The study of elbow injury in male adult kendo players

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Abstract. [Purpose] Elbow injury in male adult kendo players was investigated and examined in order to obtain an indicator of prophylaxis of injury. [Subjects and Methods] The subjects were 22 male adult kendo players aged 25 to 60 years old, and presence or absence of pain, range of motion, and muscle strength in the elbow joints were investigated. In addition, among athletes with limited range of motion (ROM) in the elbow joints, three athletes who had received an explanation and had provided informed consent underwent CT, and the images were examined. [Result] As a result, posterior pain and decreased range of extension motion in the right elbow were noted in 86% of the subjects, and the CT images showed free bone fragments and osteophytes in the olecranon. Also, characteristics were noted that extension muscle strength was stronger than flexion muscle strength in elbow muscle strength. [Conclusion] Based on these results, characteristic disorders in male adult kendo players include an impingement disorder in the posterior region of the right elbow.

Key words: Elbow injuries, Male adult, Kendo players

INTRODUCTION

Since 2012, we have provided medical support for National Athletic Meet players of the kendo (a Japanese martial art) competition held in Wakayama prefecture. Through this support activity, we had the opportunity to care for male kendo players in their 40’s or older with right elbow pain and restricted elbow extension. The most common sport injuries seen among young kendo players are lower-extremity and foot injuries, followed by low back injuries1). Although the incidence of injuries while doing kendo is lower as compared with other sports2), continued kendo practice is characteristically associated with a high incidence of low back pain3) and a lack of elbow injuries. In addition, the most common injuries in elderly kendo players are also reportedly lower-extremity and foot injuries, followed by injuries of the knee and elbow4). However, reports of elbow injuries in kendo players are extremely limited. Therefore, we herein investigated actual conditions of elbow injuries and their causes in adult kendo players. We also endeavored to obtain factors for preventing injuries by examining elbow function, as well as the occurrence of elbow pain.

SUBJECTS AND METHODS

This study included 22 elite, male adult kendo players ranging in age from 24 to 60 years in Wakayama prefecture. The duration of their kendo practice was 34.1 ± 12.9 years. The position of National Athletic Meet kendo players is determined according to age. Thus, the 22 players were classified, by position, into four groups: group A of 7 players aged 25–35 years.
(Jiho); group B of 5 players aged 36–45 years (Chuken); group C of 5 players aged 46–55 years (Fukusho); and group D of 5 players aged 56 years or more (Taisho). Players aged less than 25 years who corresponded to the position of Senpo were excluded due to the limited small number of players (n=3). We conducted a questionnaire survey to examine the presence/absence of elbow pain in these four groups. The range of motion (ROM) for elbow flexion and extension was measured by a single examiner using the ROM measurement method specified by the Japanese Orthopaedic Association. Similarly, the strength of the elbow flexors and extensors was measured using a handheld dynamometer (μ TasF-1, Anima Corp., Tokyo, Japan). The following items were evaluated: 1) intergroup comparison of elbow flexion and extension ROM; 2) bilateral difference in elbow flexion and extension ROM in each group; 3) muscle strength of the elbow flexors and extensors in each group; 4) bilateral difference in the muscle strength of the elbow flexors and extensors in each group. All statistical analyses were performed using SPSS 12.0 for Windows and statistical significance was calculated at p<0.05 with repeated measures ANOVA (Tukey HSD). Furthermore, 3 players with limited ROM of the elbow joint and current elbow pain received an explanation of this study and gave informed consent before undergoing computed tomography (CT). The study received approval from the Ethics Committee of Sumiya Orthopedic Hospital.

### RESULTS

A total of 17 players had a history of elbow pain: 2 in group A and 5 each in groups B, C, and D. A total of 3 players had current elbow pain: 1 in group C and 2 in group D. All players experienced pain in the posterior aspect of the right elbow. The ROM for right and left elbow flexion was 141.3° ± 4.4° and 143.1° ± 5.3° for group A, 144.0° ± 4.2° and 146.0° ± 4.2° for group B, 143.0° ± 4.5° and 144.0° ± 4.2° for group C, and 141.0° ± 6.5° and 144.0° ± 4.2° for group D, respectively, showing no significant intergroup difference; in addition, no significant intragroup difference in elbow flexion ROM between the right and left sides was observed in any group . The ROM for right and left elbow extension was −9.0° ± 2.2° and 0° for group A, −9.0° ± 2.2° and 0° for group B, −10.0° ± 5.0° and 0° for group D, respectively; hence, groups B, C, and D, as compared to group A, showed significantly decreased right elbow extension ROM, and groups B, C, and D, but not group A, showed significantly decreased elbow extension ROM on the left side as compared to the right (Table 1). The muscle strength of the right and left elbow flexors was 219.3 ± 33.6 N and 195.1 ± 40.1 N for group A, 176.0 ± 34.2 N and 161.6 ± 35.8 N for group B, 164.6 ± 24.7 N and 163.2 ± 25.6 N for group C, and 142.8 ± 19.3 N and 126.0 ± 15.7 N for group D, respectively; hence, group A showed significantly higher muscle strength of the elbow flexors on the right side than on the left side, and the other groups showed no difference in muscle strength of the elbow flexors between the right and left sides (Fig. 1). The muscle strength of the right and left elbow extensors was 279.4 ± 48.9 N and 239.1 ± 52.5 N for group A, 221.4 ± 27.2 N and 192.6 ± 22.2 N for group B, 213.8 ± 16.6 N and 187.8 ± 22.4 N for group C, and 186.6 ± 25.3 N and 167.0 ± 24.5 N for group D, respectively; hence, all groups showed significantly higher muscle strength of the elbow extensors on the right side than on the left side. Moreover, the muscle strength of the elbow extensors, as compared to the elbow flexors, was higher on the right side and left side in all groups, with significant differences on the right side in all groups excluding group B, and on the left side in groups A and D (Table 2). CT findings in the players with current pain and limited ROM of the elbow joint included osteophytes and free bone fragments in the posterior aspect of the elbow; however, the conditions in the elbow cross-section remained relatively favorable (Fig. 2).

### DISCUSSION

According to some reports, the elbow generally accounts for a fairly small percentage of all sites of injury experienced by kendo players1–3). However, the survey used in this study revealed elbow pain in 19 (86%) of 22 male adult kendo players, suggesting that such pain reflects relatively common injury. Intergroup comparison showed the incidence of elbow pain to be 29.1% in players in group A and 100% in players in groups B, C, and D, suggesting that elbow pain may begin in kendo players in their 30s or younger. Intergroup comparison of ROM revealed elbow extension to be significantly limited in groups

### Table 1.

Intergroup comparison and of elbow flexion and extension ROM and intragroup comparison of the difference in elbow flexion and extension ROM between the right and left sides in each group

<table>
<thead>
<tr>
<th>Group</th>
<th>Flexion</th>
<th>Extension</th>
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<tbody>
<tr>
<td></td>
<td>Rt</td>
<td>Lt</td>
</tr>
<tr>
<td>A group (n=7)</td>
<td>141.3 ± 4.4</td>
<td>143.1 ± 5.3</td>
</tr>
<tr>
<td>B group (n=5)</td>
<td>144.0 ± 4.2</td>
<td>146.0 ± 4.2</td>
</tr>
<tr>
<td>C group (n=5)</td>
<td>143.0 ± 5.5</td>
<td>144.0 ± 4.2</td>
</tr>
<tr>
<td>D group (n=5)</td>
<td>141.0 ± 6.5</td>
<td>144.0 ± 4.1</td>
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Mean ± SD. Comparison between groups *p<0.05, **p<0.01. Left and right comparison +p<0.05, ++p<0.01

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B, C, and D, as compared to group A. Additionally, among players in groups B, C, and D, those presenting with current elbow pain were found to have osteophytes and free bone fragments in the posterior part of the elbow on CT. These observations suggest that elbow injury may begin in kendo players at age 35 years or older. Furthermore, elbow injury was characterized by findings in the posterior aspect of the right elbow in all groups, which may be associated with posture during full-power striking (uchikomi) in kendo and the physical characteristics of kendo players. In the basic stance in kendo, players swing bamboo swords (shinai) up using flexion movement of the shoulder and elbow, and swing them down using extension.

**Table 2.** Comparison of the left and right elbow flexion-extension strength in each group

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Mean ± SD. Comparison of the elbow extension with the elbow flexion in each group, *p<0.05, **p<0.01
Left and right comparison, +p<0.05, ++p<0.01

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movement of the shoulder and elbow, with the right hands and feet being ahead of the left hands and feet, regardless of hand and foot dominance. During this stance in kendo, the right elbow is ahead of the left elbow and in full extension (Fig. 3). Therefore, extension movement of the right elbow may cause posterior impingement, possibly resulting in injury due to limited extension of the right elbow; CT identified free bone fragments and osteophytes in the olecranon. Kijima et al. suggested that the osteophytes and loose bodies from osteophyte fractures in the olecranon and olecranon fossa, recognized as the initial features of osteoarthritis of the elbow, may cause impingement associated with certain movements by sports players. In addition, the mechanism for generation of loose bodies from osteophyte fractures, resulting in posteromedial impingement in cases of throwing injuries of the elbow, reportedly involves bony compression in a cross-section of the elbow due to both joint extension and valgus stress. Kendo, as compared to baseball, appears not to cause as much valgus stress at the elbow, but is more strongly associated with impingement occurring due to extension movement of the elbow. This is explained by the observation that despite the reported decreased strength of the elbow extensors compared to that of the flexors, the extensor muscle strength was significantly greater in kendo players than in baseball players, and was 61% of the corresponding value for the flexors (data on isotonic contractions); in fact, kendo is apparently a sport whose characteristics include the importance of striking (uchikomi) by using movement of the elbow extensors. Yamamoto et al. reported that kendo was a sport requiring upper limb power in players when swinging bamboo swords up and down. This study revealed the elbow muscle strength on the right side to be significantly higher than that on the left side in kendo players. These observations suggest that the necessity for more power in the upper limb on the right side than on the left side may cause stress on the right elbow. Elbow injuries associated with kendo may be difficult to prevent because of the characteristics of this sport and the mechanism of injury. Individual kendo players need to receive preventive education on the causes of elbow injuries. In addition to improvement in physical function (e.g., muscle strength, flexibility, and balance) in kendo, care after playing the sport (stretching and icing) is also important.

This study included elite kendo players at a high competitive level. One report showed a correlation between competitive level and upper-limb power in kendo players, suggesting that elbow injury may even occur in players at a high competitive level. Ongoing investigation of this hypothesis and further study on injury prevention are needed in the future.

REFERENCES