

## Anatomical Dimensions of Lateral Ulnar Collateral and Annular Ligaments<sup>[\*]</sup>

Lateral Ulnar Kollateral ve Anuler Ligamanlarının Anatomik Boyutları

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Submitted / Başvuru tarihi: 26.10.2006 Accepted / Kabul tarihi: 10.11.2006

**Objectives:** Anatomical dimensions of lateral ulnar collateral and annular ligaments were determined in the present study.

**Patients and Methods:** These measurements were performed on 20 elbows from 10 cadavers. Lateral ulnar collateral and annular ligaments were dissected in all elbows and their anatomical lengths and widths were measured.

**Results:** The mean length of the right annular ligament was 55.6 mm and the mean width was 12.6 mm. The mean length of the right lateral ulnar collateral ligament was 23.2 mm and the mean width was 13.6 mm. The mean length of the left annular ligament was 55.4 mm and the mean width was 11.5 mm. The mean length of the left lateral ulnar collateral ligament was 19.3 mm and the mean width was 12.1 mm.

**Conclusion:** Ruptures of lateral ulnar collateral and annular ligaments generally occur during elbow dislocations. The dimensions of these two ligaments are important since they determine the grafts to be chosen for their surgical repair. These dimensions are quite helpful for the surgeon who will perform the reconstruction for estimating the length and thickness of the graft to be used for this purpose. When the mean values obtained in the present study are taken into consideration, grafts of at least 10 cm in length, a value which is five folds greater than the ligaments' length, are required for repairing the lateral ulnar collateral and annular ligaments. We believe that more reliable results can be obtained with series comprising higher numbers of cadavers.

**Key Words:** Elbow; cadaver; dimensions; joint; ligament.

**Amaç:** Bu çalışmada lateral ulnar kollateral ve anuler ligamanların boyutları araştırıldı.

**Hastalar ve Yöntemler:** Ölçümler 10 kadavranın 20 dirseğinde yapıldı. Lateral ulnar kollateral ve anuler ligaman tüm dirseklerde diseke edildi. Uzunlukları ve genişlikleri ölçüldü.

**Bulgular:** Sağ anuler ligamanın ortalama uzunluğu 55.6 mm, ortalama genişliği 12.6 mm, sağ lateral ulnar kollateral ligamanın ortalama uzunluğu 23.2 mm, ortalama genişliği 13.6 mm bulundu. Sol anuler ligamanın ortalama uzunluğu 55.4 mm, ortalama genişliği 11.5 mm, sol lateral ulnar kollateral ligamanın ortalama uzunluğu 19.3 mm, ortalama genişliği 12.1 mm ölçüldü.

**Sonuç:** Genellikle bu ligamanların yırtılması dirsek çıkışlarında meydana gelir. Bu ligamanların greftlenerek yapılan cerrahi onarımı sırasında, ligamanların boyutları greft seçimini belirleyeceğinin oldukça önemlidir. Çünkü bu ligamanların boyutları rekonstrüksiyonu yapacak cerrah için oldukça yardımcıdır. Böylece kaç cm uzunlukta ve kalınlıkta grefte ihtiyaç olduğu önceden kestirebilir. Çalışmamızda bulduğumuz ortalamalarla yola çıkarak lateral ulnar kollateral ligaman ve anular ligaman tamiri için en az beş katı uzunluk olan 10 cm'lik grefte ihtiyaç vardır. İnanıyoruz ki daha büyük olgu sayılarında çalışmalarla daha yüksek sonuçlar elde edilebilecektir.

**Anahtar Sözcükler:** Dirsek; kadavra; boyut; eklem; ligaman.

\*This study was presented in the VI. International Symposium of Clinical Anatomy, October 8-10, 2004, Varna, Bulgaria (Bu çalışma 6. Uluslararası Klinik Anatomi Sempozyumu'nda sunulmuştur (8-10 Ekim, 2004, Varna, Bulgaristan).

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<sup>③</sup>Medical Journal of Trakya University. Published by Ekin Medical Publishing. All rights reserved.

Anatomically, the lateral collateral ligament of the elbow joint consists of a ligamentous expansion proceeding down from the lateral epicondyle to the ulna (major expansion which inserts into supinator crest of ulna) and also sends expansions down to the annular ligament (AL) and radius. Surgically, it consists of four components: the AL, the radial collateral ligament, accessory lateral collateral ligament and the lateral ulnar collateral ligament (LUCL).<sup>[1]</sup>

The AL is a strong band, which encircles the radial head, holding it against the radial incisura of the ulna, maintains the radial head in contact with the ulna. The radial collateral ligament originates from the lateral epicondyle and terminates in the AL. Accessory lateral collateral ligament originates from AL and terminates at the ulna.<sup>[1,2]</sup>

The function of the LUCL, originating from the lateral epicondyle and terminating to the tubercle of the crest of the supinator on the ulna, is to provide stability to the humero-ulnar joint and it is shown to be deficient in posterolateral rotatory instability of the humero-ulnar joint. Other three ligaments do not contribute to the instability. In posterolateral rotatory instability, the elbow luxates in a posterolateral direction; the ulna and radius rotate off the humerus by the external rotation and then the elbow dislocates incompletely and, in this way, the coronoid is perched on the trochlea. At the end of the process, the elbow dislocates fully and the coronoid rests behind the humerus.<sup>[3,4]</sup>

Cutting or elongation of AL causes instability at the proximal radio-ulnar joint. Deficiency of the LUCL, due to a cut or elongation, also causes posterolateral instability at the humero-ulnar joint. In both situations, ligamentous reconstruction is required. Thus, knowing the dimensions of the ligaments is useful while planning the reconstructive procedure. Therefore, the dimensions of the LUCL and AL were assessed in this study.

## PATIENTS AND METHODS

The dimensions of the LUCL and AL were investigated on 20 elbow joints from adult cadavers. Among the ten cadavers investigated,

nine were male and one was female. The mean age at the time of death was 48.5 years (range 42 to 60). The skin, fascia and muscles were removed around the elbow specimen. Afterwards, the lengths of lateral ulnar collateral and AL's were measured from origins to insertions. The widths were measured from the widest zone. On the other hand, the capsule and ligaments were preserved, the LUCL and AL's were detected and the measurements were performed by a metal tape measure with 1 millimeter measure markings.

## RESULTS

The mean length of the right AL was 55.6 mm (min-max= 41-70, SD= 9.43 mm) and the mean width was 12.6 mm (min-max= 8-26, SD= 5.3 mm). The mean length of the right LUCL was 23.2 mm (min-max= 14-36, SD= 6.53 mm) and the mean width was 13.6 mm (min-max= 9-18, SD= 2.76 mm). The mean length of the left AL was 55.4 mm (min-max= 45-70, SD= 8.75 mm) and the mean width was 11.5 mm (min-max= 5-22, SD= 5.87 mm). The mean length of the left LUCL was 19.3 mm (min-max= 15-25, SD= 4.11 mm) and the mean width was 12.1 mm (min-max= 8-18, SD= 2.56 mm). The dimensions of the annular and LUCL's are shown in Table 1.

## DISCUSSION

The lateral ligament complex is essential in maintaining elbow stability. The AL is a component of the lateral ligament complex of the elbow. Especially, the LUCL inserted on the ulna helps to stabilize the humero-ulnar joint.<sup>[3,4]</sup> In addition, the role of LUCL in elbow function was demonstrated in the elbow dissections of patients suffering from lateral soft-tissue injury pattern in the studies of Safran and Baillargeon<sup>[5]</sup> and McKee et al.<sup>[6]</sup> King et al.<sup>[7]</sup> have shown the role of the LUCL in the stability of the elbow in their study conducted on a biomechanical cadaver. Additionally, Lee and Teo<sup>[8]</sup> emphasized the significance of the same ligament after surgical reconstruction for posterolateral rotatory instability of the elbow.

On the other hand, the AL assists lateral stability and provides the proximal radio-ulnar joint stability.<sup>[7,9]</sup> The insufficiency of these liga-

**Table 1. Dimensions of the annular ligament and lateral ulnar collateral ligament**

Cadaver	Right				Left			
	AL	Width	Length	Width	AL	Width	Length	Width
Length					Length			
1	63	13	25	15	55	22	18	11
2	50	13	30	14	55	22	18	11
3	64	16	24	16	45	7	25	12
4	52	11	36	15	60	12	15	12
5	41	8	14	11	50	9	15	8
6	60	26	24	9	51	10	25	12
7	70	10	18	11	70	9	18	12
8	46	8	18	12	50	8	18	14
9	48	11	18	15	48	11	16	11
10	62	10	25	18	70	5	25	18
Mean±SD	55.6±9.43	12.6±5.3	23.2±6.53	13.6±2.76	55.4±8.7	11.5±5.87	19.3±4.11	12.1±2.56

AL: Annular ligament; LUCL: Lateral ulnar collateral ligament.

ments may lead to symptomatic instability and needs free tendon graft reconstruction.<sup>[6,10,11]</sup> On the other hand, the mean lengths of these two ligaments are important for a surgeon, who will use a graft during the surgical repair of these ligaments. Therefore, the dimensions of these ligaments were assessed in a number of studies. Takigawa et al.<sup>[12]</sup> in their study performed on cadavers, reported the thickness of the LUCL to be between 4.3 and 11.2 mm and its length between 28.6 and 38.4 mm.<sup>[12]</sup> Their findings on the length of the ligament were quite different from those reported in this study and other studies.<sup>[1,4,5,13]</sup> Imatani et al.<sup>[14]</sup> examined the lateral collateral ligament complex of the elbow joint from cadavers under a microscope and reported that the borders of the ligaments could not be separated from the peripheral tissues, seeing that. They suggested that this finding was the main reason behind the variability in the dimensions of the ligaments reported by different researchers.

According to the results of our study, grafts of at least 10 cm in length, which is five folds the length of the ligaments, are required for repairing the lateral ulnar collateral and AL's. If the dimensions of the ligaments are known, it becomes easier to determine the dimensions of the free tendon grafts that will be used in the

surgical repair. We believe that more reliable results can be obtained with studies performed on greater series.

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