
2. High difference of Moticon LSI between qualitative tests compared to quantitative tests (29%)
3. Low difference in quantitative tests between Moticon LSI and RTAA LSI (9%)

4. Moticon objectifies the qualitative tests by giving concrete measures in addition to the given subjective criteria
5. Moticon adds qualitative measures to the quantitative tests
Contact

Moticon ReGo AG
Machtlfinger Str. 21
81379 Munich, Germany

EMail sales@moticon.de
Phone +49 89 2000 301 15