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Characteristics and prognosis of medial epicondylar fragmentation of the humerus in male junior tennis players

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Background: Although medial epicondylar fragmentation of the humerus is a reported elbow injury in junior tennis players, there have been only a few studies on this entity, and none have investigated the characteristics and prognosis of medial epicondylar fragmentation.
Methods: Forty-one male junior tennis players, aged 11 to 14 years (mean, 13 years), underwent elbow examination by ultrasonography. Elbow re-examination was performed in subjects with medial epicondylar fragmentation at an average of 20 months (12-30 months) after the initial examination.
Results: On examination, 9 subjects (22%) had elbow pain. Ultrasonography showed that 6 subjects (15%) had medial epicondylar fragmentation, all of whom had elbow pain. Medial epicondylar fragmentation was present in 5 (38%) of 13 subjects aged 11 to 12 years and in 1 (4%) of 28 aged 13 to 14 years. More subjects aged 11 to 12 years had medial epicondylar fragmentation ($P = .0084$). All 6 subjects with medial epicondylar fragmentation continued to play tennis between the initial elbow examination and the re-examination. At re-examination, although ultrasonography showed that 5 developed bone union and 1 had nonunion, 3 subjects (50%) reported elbow pain.
Conclusions: Our results demonstrated that subjects aged 11 to 12 years had a high frequency (38%) of medial epicondylar fragmentation. Although medial epicondylar fragmentation was the main cause of elbow pain (67%) at the initial elbow examination, all 6 players with medial epicondylar fragmentation continued to play tennis between the initial elbow examination and the re-examination. At re-examination, 5 subjects presented spontaneous bone union (83%), but 3 subjects (50%) reported elbow pain.
Level of evidence: Level I, Prospective Cohort, Design, Prognosis Study.

Keywords: Tennis; athlete; elbow; prognosis; characteristic; medial epicondylar fragmentation

In junior tennis players, medial epicondylar fragmentation of the humerus[2,3,5] is a reported elbow injury, whereas in adult tennis players, medial collateral ligament injury[1] has been reported. However, there have been only a few studies on medial epicondylar fragmentation. We reported that medial epicondylar fragmentation was present in 5 of 8

Institutional Review Board approval was obtained before the start of this study, and informed consent was obtained from the subjects.

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subjects with medial elbow pain at elbow examination by ultrasonography in 71 junior tennis players.[3] However, it has not yet been addressed whether junior tennis players with medial epicondylar fragmentation have associated characteristics in body or tennis style and whether they have difficulty in playing tennis after long-term observation. Elbow examinations with ultrasonography were performed to examine whether junior tennis players have medial epicondylar fragmentation and to investigate the associated characteristics and prognosis of medial epicondylar fragmentation.

Methods

This is a prospective cohort study about prognosis to assess medial epicondylar fragmentation of the humerus. Forty-one male elite junior tennis players who underwent elbow examinations performed in a regional selection camp from 2006 to 2009 participated in this study. They were aged 11 to 14 years (mean, 12.6 years), and their years of tennis experience ranged from 2 to 9 years (mean, 4.7 years). Elbow examination was performed once a year after the fall tennis season had ended. We have reported some of the results in a previous study.[3,5]

They were asked to complete a self-report questionnaire concerning height, weight, body mass index (BMI), time of warming up before training per day, number of hours and days of training per week, types of backhand stroke, type of grip (in forehand stroke, backhand stroke, and serve), and current and experienced episodes of elbow pain. Physical examination was also performed concerning joint laxity, flexibility of the core and lower extremity, and range of motion (ROM) of the shoulder.

As described in Nakajima's report,[7] we investigated joint laxity. This consisted of 7 regions: wrist, elbow, shoulder, spine, hip, knee, and ankle. Each region was measured on a numerical rating scale (0, no laxity; 1, laxity), and the final joint laxity score was defined as the sum of the scores of these 7 regions, resulting in a score ranging from a minimum value of 0 to a maximum value of 7. To test the flexibility of the core and lower extremities, the finger-floor distance (FFD), straight leg raising test (SLR), and heel-hip distance (HHD) were examined. FFD was performed in a standing position on a chair, and the distance between the tip of the middle finger and the chair was measured. The FFD result was considered positive when the middle finger passed over the chair. To test SLR, the passive ROM of hip flexion was bilaterally measured with a standard goniometer in the supine position. To test HHD, the distance between the hip and heel was bilaterally measured in the prone position when we passively flexed the knee. The passive ROM of the external and internal rotation of the shoulder was bilaterally measured with a standard goniometer. The ROM was measured in the supine position with the shoulder in 90° of abduction, the elbow in 90° of flexion, and the forearm in neutral rotation. With a 10-MHz annular array transducer (SonoSite, Inc, Bothell, WA, USA), ultrasonography of the medial aspects of both elbows was performed to investigate medial epicondylar fragmentation, as described in previous reports.[6,8]

For subjects with medial epicondylar fragmentation, physical examination of the elbow was performed by the authors, including tenderness of the medial epicondyle, moving valgus stress test, Tinel sign of the ulnar nerve, and muscle weakness in the ulnar nerve distribution. We also examined what types of tennis shots caused elbow pain in subjects with medial epicondylar fragmentation. We advised all subjects with medial epicondylar fragmentation to play tennis with consideration of their elbow pain and to avoid the types of shots that caused elbow pain. We did not perform special treatment. Elbow re-examination was performed in subjects with fragmentation at an average of 20 months (12-30 months) after the initial elbow examination.

At elbow re-examination, we examined elbow symptoms and performed ultrasonography to investigate whether bone union of the medial epicondylar fragmentation was achieved. With regard to the elbow symptoms, we examined the presence and duration of elbow pain, the difficulty in playing due to elbow pain, and the types of shots that caused elbow pain. We also asked these subjects to perform a self-evaluation of their elbow condition during the prior season with a visual analog scale (best elbow condition, 100 points; worst, 0 points).

To investigate factors contributing to medial epicondylar fragmentation, we investigated relationships between the following: elbow pain and medial epicondylar fragmentation; age, height, weight, BMI, and medial epicondylar fragmentation; tennis style of play and medial epicondylar fragmentation; and physical findings and medial epicondylar fragmentation. In investigating these relationships, we compared the possible factors between subjects with and without fragmentation. We compared the frequency of medial epicondylar fragmentation between subjects aged 11 to 12 years and subjects aged 13 to 14 years. In addition, we investigated the relationship between grip style in forehand stroke and medial epicondylar fragmentation by comparing grip style in subjects aged 11 to 12 years and subjects aged 13 to 14 years. Statistical analysis of the data was carried out with the Mann-Whitney U test and Fisher exact test. Differences at $P < .05$ were considered to be significant.

Results

The mean height was 159 cm (range, 136-179 cm), the mean weight was 47 kg (range, 30-78 kg), and the mean BMI was 18.6 kg/m^2 (range, 15-25 kg/m^2). The warm-up time before training ranged from 2 to 40 minutes (mean, 15 minutes) per day. The number of hours of training per week ranged from 10 to 28 hours (mean, 14 hours), and the number of days of training per week ranged from 3 to 7 days (mean, 5.4 days). The single backhand stroke was used in 9 subjects, and the double backhand stroke was used in 32. The type of grip (n = 33) in the forehand stroke was western in 28 subjects, eastern in 4, and continental in 1. The type of grip in the backhand stroke (dominant side) was western in 14 subjects, eastern in 10, and continental in 9. The type of grip in forehand volley was western in 0 subjects, eastern in 8, and continental in 25. The type of grip during the serve was western in 0 subjects, eastern in 9, and continental in 24. At elbow examination, among 41 subjects, 9 (22%) reported elbow pain.

The mean joint laxity score was 1.4 points (range, 0-5 points). The mean FFD, testing the flexibility of the core