



# Cleland's and Grayson's Ligaments: an anatomic study

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## Research Article

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**Purpose:** The cutaneous ligaments of the human digits were first reported by FRS Cleland and J Grayson. During digital movements they are the delicate functional structures essential for normal skin stability. Cleland's ligaments extend bilaterally between the phalanx and the finger dermis, and Grayson's ligaments extend to the digital neurovascular bundles. **Methods:** We performed a detailed anatomical dissection in a total number of 70 fingers (50 formaldehyde fixed and 20 fresh hand fingers). The origin and the insertion of the ligaments and a new approach for the dissection of the ligaments have been discussed. **Results:** The usage of the midlateral exposure is better than the other classical dissection techniques. **Conclusion:** The knowledge of a detailed morphometry of Cleland's and Grayson's ligaments can be important for surgical procedures of Dupuytren's disease and flap design.

**Key words:** Cleland's Ligament, Grayson's Ligament.

## Cleland ve Grayson ligamentleri: anatomik çalışma

**Amaç:** İlk olarak FRS Cleland ve J Grayson tarafından tanımlanan yüzeysel el ligamentlerinden Cleland ligamentleri falanxlara ve parmak derisine bilateral olarak uzanırken, Grayson ligamentleri ise nörovasküler demet üzerinde yer alırlar. **Yöntem:** Bu çalışmada detaylı anatomik diseksiyonla 50 formaldehit fikse el parmağı ve 20 fresh kadavra parmağı olmak üzere toplam 70 parmakta Cleland ve Grayson ligamentlerinin morfometrik ve topografik yerleşimi değerlendirilerek literatür bilgileri ile tartışıldı. **Sonuçlar:** Cleland ve Grayson ligamentlerinin anatomik yapısını detaylı bir şekilde ortaya konulması Dupuytren hastalığının cerrahi tedavisinde ve flap tasarımlarında önemlidir. **Tartışma:** Anatomi diseksiyonlarında kullanılan standart tekniklerin dışında midlateral yaklaşımın bu ligamentlerin değerlendirilmesinde daha etkin olduğu saptandı.

**Anahtar kelimeler:** Cleland ligamenti, Grayson ligamenti.

Anatomical literature provides a relatively scarce amount of data on the cutaneous ligaments of the human digits. The cutaneous ligaments of the human digits were first described by Cleland.<sup>1</sup> Cleland first reported the existence of these ligaments at the Meeting of the British Association in Dundee in 1867 and published his work in 1878. During 1930's Grayson mentioned that "But in addition to these structures it was apparent that there is also a fibrous septum volar to the digital nerves and vessels. This septum forms a series of retinacula which, if we refer to Cleland's ligaments as the deep digital skin retinacula, might well be termed the superficial or volar retinacula. Their distribution is such that they could obviously subserve precisely the same function as their deeper fellows" and defined the Grayson's ligament.<sup>2</sup>

These ligaments arise from both sides of the phalanges and they are inserted onto the skin over the interphalangeal joints. The detailed anatomy of the digital cutaneous ligaments is surgically important. It is important to understand the topographic anatomy of the cutaneous ligaments of the human digits in order to clarify the physiological role of these structures for normal skin stability during digital movements.<sup>1-4</sup> They may work synergistically in stabilizing the neurovascular bundle during digital flexion.

In this study we aimed to perform a series of detailed anatomical dissections of the human digits to investigate Cleland's and Grayson's ligaments morphometrically and topographic arrangements of them. The knowledge of a detailed morphometry of Cleland's and Grayson's ligaments can be important for surgical procedures of Dupuytren's disease and flap design.

Because of the localization of the ligaments the ventromedial and the dorsomedial aspect is used by the previous investigators. In this study we tried the midlateral aspect and we can speculate that the midlateral exposure of the ligaments is better than the other classical anatomic dissection techniques.

## METHODS

This study comprises anatomical dissections performed on 12 human adult cadavers (33–76 years; males (n=9); females (n=3) obtained from the Department of Anatomy at the Akdeniz University of Antalya (Turkey). The cadavers were from Turkish population. In the present study 10 of 12 cadavers were formaldehyde fixed and the rest two cadavers were fresh frozen. To analyze the morphology of the cutaneous ligaments of the digits, systematic dissections of the hands were performed.

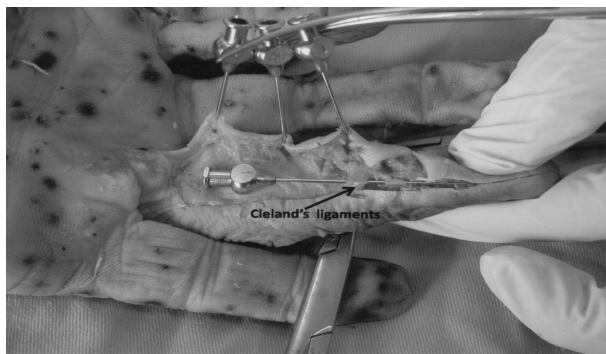
Three different dissection aspects (exposures) were performed in the present study. The dorsomedial and ventromedial aspects were performed according to the literature described by Chrysopoulou MT et al. Additionally the midlateral aspect was discussed.

1- Dissection from the midlateral aspect: After an incision 2 cm below the finger tip, the skin was released and after the resection of the adipose tissue the Grayson ligament was identified. In the dorsal part of the finger after pulling the neurovascular bundle to the lateral side, the Cleland's ligament was identified nearby under the neurovascular bundle. In the midlateral exposure the identification of the ligaments is easier and better than the other classical anatomic dissection techniques (Figure 1).<sup>5</sup>

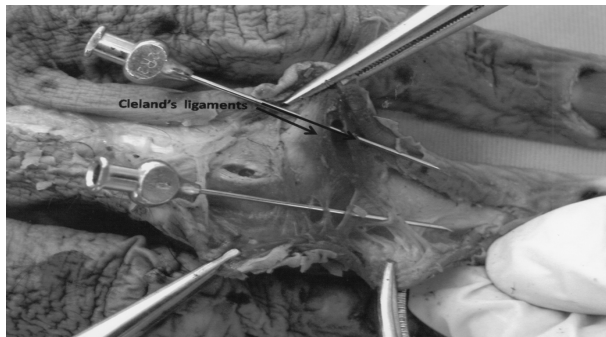
2- Dissection from the dorsal aspect: We performed a midline incision of the dorsal skin of the digit and hand. The incision was from the fingernail to a point approximately 2 cm proximal to the metacarpo-phalangeal joint. We released the skin from the underlying tissue and dorsal wrinkle ligaments and reflected laterally. Thus, the extensor expansion and the fascial covering were exposed. Then we divided the extensor expansion. Each half was reflected laterally so that we could measure the shaft widths and lengths of the proximal and middle phalanges. We isolated the Cleland's ligament from adjacent fat at the level of proximal interphalangeal joint (Figure 2).

3- Dissection from the midventral aspect: We made a palmar midline incision. This incision was deeper than the dorsal aspect. Then we reflected

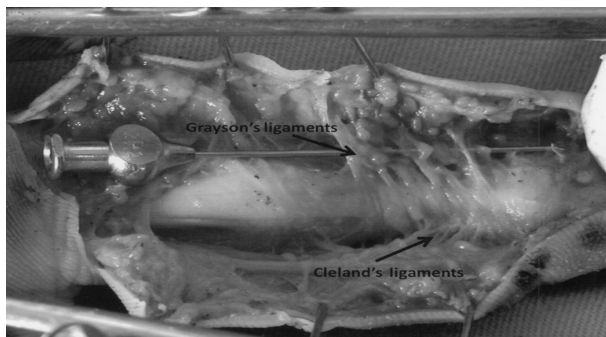
the skin laterally. We again removed the whole adipose tissue encountered in the region of the fibers, thereby exposing the fibers. From the ventral aspect we first identified the Grayson ligaments overlying the neurovascular bundle. They were in the same level as the natatory ligaments. In the other side of the finger we observed the Cleland's ligaments under the neurovascular bundle lying laterally to the skin in the dorsal part of the finger (Figure 3).



**Figure 1. Ventrolateral aspect.**



**Figure 2. Dorsal aspect.**



**Figure 3. Midlateral aspect.**

All the measurements were made from the ventral aspect in the middle phalanx of II, III, IV, V digits. In the thumbs, we measured the distances above the distal phalanx. Total length of the Cleland and Grayson ligaments from origin to insertion was measured by electronic caliper.

## RESULTS

In both ligaments no significant difference was encountered between cadaveric and fresh digits. Although some of the Cleland's ligaments were irregular and some of them were V shaped and there were no correlation between the numbers of fibrous bundles. There were no significant differences between the Grayson's ligament shapes. From the ventral aspect Grayson's ligament was lying palmarly over the neurovascular bundle. Examination of the Cleland's ligament was easier from the midlateral exposures. The detailed origo-insertio measurements of the Cleland's and Grayson's ligaments are given at Table 1.

## DISCUSSION

J Weitbrecht first mentioned the cutaneous ligaments in 1742.<sup>6</sup> After the description of Cleland and Grayson, a book entitled "Retaining Ligaments of the Digits of the Hand", was published by Lee Milford in 1968. He encountered the anatomy of Cleland's and Grayson's ligaments. Milford described four fibrous condensations, two proximal and two distal, arising from the proximal interphalangeal joint capsule and the lateral margin of the middle phalanx. These fibers radiated in two planes, forming a cone like structure before inserting into the dorsal skin.<sup>7</sup> Additionally, Chrysopoulo MT described ventral fibers of the Cleland's ligament.<sup>3</sup>

In one case, the neurovascular bundles of the middle finger were entrapped by the proximal edges of Cleland's ligaments.<sup>8</sup> Furthermore, we can speculate that these ligaments are not only the structures for skin stability but also the probable structures for the stability of the fractures.

**Table 1. Ratio between origin and insertion of the Cleland's and Grayson's Ligaments from each human digit (cm).**

	<b>Thumb</b>	<b>Index</b>	<b>Middle</b>	<b>Ring</b>	<b>Little</b>
	<b>X±SD</b>	<b>X±SD</b>	<b>X±SD</b>	<b>X±SD</b>	<b>X±SD</b>
<b>Cleland's Ligament</b>					
Proximal phalanx	0.56±0.03	-	-	-	-
Middle phalanx	-	0.84±0.03	0.83±0.05	0.72±0.11	0.49±0.04
<b>Grayson's Ligament</b>					
Proximal phalanx	0.53±0.02	-	-	-	-
Middle phalanx	-	0.76±0.08	0.74±0.05	0.70±0.04	0.49±0.06

The data of the present study have advanced the morphological understanding of Grayson's ligaments and have confirmed previous reports regarding the anatomy of Cleland's ligaments. This study has advanced our anatomic understanding of Cleland's and Grayson's ligaments and the possible functions in the entrapment neuropathies of the neurovascular bundle. We thought that exposures directly midlateral aspect was more suitable way to reach to the pulley system and enlargement laterally by providing the neurovascular bundle and the Cleland's ligament was more helpful for the hand surgeons.

The results of the present study were parallel to the morphometrical investigations of Ary-Pires et al. In our study, the origin-insertion values of the ligaments were a little less than their results. This difference could be belong to the blind investigator or ethnical differences of the cadavers.

It is well known that Dupuytren's disease is a palmar fibromatosis bringing about irreversible finger contracture. The morphometrical data concerning the cutaneous ligaments of the digits may present surgical significance in the treatment of such a clinical condition, especially in hand microsurgery, relieving tension in the palmar fascia that has been proposed as a causative factor for Dupuytren's disease.<sup>4</sup> We believed that midlateral exposures were more suitable for anatomic dissections and these ligaments were clinically

important for fracture fixations and neurovascular explorations in Dupuytren's disease surgery for hand surgeons.

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