Indian Journal of Clinical Anatomy and Physiology 2023;10(4):236–243

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Indian Journal of Clinical Anatomy and Physiology

Journal homepage: https://www.ijcap.org/

Original Research Article

Assessing the histomorphology, and microscopic composition of the triangular fibrocartilage complex [TFCC] of the wrist joint: A cadaveric observational study

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ARTICLE INFO

Article history:
Received 30-11-2023
Accepted 08-12-2023
Available online 20-01-2024

Keywords:
TFCC
Wrist joint
Histology
Ligaments

ABSTRACT

Background: TFCC, being a complicated structure, located on the ulnar side of the wrist is composed of multiple distinct anatomic entities which together play a critical role in wrist biomechanics. The anatomy of TFCC has not been extensively studied in the Indian population.
Objective: To elucidate the microscopic anatomy and composition of the triangular fibrocartilage complex of the wrist joint using haematoxylin-eosin and Verhoff Van Gieson staining methods.
Materials and Methods: Samples collected from 40 specimens (20 right and 20 left limbs) were placed in 10% neutral buffered formalin for fixation. Paraffin-embedded blocks were prepared and tissue sections were taken at 7-micron thickness. The slides were subjected to H&E and VVG staining following standardized protocol.
Results: The morphological structure of the seven components of triangular fibrocartilage complexes was assessed. The articular disc consisted of densely packed interlaced fibrocartilage with sparse blood vessels. Radioulnar ligaments showed densely-packed-parallel or interlaced- collagen-bundles. A mixture of tight and loose parallel tissue was observed in the sub-sheath of the extensor carpi ulnaris muscle, the ulnar-triquetral (UTL), and the ulnar-lunate ligament (ULL). Irregular morphological composition and loose connective tissue predominated in the ulnar-carpal meniscus (UCM). Blood vessels were observed in the epi-fascicular/ fascicular areas of the UTL, interstitial region of ULL and UCM.
Conclusion: The microscopic anatomy of TFCC was complex owing to the varied nature of its entities. An understanding of the distribution of connective tissue, blood vessels, and elastic fibres would be of immense help in planning arthroscopic procedures.

1. Introduction

Ulnar wrist pain is one of the most common wrist problems perceived by hand surgeons. It may be either acute or chronic and include the following causes like fractures, dislocations, ligament injuries, avascular necrosis, and degenerative changes affecting the ulnar carpus and distal radioulnar joint. In the elderly groups wrist pain has been emerging as an important treatment modality making the entire focus to be on the wrist joint. It has been noted that TFCC (triangular fibrocartilage complex) remains the most recognized cause of ulnar wrist pain.[1] This urges us to analyse the complex anatomical and biomechanical structure of TFCC.

Understanding anatomy and biomechanics as they relate to pathology, pain, conservative management, operative procedures, postoperative management, and the progression or rehabilitation is essential to assessment and planning treatment. The triangular fibrocartilage complex (TFCC) is a complicated ligamentous fibrocartilaginous structure composed of multiple anatomical structures located in the ulnar aspect of the human wrist separating the radiocarpal

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https://doi.org/10.18231/j.ijcap.2023.054

and distal radioulnar joints. TFCC has seven distinct components: the articular disc (AD), the volar radioulnar ligament (VRUL), the dorsal radioulnar ligament (DRUL), the ulno lunate (UL), the ulno triquetral ligaments (UT q), the sub sheath of the extensor carpi ulnaris (SS-ECU) tendon and the ulnocarpal meniscoid structure (UCM).[2] The articular disc showed less blood supply compared to other areas of the components of TFCC.[3] The peripheral 15–25% of the disc being the dorsal, volar, and ulnar parts showed sparse vascularity.[4] The fibrocartilaginous disc is placed at the center and the ulnar collateral ligament is placed at the palmar portion and has the radioulnar ligament attached to the sigmoid notch which differentiates into the dorsal and palmar aspect. (Figure 1)

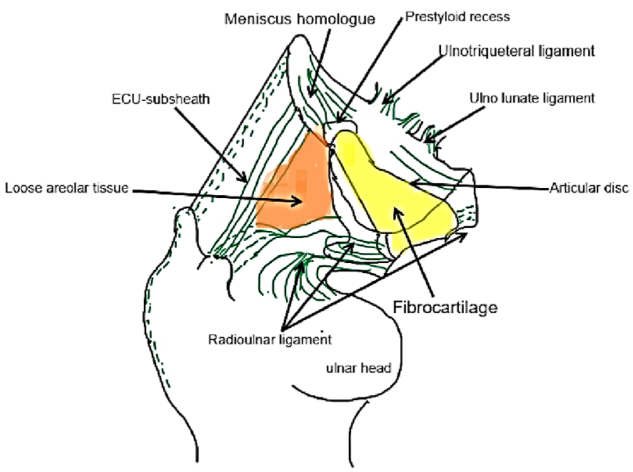

Figure 1: Schematic diagram of Triangular Fibrocartilage Complex components: Ligaments shown in green, fibrocartilage in yellow and loose areolar tissue in orange

Mechanical and dynamic stability of the wrist joint relies on fine interactions among these components of TFCC.The knowledge about the micromorphological features of TFCC reflects their biomechanical functions and also the stability of the distal radioulnar joint.[5] The biomechanical functions of TFCC can be viewed as follows: it acts as a stabilizer for the distal radioulnar joint and the ulnar carpus, helps in the transmission of the axial load and serves as a cushion for the ulnar carpus.[6] In the dynamic condition, a tripod of stabilizers acts together to ensure stable functioning of the distal radioulnar joint (DRUJ). Structures constituting the tripod are bony contact between adjacent bones, TFCC complex which tends to act as an intrinsic stabilizer, and distal forearm structures acting as distal stabilizers. Thus, treatment for disorders involving DRUJ mandates a deeper understanding of the stabilizers, especially the TFCC.[7]

Knowledge regarding the histology and vascular pattern of TFCC shall be high yielding for the arthroscopic surgeons while planning for surgeries involving wrist joints. Consequently, diminished rates of structural injury and better reconstruction of wrist joints are expected to be achieved.[8] It is also useful for radiologists while interpreting scans of patients presenting with chronic wrist pain. The anatomy of TFCC has not been extensively studied in the Indian population. There is no data regarding the micro-composition and pattern of vascular distribution. This study makes the treatment options optimal and helps in the progression of future studies in clinical practices.[9] TFCC injuries diagnosed based on imaging modalities have become unreliable to hand surgeons and radiologists since a uniform classification system has not been made up to date. This study aims to propose the micro-composition of TFCC and in doing so it can overcome the discrepancies faced and sets a reference point to the clinicians.

2. Materials and Methods

This study was conducted in the department of Anatomy at Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) in the voluntarily donated and unclaimed human cadavers. The study protocol was carried out in accordance with the guidelines of the Institutional Ethics Committee. A total of 40 upper limbs from 20 formalin embalmed cadavers of either sex were evaluated in this study after employing the suitable inclusion and exclusion criteria. The study was outlined under the following headings:

2.1. *Study design*

Descriptive study.

2.2. *Study participants*

The formalin embalmed human cadavers which were sanctioned for the undergraduate teaching in the department of Anatomy were designated as the study participants.

2.3. *Inclusion criteria*

The embalmed cadavers which were found suitable for dissection during the study duration were included in the study.

2.4. *Exclusion criteria*

Cadavers with observed pathological, traumatic or degenerative abnormalities in the wrist joint region.

2.5. *Dissection technique*

Make a transverse incision across the front of the wrist joint. Cut through the annular ligament and divide the interosseus membrane from above downward. Draw the radius laterally to expose the connections of the articular capsule and disc. The structural complex of fibrocartilage and its associated structures will be detached proximally by means of an oblique osteotomy of the ulnar head, proximal to the fovea and ulnar styloid. A dorsal radiocarpal capsulotomy, following the direction of the most proximal fibres of the dorsal radio triquetral ligament, will be used to enter the TFCC. After resection of the soft tissues and capsule of the distal radioulnar joint TFCC will be removed enblock. After specimen collection, TFCC was kept in 10% neutral buffered formalin for 2 days for fixation. All specimens will then be embedded in paraffin. Two transverse slices of approximately 0.5 cm thickness will be taken (first slice from proximal attachment and second slice from the distal attachment). On tissue processing, 5-7 μm thick sections will be prepared. The tissue sample were washed with normal saline and transferred to the tissue cassettes for tissue processing. After appropriate tissue sectioning the slides were subjected to Haematoxylin and eosin and Verhoff Van Gieson staining following standardised protocols. The slides were examined using the bright field compound microscope (Olympus CX41, Tokyo, Japan) under 4X, 10X and 40X magnification and pictures were taken with a digital camera fitted into microscope.

Histology: Pattern of loose connective tissue, collagen fibres and its number, elastic fibres, number of blood vessels, total luminal surface area of vessel per section were observed. (Figures 2 and 3)

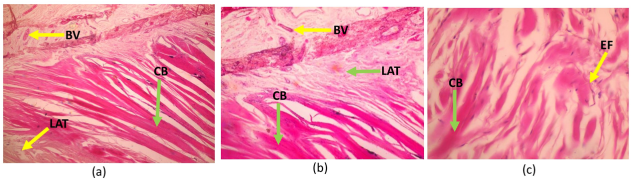

Figure 3: Transverse section of distal part of dorsal radioulnar ligament-epi-ligament: Haematoxylin and eosin stain (**a**): 4X; (**b**):10X; (**c**): 40X magnification. CB, Collagen bundles; LAT, Loose areolar tissue; BV, blood vessel; EF, Elastic fibre

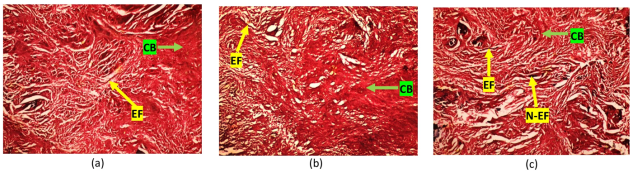

Figure 4: Transverse section of distal part of dorsal radioulnar ligament-epi-ligament: Verhoff Van Gieson (**a**): 4X; (**b**): 10X; (**c**): 40X magnification. CB, Collagen bundles; LAT, Loose areolar tissue; BV, blood vessel; EF, Elastic fibre

Verhoeff Van Gieson stain: Pattern of elastic fibre and its nuclei and collagen were seen. (Figures 4 and 5)

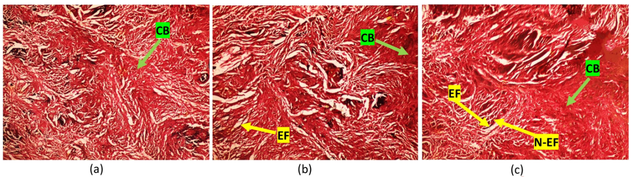

Figure 5: Transverse section of distal part of dorsal radioulnar ligament-epi-ligament: Verhoff Van Gieson (**a**): 4X; (**b**): 10X; (**c**): 40X magnification. CB, Collagen bundles; LAT, Loose areolar tissue; BV, blood vessel; EF, Elastic fibre

2.6. *Statistical analysis*

The collected data was entered and analysed in SPSS software 26.0 version (IBM corp. Armonk, NY, 2019) and results were represented in median with range in millimetre. Student T test/Mann-Whitney U test was used to study the association between categorical and continuous variable. Chi-Square test was used to study the association between 2 categorical variables. P value <0.05 was considered as statistically significant.

3. Results

A total of 40 wrist joints were studied. Of which 50% were right upper limb and rest 50% were left upper limb. The articular disc (AD) was studied for the histomorphological parameters and the same is depicted in Table 1. The statistical difference was not significant between either side limb with regards to the parameters observed.

The ulna-lunate ligament (UL) studied for the histomorphological parameters in detail and there was no difference observed between either side limbs. The number of blood vessel was observed to be 0 to 2 in proximal part and 0 to 1 in the distal part. The details observed in UL is described in Table 2.

The ulna-carpal meniscoid (UCM) was observed to be having 6.5 ± 2.16 and 7.25 ±2.73 collagen fibers in the proximal part of right and left side respectively. The distal part of the (UCM) had 5.3 ± 1.81and 5.8 ±1.73 collagen fibers in the right and left side respectively. The course of collagen fibers was mixed tight and loose parallel in majority of the limbs with 70% in both proximal and distal part of right limb and 75% and 80% in proximal and distal part of left limb respectively. The loose areolar tissue was observed to be none in 60% or more in the proximal and distal part of (UCM) on either side. The number of blood vessels was observed to be 7.7 ± 1.52 and 6.35 ± 1.08 in the proximal and distal part of (UCM) on the right side respectively. It was 7.35 ± 1.72 and 6.35 ± 1.19 blood vessels in the proximal and distal part of (UCM) on the left side respectively. The elastic fibers were observed to be none in majority of the limbs with median number of fibers being 1 in both proximal and distal part of (UCM) on either side by VVG stain. There was no significant difference

Table 1: Histolomorphological details of articular disc(n=40)

S. No.	Histological parameter	Proximal			Distal		
		Right	Left	p value	Right	Left	p value
1	No. of collagen fibres	16.65 ± 4.31	16.85 ± 3.92	0.72	16.65 ± 4.31	16.85 ± 3.92	0.79
2	Course of collagen fibres	DPI-90% DPP-10%	DPI=90% DPP-10%	0.52	DPI-95% DPP-5%	DPI=90% DPP-10%	0.64
3	No. of connective tissue	None-15% Few-85%	None-15% Few-85%	0.87	None-15% Few-85%	None-15% Few-85%	0.89
4	No. of blood vessel	0-20% 1-15% 2-30% 3-30% 4-5%	0-10% 1-15% 2-30% 3-40% 4-10% 7-5%	0.62	0-15% 1-15% 2-50% 3-20%	0-10% 1-10% 2-40% 3-25% 4-15%	
5.	Surface area of blood vessel (μm2)^	7239 (5639, 8299)	7450 (5092, 8448)	0.69	6709 (5102, 8330)	8103 (7432, 9027)	0.72
6.	No. of elastic fibres by H & E stain	None-15% Few-85%	None-25% Few-75%	0.44	None-10% Few-90%	None-10% Few-90%	0.91
7.	Number of elastic fibres by VVG stain*	5.85 ± 2.42	6.31 ± 2.59	0.11	6.32 ± 2.59	7.55 ± 2.82	0.41
8.	Number of elastic fibre nuclei by VVG stain*	6.15 ± 2.32	7.41 ± 2.47	0.41	6.75 ± 2.75	8.32 ± 2.32	0.39
9.	Number of collagen fibre by VVG stain*	16.85 ± 4.19	16.55 ± 3.72	0.83	17.15 ± 5.42	16.95 ± 4.77	0.77

DPI- Densely packed interlacing, DPP- Densely packed parallel, H & E- Haematoxylin eosin stain, VVG- Verhoff Van Gieson stain, *- Mean± SD, ^ Median (Interquartile range)

Table 2: Histomorphological details of Ulno-Lunate ligament (n=40)

S.No.	Histological parameter	Proximal			Distal		
		Right	**Left**	**p value**	**Right**	**Left**	**p value**
1	No. of collagen fibres	13.65 ± 4.92	15.2 ± 4.65	0.48	12.35 ±3.75	14.7 ± 4.76	0.61
2	Course of collagen fibres	DPI-5% DPP-35% MTLP-60%	DPP-50% MTLP-50%	0.68	DPI-5% DPP-35% MTLP-60%	DPP-45% MTLP-55%	0.51
3	No. of connective tissue	None-80% Few-20%	None-80% Few-20%	0.93	None-80% Few-20%	None-980% Few-10%	0.77
4	No. of blood vessel	0-40% 1-50% 2-10%	0-25% 1-50% 2-25%	0.73	0-55% 1-45%	0-35% 1-65%	0.71
5.	Surface area of blood vessel (μm2)^	1827 (1099, 1920)	1726 (1345, 2876)	0.86	1452 (1298, 1475)	1108 (1092, 1762)	0.24
6.	No. of elastic fibres by H & E stain	None-85% Few-15%	None-90% Few-10%	0.79	None-80% Few-20%	None-85% Few-15%	0.83
7.	Number of elastic fibres by VVG stain^	2(1,3)	2(0,3)	0.91	2(1,3)	2(1,3)	0.96
8.	Number of elastic fibre nuclei by VVG stain^	2(1,3)	2(1,3)	0.93	2(1,3)	2(1,3)	0.97
9.	Number of collagen fibre by VVG stain*	14.05 ± 4.71	15.63 ± 4.34	0.79	12.63 ± 3.61	15.21 ± 4.30	0.47

DPI- Densely packed interlacing, DPP- Densely packed parallel, MTLP- Mixed tight and loose parallel, H & E- Haematoxylin eosin stain, VVG- Verhoff Van Gieson stain, *- Mean± SD, ^ Median (Interquartile range)

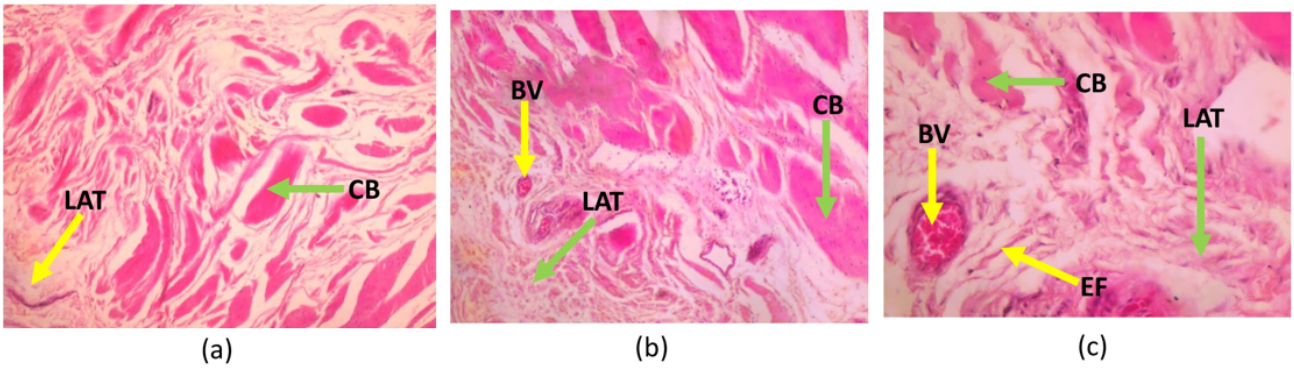

Figure 2: Transverse section of proximal part of articular disc: Haematoxylin and eosin stain (**a**): 4X; (**b**): 10X; (**c**): 40X magnification. CB, Collagen bundles; LAT, Loose areolar tissue; BV, blood vessel; EF, Elastic fibre

between either side limbs in all the above parameters.

The Ulno-triquetral ligament (UTL) was observed to have similar histomorphological parameters on either side limb. The details of the parameters studied is described in Table 3.

The subshealth of extensor carpi ulnaris (SS-ECU) tendon was observed to be having 13.3 ± 3.91 and 13.25 ± 3.49 collagen fibers in the proximal and distal part of (SS-ECU) respectively in right side limb. Similarly, 13.45 ± 3.66 and 12.85 ± 3.36 collagen fibers were observed in the proximal and distal part of (SS-ECU) respectively in the left limb. The number of loose areolar tissue was none in 95% specimens on the right side and 90% specimens on left side, both proximal and distal part of (SS-ECU). The median surface area of blood vessels was 7619 and 7843 μm^2in the proximal and distal part of (SS-ECU) respectively on right side. The median surface area of blood vessels was 7034 and 7394 μm^2 in the proximal and distal part of (SS-ECU) on left side. The median number of elastic fibers was 2 in both proximal and distal part of both the sides by VVG stain. There was no significant difference between either side limbs in all the above parameters.

The details of histomorphological parameters are presented in table 4 for both the volar and dorsal radio-ulnar ligament. The statistical difference was not significant between either side limbs with regards to the parameters observed.

4. Discussion

By and large it was known that TFCC comprises of a fibrocartilaginous disc and surrounding fibro ligamentous structures.[10–17] In the present study all four structural types of collagenous fibre arrangements were observed in the components of TFCC namely densely packed interlaced, densely packed parallel, mixed tight and loose interlaced and parallel pattern of fibres. The quantity of elastic fibres and connective tissue were classified as few, none or many in each component of TFCC.

4.1. Articular disc(AD)

The majority of the collagen fibres were densely packed interlacing which was in accordance with reported literature in the past[3,5,13,18] and throughout the fibrocartilage fibres ran in multiple directions. Similar arrangement of densely packed interlaced fibres was documented by the previous studies related to the TFCC.[4,14,16] Also articular disc showed sparse vascularity compared to other peripheral areas of the TFCC in our study.[5] Semisch et al had studied that avascularity was seen in central and radial areas compared to ulnar border of the disc which showed sparse vascularity. The disc had sparse interstitium with fewer connective tissue in our study. The distribution of elastic fibres was fewer in our study which was in analogous with the results of reported literature in the past.[5,16] Hence, AD acts as a shock absorber because of the presence of minimal elasticity thereby acting as a buffer for axial carpal forces and has a minor role-play in (DRUJ) instability.[18,19]

4.2. Volar radioulnar ligament (VRUL) and Dorsal Radioulnar ligament (DRUL)

Both these epi-ligaments showed resemblance in the arrangement of fibres and vascularity. They had exhibited either densely packed interlaced or parallel arrangement of collagen fibres as noted by *Chidgey LK et al., and Semisch M et al.*[4,5] The fibres showed wavy appearance which ran in radioulnar direction. This wavy pattern was responsible for unidirectional distension of the fibres during tensile forces which was described.[4,5] Chidgey et al and Semisch et al observed longitudinal wave like fibres in their study. The vascularity of these epi-ligaments were comparatively more near the volar and dorsal margins than near the margins contiguous to disc.[4,17] They had shown sparse interstitium and the connective tissue fibres falls under the classification of none as put forward by Chidgey et al.[4] The arrangement of elastic fibres were also under the category of none similar to Chidgey et al[4] which provided support

Table 3: Histomorphological details of ulno-triquetral ligament (n=40)

S. No.	Histological parameter	Proximal Right	Proximal Left	p value	Distal Right	Distal Left	p value
1	No. of collagen fibres	2.9 ± 1.4	2.4 ± 1.1	0.74	1.95 ±0.7	2.3 ± 1.12	0.86
2	Course of collagen fibres	DPP-20% MTLP-65% MTLI-15%	DPP-15% MTLP-65% MTLI-20	0.87	DPP-20% MTLP-60% MTLI-20%	DPP-15% MTLP-70% MTLI-15%	0.73
3	No. of connective tissue	None-55% Few-45%	None-70% Few-30%	0.71	None-60% Few-40%	None-70% Few-30%	0.83
4	No. of blood vessel	1-5% 2-10% 3-45% 4-30% 5-10%	2-15% 3-40% 4-45%	0.61	2-20% 3-65% 4-15%	1-5% 2-15% 3-35% 4-35% 5-10%	0.71
5.	Surface area of blood vessel (μm2)^	4045 (3209, 5034)	3983 (3862, 4793)	0.83	3764 (2933, 4562)	3900 (3273, 4302)	0.72
6.	No. of elastic fibres by H & E stain	None-70% Few-30%	None-70% Few-30%	0.77	None-70% Few-30%	None-75% Few-25%	0.88
7.	Number of elastic fibres by VVG stain^	2(0,8)	2(1,8)	0.86	1(0,7)	2(0,7)	0.90
8.	Number of elastic fibre nuclei by VVG stain^	2(0,8)	2(0,8)	0.93	2(0,8)	2(0,8)	0.92
9.	Number of collagen fibre by VVG stain*	3.1 ± 1.35	2.5 ± 1.02	0.77	2.15 ± 0.72	2.3 ± 1.12	0.88

MTLI- Mixed tight and loose interlacing, DPP- Densely packed parallel, MTLP- Mixed tight and loose parallel, H & E- Haematoxylin eosin stain, VVG- Verhoff Van Gieson stain, *- Mean± SD, ^ Median (Interquartile range)

Table 4: Histomorphological details of proximal part of volar and dorsal radio-ulnar ligaments (n=40)

S. No.	Histological parameter	Volar Right	Volar Left	p value	Dorsal Right	Dorsal Left	p value
1	No. of collagen fibres	15,41 ± 3.92	15.7 ± 3.71	0.81	15.85 ± 3.91	15.1 ± 4.61	0.88
2	Course of collagen fibres	DPI-45% DPP-40% MTLP-10% MTLI-5%	DPI-40% DPP-55% MTLP-5%	0.74	DPI-45% DPP-45% MTLP-10%	DPI-55% DPP-15%	0.54
3	No. of connective tissue	None-55% Few-45%	None-65% Few-35%	0.71	None-35% Few-65%	None-40% Few-60%	0.82
4	No. of blood vessel	0-15% 1-30% 2-35% 3-20%	0-25% 1-30% 2-25% 3-20%	0.78	0-10% 1-10% 2-55% 3-25%	0-10% 1-30% 2-50% 3-10%	0.61
5.	Surface area of blood vessel (μm2)^	1871 (1468, 3498)	1896 (1346, 2908)	0.91	3390 (1563, 3897)	2871 (1461, 3902)	0.72
6.	No. of elastic fibres by H & E stain	None-60% Few-40%	None-50% Few-50%	0.44	None-45% Few-55%	None-30% Few-70%	0.38
7.	Number of elastic fibres by VVG stain^	9(2,11)	8(2,9)	0.78	9(1,12)	8(2,12)	0.85
8.	Number of elastic fibre nuclei by VVG stain^	10(2,12)	8(2,10)	0.69	9(1,12)	8(2,10)	0.72
9.	Number of collagen fibre by VVG stain*	15.75 ± 3.92	15.4 ± 3.72	0.91	15.78 ± 4.08	15.42 ± 4.13	0.89

DPI- Densely packed interlacing, MTLI- Mixed tight and loose interlacing, DPP- Densely packed parallel, MTLP- Mixed tight and loose parallel, H & E- Haematoxylin eosin stain, VVG- Verhoff Van Gieson stain, *- Mean± SD, ^ Median (Interquartile range) to the ligaments by restoring the fibre length in response to tensile forces. This taut structural arrangement of the epi-ligaments is responsible for the stability of DRUJ and signify the role played by these ligaments during pronation and supination.[18]

4.3. Ulno lunate ligament (UL)

The nature of collagen fibres were observed to be mostly of mixed tight and loose parallelly arranged fibres which corresponded to the observation.[5,18] This ligament had very less vascularity, connective tissue and elastic fibres or falls in the category none as proposed.[5,16] This morphology infers that the ligament has less elasticity and greater resistance to tensile loads during various wrist positions making ulno lunate ligament an essential stabiliser of the wrist joint in mechanical function.[20]

4.4. Ulno -triqueteral ligament(UTL)

The alignment of the collagen fibres were mostly of mixed tight and loose parallel fibres as observed.[5] The vascularity was comparatively more than the ulno lunate ligament and the fascicular and epifascicular regions both showed higher vascularity as studied.[5] The amount of connective tissue and elastic fibres were none to very less in accordance with the observations.[5] This mixed arrangement of fibres allow them to show more adaptability of this ligament to different wrist motions implying less resistance to tensile forces.[18]

4.5. Ulnocarpal-meniscoid (UCM)

Both mixed tight and loose interlaced as well as parallel collagen fibre bundles were seen in which mixed tightly and loosely packed parallel fibres predominated,[5,16] also noted similar arrangement of collagen fibres in their study. There was rich vascularity and connective tissue fibres observed in between the densely packed collagen bundles with fewer to more elastic fibres in correspondence with results of Palmer et al.[11] This morphological composition implies this structure acts as an ulnar buffer for other components of TFCC and had no role in wrist stability. The rich vascularity point towards the good healing ability of the structure.[18]

4.6. Subsheath of extensor carpi ulnaris tendon (SS-ECU)

There was a combination of array of densely packed parallel and mixed tight and loose interlaced and parallel collagen fibres in this component. Mixed tight and loose parallel collagen fibres were prominent. The study by Semisch et al. had similar findings. Blood vessels were predominant at the insertion sites.[5] There were none to very few connective tissue and elastic fibres observed in our study. This less elasticity reflects the mechanical function of this subsheath during carpal motion and rotation of forearm.[17] This subsheath prevents the tendon from subluxation and dislocation of the ulnar head during various wrist movements.[13,21] This study had limitations like assigning the types of structure to different areas of the components was sometimes difficult. Sometimes few areas showed structural variations of one type and features of another type.

4.7. Clinical consequences

Knowledge regarding the histomorphometry and microscopic composition of TFCC shall be highly yielding for the arthroscopic surgeons while planning for surgeries involving wrist joint. Consequently, diminished rates of structural injury and better reconstruction of wrist joint are expected to be achieved. It is also useful for radiologists while interpreting scans of patients presenting with chronic wrist pain. It also helps in designing novel treatments for chronic wrist pain and precise points for focal electro thermal collagen shrinkage procedures.

5. Conclusion

The articular disc consisted of densely packed fibrocartilage with avascularity except in its ulnar region. Densely packed parallel or interlaced collagen fibres were seen in dorsal and volar radioulnar ligaments. The ulno lunate, ulno triqueteral, subsheath of extensor carpi ulnaris tendon showed predominantly mixed tight and loose parallel collagen array. The microscopic composition of the articular disc and ulnocarpal meniscoid implies a buffering function. The tight structure and very few elastic fibres of radioulnar and ulno lunate ligaments displays a central stabilizing role. The rich vascularity of the ulnocarpal meniscoid indicates good healing potential of the structure. The subsheath of extensor carpi ulnaris tendon prevents subluxation and dislocation of ulnar head during mechanical functions. The anatomy of TFCC haven't been extensively studied in Indian population. There is no data regarding the micro-composition and vascular pattern of distribution. Hence, the study has been formulated and the outcomes of the study would serve as the much-needed data while planning arthroscopic procedures and relevant radiological observations.

6. Authors Contribution

NR collected the data, reviewed the literature and drafted the manuscript. NR performed the data analysis. DKV conceptualised the study and critically revised the manuscript. All authors contributed to review of literature, drafting of the manuscript and approved the final version of the manuscript. DKV shall act as guarantor of the paper.

7. Funding Information

The study was funded by the intramural grant sanctioned by the Institution, JIPMER, Puducherry.

8. Conflict of Interest

The authors declare no conflict of interests

8.1. Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgements

None.

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Cite this article: Rajaram N, Kumar VD. Assessing the histomorphology, and microscopic composition of the triangular fibrocartilage complex [TFCC] of the wrist joint: A cadaveric observational study. *Indian J Clin Anat Physiol* 2023;10(4):236-243.