Repellent strain injury to the foot in elite women kendoka

N R Nunn, J W Dyas, I Parker Dodd

Abstract
Objective—To account for the apparent high incidence of pain in the feet of elite women kendo players.

Methods—A clinical evaluation was done by a chiropractor, the women were interviewed about their kendo experience, and the conditions and frequency of training and ground reaction forces were measured on a Kistler force plate during the kendo attacking action.

Results—Four out of the five women presented with plantar fasciitis. They had all practised for some time on wooden floors laid on concrete, for between two to four hours a week. They warmed up conscientiously but cool down was more cursory. The force plate results showed that they were hitting the floor with a mean force of four times body weight during a transient impact.

Conclusions—High motivation for practice and training, hard floors, ignoring painful feet, and cursory postpractice cool down probably produced the condition. Postpractice icing and stretching were found to be most effective in the short term. In the longer term reducing the level of impact, either by training on sprung floors or changing the footwork, might reduce the incidence and intensity of the fasciitis.

Keywords: kendo; foot pain; plantar fasciitis.

Case report
During the preparation for the 1995 European Kendo Championships, the British kendo squad obtained the services of a chiropractor (NRN). Four of the five women in the GB national kendo squad presented themselves and they all reported pain in the right foot. The pain had been present for some time in all of them and they had simply put up with it. All of them were vague about the time of onset.

The pain was under the transverse arch and emanated from the calcaneus. There was also point tenderness in the short muscles in the sole of the foot. Discomfort was elicited by dorsiflexing the ankle and then dorsiflexing the toes. This presentation indicated plantar fasciitis.1 The mean height of the women was 164.5 cm (range 162.8 to 168.9 cm) and mean weight 67.8 kg (64.8 to 71.6 kg). Their age range was from 29 years to 37 years. Their experience is shown in table 1.

The sport is performed barefoot and the predominant surface upon which they train away from squad sessions is wood laid on concrete. They usually train twice a week for a total training time of between two and four hours. They report warming up for about 15 minutes before each session, using static stretching techniques for upper and lower body. A cooling down procedure was not followed so systematically.

INVESTIGATIONS
During squad training, the ground reaction forces created by the right foot stamp during kendo’s unique attacking action were measured on a calibrated Kistler force plate system operating at 500 Hz sampling frequency. The results are shown in table 2. The peak forces are given in body weight units to allow for comparison. The transient force-time interval was of a short duration, as can be seen in figs 1 and 2. This was followed by a support/drive phase which lasted about 0.25 s. There are indications, at this sampling rate, of force plate vibration at its natural frequency. The effects of this “ringing” upon the trace are felt to be acceptable. Other studies on foot striking activity indicate similar orders of magnitude for peak impact forces.3

Discussion
Rest, ice, compression, and elevation were the suggested procedures for alleviating this condition. In a more severe case the heads of the metatarsals were, on palpation, felt to be fixed, with little movement. Adjustment of the metatarsal heads is a technique which restores the anteroposterior gliding movements to these joints. This involves moving the phalanges in a dorsal direction with a short mobilising impulse.4 This gave almost instant relief.

Table 1 Details of competence and experience

<table>
<thead>
<tr>
<th>Rank</th>
<th>Experience (years)</th>
<th>Number of international matches</th>
<th>Floor type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd</td>
<td>4</td>
<td>10</td>
<td>Wood on concrete</td>
</tr>
<tr>
<td>3rd</td>
<td>9</td>
<td>40</td>
<td>Wood on concrete</td>
</tr>
<tr>
<td>4th</td>
<td>10</td>
<td>40</td>
<td>Wood on concrete, carpet</td>
</tr>
<tr>
<td>4th</td>
<td>12</td>
<td>50</td>
<td>Wood on concrete</td>
</tr>
</tbody>
</table>

Table 2 Force plate results for four women kendoka

<table>
<thead>
<tr>
<th>Subject</th>
<th>Transient force (body weight units)</th>
<th>Support/drive force (body weight units)</th>
<th>Support/drive force time interval (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.9, 1.8, 2.1</td>
<td>1.3, 1.5, 1.4</td>
<td>284, 274, 274</td>
</tr>
<tr>
<td>B</td>
<td>3.8, 3.2, 4.4</td>
<td>1.6, 1.7, 1.7</td>
<td>267, 260, 242</td>
</tr>
<tr>
<td>C</td>
<td>4.2, 5.1, 5.5</td>
<td>1.8, 1.8, 1.8</td>
<td>206, 200, 180</td>
</tr>
<tr>
<td>D</td>
<td>4.5, 4.3, 5.2</td>
<td>1.7, 1.7, 1.6</td>
<td>302, 346, 290</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>4.00 (1.34)</td>
<td>1.63 (0.16)</td>
<td>260 (47)</td>
</tr>
</tbody>
</table>

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Postpractice icing was suggested and performed. This afforded considerable relief, as did postpractice stretching. Strapping was also recommended, but the idea was less favourably received. Rest is not a popular idea, particularly before international competitions.

Observations of practice sessions indicate that the right foot stamping action (called “fumikomi ashi”) involved in a kendo attack occurs about every 15 to 20 seconds. This happens when the attacker attempts to “cut” with their bamboo sword (called a shinai) one of the armoured targets on the opponents body. In an hour’s practice the right foot is hitting the floor some 200 times with the forces shown in table 2.

Kendo, as practised in Japan, takes place on sprung wooden floors and the floor where the squad practise as a group has similar properties. One of the authors (IPD) has practised on such sprung floors for the past 10 years and shows no sign of fasciitis. It would seem that the nature of the flooring is of paramount importance in preventing this kind of strain. In reality it is sometimes very difficult to find an appropriately sprung floor on which to practise and so it seems important that the coaches and teachers of kendo in this country are aware of the effects of stamping on hard floors. The reduction of the level of impact, either by changing floors, changing the incidence of fumikomi ashi practice, or changing the nature of the footwork clearly needs to be investigated.