The development and validation of a functional assessment tool for the hip in the athletic population: The KJOC Athletic Hip Score

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Disclosures

- No relevant disclosures to this project.
Background

• Initial questionnaires developed for hip fracture or THA and may not be sensitive to athletic population
• No validated hip assessments specifically designed to evaluate performance and function of the athletic hip
• Current validated hip assessments address recreation/sport in subsections (iHOT-33, non-arthritic hip score, HOS-sports scale)
Purpose

• To develop a dedicated patient reported functional assessment tool for the athletic population

• KJOCC Athletic Hip Score

• Hypothesis: The new scoring system developed will be valid, reliable, and responsive in the evaluation of hip function in the athlete.
Methods

• Pilot questionnaire of 13 questions was administered to 20 athletic individuals at 1 month interval time
• Questions removed for poor reliability or importance
• Final 10 question assessment formulated and administered to 251 athletes from multiple sports (USC, LMU, Fullerton, High school athletes) in addition to 3 other validated assessments (m-HHS, iHOT-33, NAHS)
• Scoring based on VAS scale as marked on 10cm line
• On demographics page, athletes self categorize into playing category

Please check the **ONE category only** that best describes your current status:

- Playing without any hip/groin trouble
- Playing, but with hip/groin trouble
- Not playing due to hip/groin trouble
1. How difficult is it for you to get loose or warm prior to competition or practice?
   - Normal warm-up
   - Never feel loose during games or practice

2. How much pain do you experience in your hip/groin?
   - No pain with competition
   - Pain at rest

3. How often does your hip uncomfortably click, catch or lock?
   - No uncomfortable clicking, catching or locking ever
   - Uncomfortable clicking, catching or locking with every hip motion

4. How much stiffness or limited motion (rotation/flexion) does your hip feel during competition?
   - No stiffness or motion restriction
   - Stiff, minimal motion

5. Have your hip/groin problems affected the way you move your other hip?
   - I have not changed any moves/functions of my other hip
   - I have had to change the way my other hip moves/functions

6. How has cutting/changing directions during your sport activity been affected by your hip/groin?
   - I have no problems with cutting/changing directions
   - I find ways to avoid cutting/changing directions

7. How much has your power/strength suffered due to your hip/groin?
   - No change in power/strength
   - Lost all power, became finesse athlete

8. What limitation do you have in endurance in competition due to your hip/groin?
   - No endurance limitation in competition
   - Significant limitation (much shorter shifts/time spent in game)

9. How much do you feel your hip/groin affects your current level of competition in your sport (i.e. is your hip holding you back from being at your full potential)?
   - Desired level of competition
   - Cannot compete, had to switch/stop sports
Reliability, Scoring Validation

- Reliability of response: assessed with pilot responses compared at 2 time points
- Questions with poor reliability removed from final assessment
- Final 10: Mean differences less than 2% or less with SD of the differences 10.2% or less
- Pearson (0.96), Spearman (0.95)
- Excellent reliability
- Final 10: exploratory factory analysis: 70% of variation accounted for by the factor
  - Validation that the sum of the 10 questions can be added up for total score
## Contrast Validity

**Validation (n=249) - Spearman correlations**

<table>
<thead>
<tr>
<th></th>
<th>KJOC raw 10</th>
<th>factor - 10</th>
<th>mHHS</th>
<th>IHOT33</th>
<th>non arthritic score</th>
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</thead>
<tbody>
<tr>
<td>KJOC raw 10</td>
<td>1</td>
<td>0.999</td>
<td>0.693</td>
<td>0.765</td>
<td>0.762</td>
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<tr>
<td>factor - 10</td>
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<td>1</td>
<td>0.690</td>
<td>0.762</td>
<td>0.757</td>
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<tr>
<td>mHHS</td>
<td>0.693</td>
<td>0.690</td>
<td>1</td>
<td>0.723</td>
<td>0.766</td>
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<tr>
<td>IHOT33</td>
<td>0.765</td>
<td>0.762</td>
<td>0.723</td>
<td>1</td>
<td>0.833</td>
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<tr>
<td>non arthritic score</td>
<td>0.762</td>
<td>0.757</td>
<td>0.766</td>
<td>0.833</td>
<td>1</td>
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</tbody>
</table>
Score comparison by category

Quantiles

<table>
<thead>
<tr>
<th>Level</th>
<th>Minimum</th>
<th>10%</th>
<th>25%</th>
<th>Median</th>
<th>75%</th>
<th>90%</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td>a-no trouble</td>
<td>69.6</td>
<td>81.97</td>
<td>88.95</td>
<td>95.5</td>
<td>99.8</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>b-trouble</td>
<td>30.2</td>
<td>35.84</td>
<td>46.35</td>
<td>56.55</td>
<td>67.725</td>
<td>78.81</td>
<td>89.6</td>
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<tr>
<td>c-NP</td>
<td>10</td>
<td>10.9</td>
<td>18.3</td>
<td>30.05</td>
<td>45.7</td>
<td>70.4</td>
<td>84.1</td>
</tr>
</tbody>
</table>

Means and Std Deviations

<table>
<thead>
<tr>
<th>Level</th>
<th>Number</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Std Err Mean</th>
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</thead>
<tbody>
<tr>
<td>a-no trouble</td>
<td>196</td>
<td>92.9311</td>
<td>7.7134</td>
<td>0.5510</td>
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<tr>
<td>b-trouble</td>
<td>40</td>
<td>57.3475</td>
<td>14.6527</td>
<td>2.3168</td>
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<td>c-NP</td>
<td>14</td>
<td>34.4571</td>
<td>20.0747</td>
<td>5.3652</td>
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</tbody>
</table>

Wilcoxon / Kruskal-Wallis Tests (Rank Sums) overall p value < 0.0001
Nonparametric Comparisons For Each Pair Using Wilcoxon Method

<table>
<thead>
<tr>
<th>Level</th>
<th>vs Level</th>
<th>p-Value</th>
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<tr>
<td>c-NP</td>
<td>b-trouble</td>
<td>0.0002*</td>
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<tr>
<td>c-NP</td>
<td>a-no trouble</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>b-trouble</td>
<td>a-no trouble</td>
<td>&lt;.0001*</td>
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## Validation and accuracy

<table>
<thead>
<tr>
<th>Score</th>
<th>Cutpoints</th>
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<tr>
<td></td>
<td>no trouble vs trouble</td>
</tr>
<tr>
<td>KJOC</td>
<td>69.6</td>
</tr>
<tr>
<td>non arthritic</td>
<td>93.8</td>
</tr>
<tr>
<td>mHHS</td>
<td>94.6</td>
</tr>
<tr>
<td>lhot 33</td>
<td>89.6</td>
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</tbody>
</table>

### Pct correct (accuracy)

<table>
<thead>
<tr>
<th>no trouble</th>
<th>trouble</th>
<th>NP</th>
<th>overall avg correct</th>
<th>SE</th>
<th>weighted overall avg correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.0%</td>
<td>80.0%</td>
<td>50.0%</td>
<td>76.7%</td>
<td>4.9%</td>
<td>94.0%</td>
</tr>
<tr>
<td>91.8%</td>
<td>37.5%</td>
<td>78.6%</td>
<td>69.3%</td>
<td>4.5%</td>
<td>82.4%</td>
</tr>
<tr>
<td>96.9%</td>
<td>60.0%</td>
<td>64.3%</td>
<td>73.7%</td>
<td>5.0%</td>
<td>89.2%</td>
</tr>
<tr>
<td>94.9%</td>
<td>32.5%</td>
<td>78.6%</td>
<td>68.7%</td>
<td>4.4%</td>
<td>84.0%</td>
</tr>
</tbody>
</table>

**KJOC hip score most accurate**
Responsiveness

• Is assessment able to show change with treatment?

• 17 patients completed pre- and post- treatment

• Average increase: 26.1 (p <0.001)
Discussion

• The KJOC athletic hip score showed high correlation with validated outcome scores (contrast validity) and excellent reliability.

• Successfully stratified athletes by injury category and showed highest accuracy

• Demonstrated responsiveness with improvements in treatment group

• Support use in future studies evaluating athletic hip

(KERLAN-JOBE INSTITUTE
A CEDARS-SINAI AFFILIATE)
References