Characteristics of Fall From Jump Elements in Competitive Figure Skaters

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Background

- Falls from jump elements are common in competitive single figure skating, yet skaters rarely wear protective gear when they compete.
- A pediatric study noted that beginner skaters tend to fall forward and use the hands to arrest the fall (90%). Additionally, figure skaters tend to hit their head more often when falling than inline skaters.
- Repetitive falls with high ground reaction forces may result in injuries.
- No studies have studied the mechanics of falls and injuries among competitive figure skaters, and how the characteristics of falls associate with experience level.

Purpose

To determine if experience in competitive figure skating associates with characteristics of falls, including the body segments that impact the ice, perceived sites of greatest energy absorption and impact severity, fall direction and landing configuration.

Methods

**Figure Skating Fall Analysis Questionnaire**
A figure skating fall analysis questionnaire was used to evaluate video footage of falls from figure skating jump elements. Videos of competition falls from 10 skaters at five experience levels were analyzed by two expert raters, who met to resolve any discrepancies in their answers.

**Video Footage Collection**

Source: 2017 BC/YT and AB/NUN/NWT Sectionals Championships

**Statistical Analysis**
We used Chi-Square and Fisher-Exact tests to test for associations between level of experience and fall characteristics.

Results

<table>
<thead>
<tr>
<th>Competitive Level</th>
<th>Pre-Novice (n=10)</th>
<th>Novice (n=10)</th>
<th>Junior (n=10)</th>
<th>Senior (n=10)</th>
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<tbody>
<tr>
<td>Juvenile (n=10)</td>
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<td>Yes</td>
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**Figure 1:** Initial Fall Direction Across Competitive Levels
No differences were seen in initial fall direction across competitive levels. Most skaters had an initial fall direction of backwards (79%).

**Figure 2:** Landing Configuration Across Competitive Levels
No differences were seen in landing configuration across competitive levels. Most skaters had a landing configuration of backwards (52%) or sideways (18%).

**Figure 3:** Perceived Site of Impact Severity Across Competitive Levels
There were no significant differences in the selection of the perceived site of impact severity across competitive levels. In 64% of the cases, the pelvis/buttocks were selected as the perceived site of impact severity. The hands were selected in 26% of the falls, and the knees were selected in 10%.

**Figure 4:** Common Body Segment Impacts With The Ice
There were no impacts to the head or shoulders in any of the analyzed falls.

Discussion

- From Chi-Square analysis including five experience levels, there were no significant differences between fall variables and competitive figure skating experience. This suggests that landing strategies are consistent, and that similar protective equipment should be appropriate across competitive levels.
- Based on Fisher Exact tests collapsing experience level into two categories, knee impact was more common in lower levels than higher competitive levels (p<0.05).
- In contrast to a previous study of beginning skaters, we found that competitive skaters most often fell backwards (52.0%) as opposed to forwards.
- Furthermore, no impacts occurred to the head, and very few impacts occurred to the torso.
- Similar to beginning skaters, hand impact was common.
- In most falls, the pelvis was perceived as the site of greatest impact severity. This is consistent with common reports in figure skaters of hip contusions.

References


Future Work

- This study illustrates a feasible protocol for examining falls from competitive competition jump elements via video analysis.
- On-going research is examining fall characteristics in the practice setting, and the use of wearable sensors to measure body segment accelerations during landing from falls.

Acknowledgements