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# Prevalence of Triangular Fibrocartilage Complex Abnormalities among Asymptomatic Young Individuals Using Magnetic Resonance Imaging in A Tertiary Center in Saudi Arabia: A Cross-Sectional Study

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## Abstract

This study aims to detect and evaluate abnormalities and injuries of triangular fibrocartilage complex (TFCC) using 3.0 T high-resolution MRI. It also determines its efficacy among young asymptomatic individuals. This is a cross sectional exploratory study with a sample size of 30 (21 women and 9 men). None of the volunteers showed signs for previous wrist injuries. Details of TFCC morphology were determined using MRI images for dominant wrist. Analysis of locations for tear or degeneration or any characteristics was also performed. An incomplete or partial tear was presented by 5 volunteers (all women) whereas degeneration or complete tear was absent. Besides, 25 volunteers showed an intact ligament including all men. Prevalence of incidental TFCC is found to be less insignificant. The fact that participants showed less prevalence of asymptomatic abnormalities can be related to their young age. Close correlation of the findings with physical examination and history of individuals is required.

**Level of Evidence:** Diagnostic, Level III.

**Keywords:** TFCC; Triangular fibrocartilage complex; MRI; Hand injury; Diagnostic

## Introduction

In the whole body, wrist joint shows the most complex articulation. For simplicity, its anatomy has been divided into three portions including the midcarpal joint, the radiocarpal joint, and the radioulnar joint (DRUJ) [1]. The key anatomic structure in wrist is the triangular fibrocartilage complex (TFCC) that functions to stabilize DRUJ and regulates load transmission from the ulnar side of wrist. TFCC functions to seal off DRUJ from the radiocarpal joint [2]. Ligaments including radioulnar (RUL's) and ulnocarpal (UCL's) and the triangular fibrocartilage discus (TFC) contribute to form the triangular fibrocartilage complex (TFCC) lesions. It functions as a stabilizer and load-bearing structure in the wrist, making it vulnerable to bear injuries and rapid degeneration [3]. TFCC lesions are common among the general population.

Injury to the components of the TFCC complex may cause ulnar-sided wrist instability, pain, and clicking, which may lead to disability [4]. Diagnosis of TFCC essentially requires history examination of patients followed with physical examination, and screening and imaging through radiography. The TFCC constructively appear thicker at the central side seemingly interposed between the medial aspect of lunate bone and the ulnar head. It is only a few millimeters and show inverse proportionality with the ulnar variance [5]. This close-fitted structure and tight anatomical position requires high-resolution imaging to detect TFCC injuries. Though, arthroscopy which traditionally is applied for soft issue injuries screening still forms a gold standard, it is not feasible every time because of its invasiveness [6].

Hand and wrist joints are particularly more vulnerable to undergo injuries. According to Swenson et al. [7], 3 to 9% of all the injuries occurring among sport individuals appear to be in hand and wrist. Additionally, a survey among high school athletes revealed hand and wrist fractures as the most common ones constituting about 40% of all the fractures [7,8]. Instability in the DRUJ is analyzed as a mechanical symptom in both the degenerative and acute TFCC tears to initiate management processes. Primarily, the conservative treatments are applied for asymptomatic individuals. MRI is applied when there is persistence of pain which prevents athletes from their performance. Due to the fact that MRI show higher sensitivity towards detection of TFCC abnormalities and lesions, the MRI arthrogram has been found

 

to be specifically significant for precisely detecting the clinically relevant TFCC tears through the overflow of contrasting leakage directed from the ulnocarpal joint into the DRUJ [9]. Using radiography for evaluating purely soft tissue TFCC injury may not possible lead to demonstrate pathognomonic abnormalities, but rather may result in demonstrating secondary findings such as fracture in the ulnar styloid or positive ulnar variance. Though, it assists physicians in making diagnosis, evaluation of the joint done through MRI, either with or without arthrography, show greater sensitivity for detecting TFCC pathologies [3]. Studies have suggested it as critically important for practitioners to show greater awareness towards use of physical examination and false positives for corroborating the diagnostic imaging [10,11]. Iordache et al. [6] conducted a similar study to investigate abnormal MRI findings and their prevalence for TFCC lesions among asymptomatic individuals through conducting MRI. The MRI scans showed higher prevalence for the incidental TFCC findings among asymptomatic individuals. Prevalence of abnormal TFCC for MRI carry substantial clinical significance in particular when they appear to be common among asymptomatic individuals. Moreover, prevalence of TFCC lesions was found to be more common among asymptomatic individuals aged 50 and above. Previous studies have shown a positive correlation between age and TFCC abnormalities [12,13]. Likewise, a number of studies have linked TFCC injuries as common among athletes and people engaged with handy jobs [14].

The fact that prevalence of degenerative tears is related to age and that older asymptomatic patients are more susceptible to reflect TFCC on examination with MRI has also been affirmed by Potter et al. [15]. Increase in age imparts several complexities and attritional changes specifically within the avascular part of the disc. Though, age alone cannot be held necessarily responsible for imparting a predictive value with regards to localization of tears, sustainment of traumatic peripheral avulsion is present among older patients. However, the findings differ in the aspect that complex tears are sustainable when there is a superimposition of traumatic avulsion on a central attritional defect. Nevertheless, there has been no significant difference detected in age when viewed by dividing tears in accordance with the different locations including central, peripheral, and complex [15].

Descriptions for arthroscopy used for distal radioulnar joint (DRUJ) was first provided by Whipple et al., but the procedure has not gained wide acceptance because of the smaller size of the joint. It is said that degenerative changes in TFCC mainly initiates from the proximal aspect whereby the deep fiber functions as the main stabilizer for DRUJ in the distal radioulnar ligamentous structure. According to Yamamoto et al., both of these structures cannot be screened thoroughly with the help of arthroscopy whether for radiocarpal joint (RCJ) or midcarpal joint (MCJ). It has been reported that pathological findings for TFCC, in particular for the proximal surface, remain the major cause of generating TFCC symptoms.

Magnetic resonance imaging (MRI) is considered to be a valuable technique for diagnosis and treatment of abnormalities in the minute musculoskeletal structures in human body, including TFCC of the wrist. Results from multiple studies have supported the accuracy of MRI in diagnosing TFCC. In a study by Magee, the sensitivity and specificity of MRI for detection of TFCC tears was found to be 86% and 100%, respectively [16]. Iordache et al. investigated incidental TFCC abnormalities using 1.9 T magnetic resonance (MR) scanners in 103 asymptomatic volunteers [6]. Abnormalities were found to be dominant in 39 wrists which were considered as a high prevalence. A tear was present in 26 wrists whereas the other 13 were considered abnormal but with no tear was identified. The study also reported a correlation between age and abnormal TFCC (point-biserial correlation coefficient (rpb)=0.23; P=0.016). Previous studies have reported high prevalence (approximately 50%) of TFCC abnormalities among young asymptomatic volunteers using MRI [17,18]. With reference to literature findings, prevalence of TFCC abnormalities among young asymptomatic individuals remains unclear or somewhat limited. No clear results can. Moreover, literature also reflects for the dearth of findings regarding accuracy of MRI for detecting incidental TFCC injuries among young individuals. The present study therefore aims to examine the diagnostic value of using 3.0 T MRI for detecting TFCC abnormalities among young asymptomatic volunteers.

## Materials and Methods

### Study participants

Around, 30 volunteers were selected amongst which 9 were men and 21 were women. All the volunteers selected were the members of medical and clerical staff in hospital. All of the volunteers selected showed no symptoms of TFCC or wrist pain. It was aimed to analyze as how much prevalent TFCC can be among asymptomatic young individuals and subsequent efficacy of MRI in detecting it. All of the volunteers selected were applied with MRI for dominant wrist. All the previous symptoms or injuries for their dominant wrists were excluded during screening.

### Ethical approval

Institutional ethical approval was obtained for the study. Participants were well-demonstrated regarding the purpose and anticipated outcomes of the study. A written informed consent was obtained from all volunteers before participation after full explanation of the study procedures, both verbally and in writing. The volunteers had to specify their dominant hand for the screening.

### MRI scanning

All scans were performed in the Radiology Department using 3.0 T MRI scanner (Siemens Magnetom Verio 3T MRI System, Siemens, and Munich, Germany). For taking MRI images, participants were guided to stand lay down in a prone

position keeping their wrist in plane while securely maintaining it immobile in custom wrist coil. Time rendered for examination of each wrist for about 30 minutes. Images were saved in the database archive system and were thereafter retrieved from there to be reviewed by a specialized radiologist with expertise in musculoskeletal imaging and also by a hand surgeon.

## Statistical analysis

In order to retrieve results, simple descriptive statistics was applied. Results were achieved as counts and percentages for categorical and nominal variables whereas mean and standard deviations were calculated for the continuous variables. Contrastingly, the categorical variables were compared using the Chi-square test. An independent t-test was applied for comparing the group means for normally distributed data. Welch's test however was applied conditionally if there was no normality assumed. Pearson's correlation coefficient was used to correlate variables' means. Lastly, a conventional P-value<0.05 was the criterion used for rejecting the null hypothesis (**Table 1**).

**Table 1** Characteristics of the 30 study samples.

| Variables | N | Min | Max | Mean | SD |
|---|---|---|---|---|---|
| Age | 29 | 12 | 25 | 22.52 | 2.3 |
| Thickness | 28 | 1.30 | 3.30 | 2.15 | 0.4 |
| | | Count | | % | |
| Total | | 30 | | 100.0 | |
| Gender | Male | 9 | | 27.6 | |
| | Female | 21 | 72.4 | | |
| Result | Positive | 5 | | 16.7 | |
| | Negative | 25 | 83.3 | | |
| Note: Demonstrates the characteristics of 30 participants for the study. | | | | | |

# Results

Thirty young volunteers were recruited, 21 (72.4%) women, and 9 (27.6%) men (P=0.171). The mean age of the participants was 22.52 (SD 2.3) years (range: 20–25 years, P=0.212).

**Table 2** Demonstrates the achieved statistical values.

| Variables | Total | Result | | p-value |
|---|---|---|---|---|
| | | Positive | Negative | |
| Age | 22.52 ± 2.3 | 24.00 ± 1.0 | 22.21 ± 2.4 | 0.121 |
| Total | 30 | 5 (16.7%) | 25 (83.3%) | N/A |
| Gender | Male | 9 | 0 (0.0%) | 9 (100.0%) | 0.171 |
| | Female | 21 | 5 (23.8%) | 16 (76.2%) | |
| Hand | Left | 30 | 5 (16.7%) | 25 (83.3%) | N/A |
| a-No statistics are computed because the variable is constant. | | | | | |

| Variable | Total | Gender | | p-value | |
|---|---|---|---|---|---|
| | | Male | Female | | |
| Thickness | 2.16 ± 0.5 | 2.44 ± 0.5 | 2.04 ± 0.4 | 0.035a | |
| a-Significant using Independent t-test @<0.05 level. | | | | | |

**Table 3** Demonstrates the correlation values.

| Correlations | | Age |
|---|---|---|
| Thickness | r | 0.024 |
| | p-value | 0.906 |
| | N | 27 |
| If r =+0.70 or higher: Very strong positive relationship<br>+0.40 to +0.69: Strong positive relationship<br>+0.30 to +0.39: Moderate positive relationship | | |

+0.20 to +0.29: Weak positive relationship
+0.01 to +0.19: No or negligible relationship
-0.01 to -0.19: No or negligible relationship
-0.20 to -0.29: Weak negative relationship
-0.30 to -0.39: Moderate negative relationship
-0.40 to -0.69: Strong negative relationship
-0.70 or higher: Very strong negative relationship

Abnormal TFCC was found in 5 wrists among participants under 30 year's age. A perforation of the articular disc at the radial side was found in 4 wrists, and a partial tear of the TFCC in 1 wrist. Mean TFCC thickness was 2.16 (SD 0.5 mm) (mean thickness in women was 2.44 (SD 0.5 mm) and in men was 2.04 (SD 0.4 mm, P=0.035). All men (n=8) showed no abnormality in the TFCC, whereas for women; 5 out of 21 (23.8%) showed TFCC injury and 16 (76.2%) showed no abnormality (P=0.171, for the comparison between men and women). TFCC thickness and age showed no/negligible correlation (r=0.024, P=0.906) (r value of +0.01 to +0.19 was considered to denote no or negligible correlation) (**Tables 2 and 3**). TFCC ligament thickness was measured in 28 participants. Mean thickness was 2.15 (SD 0.4 mm) (range: 1.30–3.30 mm) (**Figures 1 and 2**).


**Figure 1** Demonstrates an MRI image for TFCC ligament (F).

## Discussion

Arthroscopy, which is considered as the gold standard procedure to diagnose TFCC abnormalities, is an invasive procedure [19]. Using radiography for evaluating purely soft tissue TFCC injury may also not possible lead to demonstrate pathognomonic abnormalities, but rather may result in demonstrating secondary findings such as fracture in the ulnar styloid or positive ulnar variance. Though, it assists physicians in making diagnosis, evaluation of the joint done through MRI, either with or without arthrography, show greater sensitivity for detecting TFCC pathologies [3]. Studies have suggested it as critically important for practitioners to show greater awareness towards use of physical examination and false positives for corroborating the diagnostic imaging [10,11].

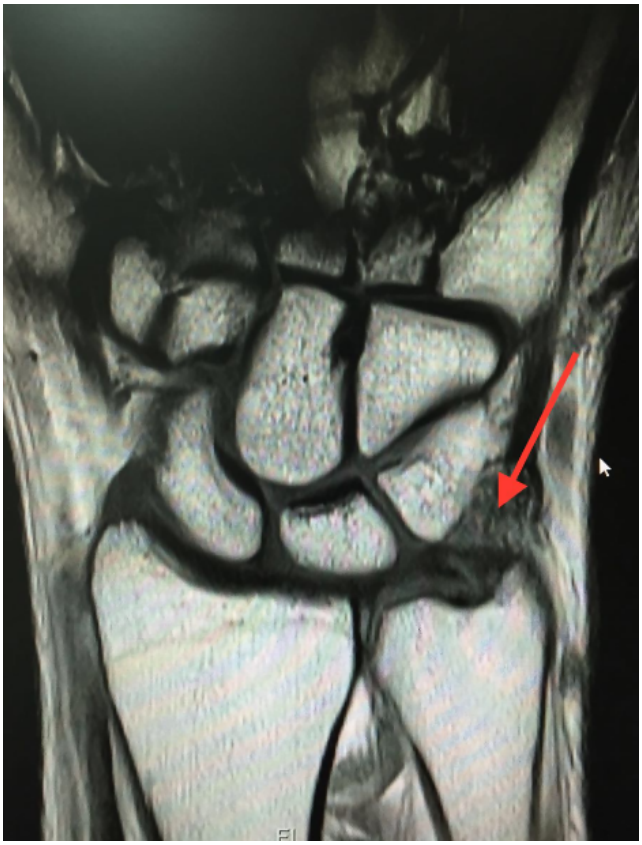

**Figure 2** Demonstrates an MRI image for TFCC ligament (FL).

Previous studies demonstrate a difference in the accuracy of MRI in diagnosing these injuries [9]. Multiple factors can play a major role in MRI accuracy in detecting TFCC lesions; the magnetic field strength is one of these factors as it was shown by Anderson et al. who suggested that imaging with 3.0 T offers higher quality at a given spatial resolution [10]. Special coils were used while scanning and the area under investigation also have their reflection on the accuracy of imaging [15,20]. Moreover, Haims et al. reported that MRI was not accurate in detecting TFCC abnormalities, especially

peripheral tears (avascular area), and that the experience of the radiologist interpreting the MRI findings has a significant influence on the ability to detect and localize TFCC abnormalities [20].

It is apparent from the results that prevalence of TFCC among asymptomatic individuals is correlated with age. Chan et al. has also showed that rate of TFCC abnormality increases among symptomatic individuals with age. These findings persuades that the occurrence of incidental fibrocartilage complex abnormalities commonly occur independent of the symptoms and probability of their prevalence increases with age. It is also not clear whether the interventions used for addressing triangular fibrocartilage complex variations are better as compared to the natural history because of varying surgical outcomes they provide [21-23].

The findings made by Potter et al. have underlined limitations of MRI for distinguishing between the complete and partial fibrocartilage tears because among 90% of the participants the results remained unclear [15]. Probability of misinterpretations is present in TFCC examination through MRI as full-thickness disruptions usually appear as partial disruptions in MRI images. Even though the limitations are present, the soft tissue contrast that MRI offers is of superior quality and enables visualization of TFCC morphology meanwhile also allowing differentiation between the degenerative infra-substance tears that corresponds to increase in signal intensity in the articular disc region and traumatic detachments present at discrete areas in the periphery.

Kato et al. showed contradictory results wherein a comparison between the high resolution MRI and standard MRI for detection of TFCC was performed among 33 individuals. Even though, the high resolution MRI appeared to show higher sensitivity, the specificity it showed for assessing TFCC was significantly low. The study therefore concluded that diagnosis of TFCC tears by MRI (both standard and high resolution) remain unsatisfactory. However, it has also been reported that accuracy of the modality is undoubtedly higher for detecting TFCC lesions among asymptomatic individuals and further can be enhanced through incorporation of better technology options [6].

In conclusion, results in the given study simply showed less prevalence of TFCC abnormalities among healthy individuals as compared to other studies in the literature which can be explained by the young age of volunteers. These results can also be attributed to the fact that the study the study did not utilize any standard for determining the specificity and sensitivity for MRI as in other studies [15]. Finally, correlation of these results are required to be correlated with patient's history and physical examination. There are some limitations to this study, which include the small sample size. Studies including larger number of participants with a wider age range are needed to demonstrate the correlation between age and TFCC.

## References

1. Moser T, Dosch JC, Moussaoui A, Buy X, Gangi A, et al. (2008) Multidetector CT arthrography of the wrist joint: How to do it 1. Radiographics 28: 787-800.
2. Toms AP, Chojnowski A, Cahir JG (2011) Midcarpal instability: A radiological perspective. Skeletal Radiol 40: 533-541.
3. Blazar PE, Chan PS, Kneeland JB, Leatherwood D, Bozentka DJ, et al. (2001) The effect of observer experience on magnetic resonance imaging interpretation and localization of triangular fibrocartilage complex lesions. J Hand Surg Am 26: 742-748.
4. Fornalski S, Lee TQ, Gupta R (2000) Chronic instability of the distal radioulnar joint: a review. Univ Pa Orthop J 13: 1-9.
5. Cerezal L, de Dios Berná-Mestre J, Canga A, Llopis E, Rolon A, et al. (2012) MR and CT arthrography of the wrist. In Seminars in musculoskeletal radiology 16: 027-041.
6. Iordache SD, Rowan R, Garvin GJ, Osman S, Grewal R, et al. (2012) Prevalence of triangular fibrocartilage complex abnormalities on MRI scans of asymptomatic wrists. J Hand Surg Am 37: 98-103.
7. Swenson DM, Yard EE, Collins CL, Fields SK, Comstock RD (2010) Epidemiology of US high school sports-related fractures, 2005-2009. Clin J Sport Med 20: 293-299.
8. Tanaka T, Ogino S, Yoshioka H (2008) Ligamentous injuries of the wrist. In: Seminars in musculoskeletal radiology. Thieme Medical Publishers, stuttgart, Germany. pp. 359-377.
9. Fufa DT, Goldfarb CA (2013) Sports injuries of the wrist. Current Rev Musculoskeletal Med 6: 35-40.
10. Anderson ML, Skinner JA, Felmlee JP, Berger RA, Amrami KK (2008) Diagnostic comparison of 1.5 Tesla and 3.0 Tesla preoperative MRI of the wrist in patients with ulnar-sided wrist pain. J Hand Surg Am 33: 1153-9.
11. Sachar K (2012) Ulnar-sided wrist pain: evaluation and treatment of triangular fibrocartilage complex tears, ulnocarpal impaction syndrome, and lunotriquetral ligament tears. J Hand Surg 37: 1489-500.
12. Blatt G, Tobias B, Lichtman DM (1997) Scapholunate injuries. The Wrist and Its Disorders. Saunders, Philadelphia, USA.
13. DeHaven KE, Lintner DM (1986) Athletic injuries: comparison by age, sport, and gender. Am J Sports Med 14: 218-224.
14. Kirschenbaum D, Sieler S, Solonick D, Loeb DM, Cody RP (1995) Arthrography of the wrist. Assessment of the integrity of the ligaments in young asymptomatic adults. J Bone Joint Surg Am 77: 1207-1209.
15. Potter HG, Asnis-Ernberg L, Weiland AJ, Hotchkiss RN, Peterson MG, et al. (1997) The utility of high-resolution magnetic resonance imaging in the evaluation of the triangular fibrocartilage complex of the wrist. J Bone Joint Surg Am 79: 1675-84.
16. Magee T (2009) Comparison of 3-T MRI and arthroscopy of intrinsic wrist ligament and TFCC tears. Am J Roentgenol 192: 80-85.
17. Metz VM, Schratter M, Dock WI, Grabenwöger F, Kuzbari R, et al. (1992) Age-associated changes of the triangular fibrocartilage of the wrist: Evaluation of the diagnostic performance of MR imaging. Radiology 184: 217-220.

18. Sugimoto H, Shinozaki T, Ohsawa T (1994) Triangular fibrocartilage in asymptomatic subjects: Investigation of abnormal MR signal intensity. Radiology 191: 193-197.

19. Ruch DS, Poehling GG (2005) Wrist arthroscopy: Anatomy and diagnosis. Green's operative hand surgery (5th edn). New York, USA.

20. Haims AH, Schweitzer ME, Morrison WB, Deely D, Lange R, et al. (2002) Limitations of MR imaging in the diagnosis of peripheral tears of the triangular fibrocartilage of the wrist. Am J Roentgenol 178: 419-422.

21. Mikić ZD (1978) Age changes in the triangular fibrocartilage of the wrist joint. J Anatomy 126: 367-384.

22. Chan JJ, Teunis T, Ring D (2014) Prevalence of triangular fibrocartilage complex abnormalities regardless of symptoms rise with age: systematic review and pooled analysis. Clin Orthop Relat Res 472: 3987-3994.

23. Bottke CA, Louis DS, Braunstein EM (1989) Diagnosis and treatment of obscure ulnar-sided wrist pain. Orthopedics 12: 1075-1079.