CONFERENCE PAPER
Targeting Rio: Enhancing the Daily Training Environment in Archery Using Technology

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ABSTRACT
Skilled archers have demonstrated a greater ability to control their postural sway immediately before the arrow is released. This study examined the effect of training conditions on in-situ postural sway of elite archers. Three elite male archers shot 12 arrows at a regulation target while standing on a Tekscan Sports Balance Analyser. Data was collected in two conditions; standing on the ground; and standing on a raised platform. Postural sway was significantly higher in the anteroposterior direction when on the platform. The results highlight the need for athletes to replicate their competition environments in their daily training environments.

Keywords: Technology, Archery, Postural Sway, Centre of Pressure

INTRODUCTION
Archery is a sport that requires athletes to control their posture to ensure precise positioning of their limbs (and as an extension, the bow) for successful performances.1 Highly skilled archers have demonstrated a greater ability to control their postural sway, just prior to arrow release.2 Through measurement of their centre of pressure, this greater control has been linked to an improvement in shooting accuracy in elite archers.3

With advances in technology, solutions are now available that permit measurement and recording of postural sway in the performance environment without imposing any restrictions on the athletes. Technology that allows for analysis in situ ensures that the performance characteristics being investigated are the same as or as close to those that occur in competition.4 It is crucial for skill acquisition that training for elite athletes replicates the performance environments in which they perform.

The aim of this project was to measure the postural control of Australia’s high performance archers using a mobile pressure sensor in-situ at training and to assess the effect of training conditions on postural sway.

METHODS
Three elite male archers with an average age of 23.3 ± 2.89 volunteered for this study. This study was completed as part of an applied sport project that falls under athlete scholarship agreements. These agreements cover athlete consent and involvement in applied sport servicing and research. Data collection took place in-situ. Participants were
measurements reported in this study are supported by similar values being reported in previous research \(^2\). However one key inclusion in the current study was the differentiation of centre of pressure for each foot individually. As such we were able to demonstrate when shooting from a raised platform postural sway increased in the AP direction, but was unchanged in the ML directions. This could be a result of the platform increasing the difficulty of the archers detecting body sway by changing their proprioception on the ground. As the archers also stand quite close to the edge of the platform, it is possible that the drop in height had a subconscious effect on their postural control.

Previous literature has highlighted that arrow precision would be compromised by sway movements in the AP direction as this occurs parallel to the target face, ultimately shifting the arrow left and right of the target. \(^5\)

**RESULTS**

The results on this study are displayed in Table 1. Condition 2 resulted in a significant increase in postural sway in both directions for the left foot (ML, \(p = 0.027\); AP, \(p = 0.001\)) but not the right foot. The results also demonstrated a significantly higher postural sway for the AP direction for the overall centre of pressure (\(p = 0.017\)).

**DISCUSSION**

The purpose of the current study was to assess the postural control of elite archers under two different conditions, in-situ. The Tekscan device and software allowed for accurate measurement of postural sway in the natural competition environment. The overall sway (not individual feet) required to shoot 12 arrows at an official target located at a distance of 70 m (Olympic distance) while standing on a Tekscan Sports Balance Analyzer (TekScan Incorporated). Centre of pressure (CoP) was recorded in two conditions: (1) standing on the ground as per a typical training session and (2) standing on a customised raised platform to replicate the competition environment expected in the Rio 2016 Olympics.

Centre of pressure data was analysed utilising the Tekscan Software Development Kit (SDK) to record and display centre of pressure. Postural sway was analysed in two directions: (1) anteroposterior (AP) and (2) mediolateral (ML). Total postural sway in each direction was measured by analysing the total excursion of the CoP during the shot. A series of independent samples t-tests were conducted to determine if postural sway differed between the two conditions.

**CONCLUSION**

This study found that elite archers demonstrated greater postural sway in the anteroposterior direction but not the mediolateral direction while shooting from a raised platform that replicated competition. These results confirm the need to measure performance characteristics in-situ and replicate the competition environment in training to allow athletes to understand the constraints placed on them.

**Table 1: Average measurements of sway (cm) in mediolateral (ML) and anteroposterior (AP) axes**

<table>
<thead>
<tr>
<th></th>
<th>ML Left Foot</th>
<th>AP Left Foot</th>
<th>ML Right Foot</th>
<th>AP Right Foot</th>
<th>ML Both Feet</th>
<th>AP Both Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Environment</td>
<td>0.39 ± 0.14</td>
<td>2.02 ± 0.63</td>
<td>0.34 ± 0.09</td>
<td>2.21 ± 0.63</td>
<td>3.45 ± 2.50</td>
<td>1.98 ± 0.54</td>
</tr>
<tr>
<td>Olympic Platform</td>
<td>0.85 ± 0.62*</td>
<td>4.31 ± 1.79**</td>
<td>0.41 ± 0.18</td>
<td>2.29 ± 0.92</td>
<td>4.11 ± 1.80</td>
<td>3.21 ± 1.51*</td>
</tr>
</tbody>
</table>

* significant at \(p < 0.05\); ** significant at \(p < 0.001\)
PRACTICAL APPLICATIONS

• Measurement of postural sway in-situ and potential biofeedback training
• Analysis of how postural sway changes with differing tasks or constraints
• Ability to link performance outcomes (accuracy) to postural control

REFERENCES