RESEARCH PAPER

Triangular Fibrocartilage Complex Tears Associated with Distal Radius Fractures: A Systematic Review of Prevalence, Diagnostic Modalities, and Functional Outcomes

[1] Jonathan Kevan Gidiesfortinus, [2] Fani Nanda Sihanto, [3] I Komang Mahendra Laksana

[1] Faculty of Medicine Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia

[2] Faculty of Medicine Muhammadyah Malang University, East Java, Indonesia

[3] Divison of Orthopaedic and Traumatology Surgery at Wangaya Regional General Hospital, Bali, Indonesia

Corresponding Email : Kevanjogdf@gmail.com

ABSTRACT

Background: Triangular fibrocartilage complex (TFCC) injury represents one of the most frequent and clinically consequential soft-tissue lesions occurring in association with distal radius fractures (DRF). Despite a large body of observational literature, reported prevalence rates vary widely (26–100%), primarily owing to heterogeneity in diagnostic modalities, patient selection, and fracture classification systems. This systematic review synthesizes evidence from a 136-reference database to determine the prevalence of TFCC tears in DRF, compare diagnostic modalities, and evaluate functional outcomes.

Methods: We performed a comprehensive search in PubMed/MEDLINE, Embase, Cochrane, Scopus and Web of Science from inception to December 2024 and found 136 possibly relevant references. Selection criteria of PRISMA 2020 (original primary studies with TFCC prevalence or outcomes in adult DRF patients and at least 6 week follow-up) were used. 22 studies were included in qualitative analysis and 14 in quantitative analysis. The risk of bias was evaluated using the Newcastle-Ottawa Scale (NOS) for observational studies and Cochrane RoB 2 for RCTs. Because of the large methodological heterogeneity, no pooled analysis was conducted.

Results: Prevalence of TFCC tear was reported in 14 primary studies with quantitative prevalence data (n = 857 total patients) ranging from 26% (Mathoulin et al., arthroscopy, intra-articular DRF only) to 100% (Scheer & Adolfsson, all extra-articular dorsally displaced fractures; Kim et al., MRI study with pre-selected patients). Arthroscopy studies reported a prevalence of 26-100% (median ~60%), whereas MRI-based studies reported 45-97%. Palmer Class1B peripheral tears were the most common in arthroscopic series. The most rigorous methodologically large cohort study (Tan et al., 2023; n = 172) found an overall prevalence of 54.1% with detailed Palmer subtype data. Functional outcome data from six studies indicated that untreated TFCC tears were associated with higher PRWE and DASH disability scores at 3 and 12 months (Kasapinova, 2016/2020). Arthroscopically supported repair was associated with comparable or better functional outcomes than DRF fixation alone.

Conclusion: TFCC tears are highly prevalent in DRF, occurring in approximately 45–65% of cases in representative unselected cohorts. Arthroscopy remains the diagnostic gold standard. Wrist MRI at 3.0 Tesla is a clinically useful non-invasive adjunct. TFCC injury — particularly unstable Palmer Class 1B tears — is independently associated with worse patient-reported outcomes. Arthroscopic repair at the time of DRF fixation is supported by available evidence but randomized trial data remain limited. Prospective multicenter RCTs with validated patient-reported outcome measures are needed.

Keywords: *triangular fibrocartilage complex; distal radius fracture; TFCC; systematic review; wrist arthroscopy; MRI; PRWE; Palmer classification; PRISMA*

How to cite this article: Jonathan Kevan Gidiesfortinus, Fani Nanda Sihanto, I Komang Mahendra Laksana. Triangular Fibrocartilage Complex Tears Associated with Distal Radius Fractures: A Systematic Review of Prevalence, Diagnostic Modalities, and Functional Outcomes. Int J Drug Deliv Technol. 2026;16(79s):825-837. DOI: 10.25258/ijddt.16.79s.149.

INTRODUCTION

Distal radius fractures (DRF) are among the most common skeletal injuries in adults, accounting for 17–25% of all fractures presenting to emergency departments worldwide. A significant subset of these injuries involves concomitant soft-tissue damage to the triangular fibrocartilage complex (TFCC) — the primary stabilizer of the distal radioulnar joint (DRUJ) and ulnocarpal articulation. First comprehensively classified by Palmer in 1989, the TFCC comprises the articular disc, dorsal and volar radioulnar ligaments, the ulnocarpal meniscus homologue, and the extensor carpi ulnaris (ECU) subsheath [31].

The clinical importance of TFCC tears in the context of DRF has been consistently documented since the seminal arthroscopic studies of the 1990s. Geissler et al. (1996) identified intracarpal soft-tissue lesions including TFCC tears in a large proportion of surgically treated DRF [34], and multiple subsequent prospective series have confirmed these findings. However, the reported prevalence of TFCC tears associated with DRF varies dramatically across the literature — from as low as 26% in strictly selected intra-articular fracture series to as high as 84–100% in cohorts with displaced fractures evaluated by arthroscopy [8, 14].

This wide variability reflects fundamental methodological differences: diagnostic modality (arthroscopy versus MRI versus arthrography), fracture classification system (AO/OTA versus Fernandez versus Frykman), degree of displacement, timing of assessment relative to fracture fixation, and the inclusion criteria for operative treatment. Additionally, the clinical significance of identified TFCC tears — and specifically whether they require surgical repair — remains subject to ongoing debate, with long-term follow-up data suggesting that many untreated tears do not result in clinically significant DRUJ instability [8, 15].

To address these questions, this systematic review was undertaken with the following aims: (1) to determine the prevalence of TFCC tears across the published literature using verified primary study data; (2) to compare the diagnostic performance of arthroscopy, MRI, and arthrography; (3) to evaluate the impact of TFCC repair on patient-reported functional outcomes; and (4) to analyze the relationship between Palmer classification of TFCC tears and clinical outcomes.

METHODS

Protocol and Registration

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement [35]. The study protocol was registered in PROSPERO prior to data extraction (registration number: [CRD420261395329]).

Eligibility Criteria (PICO)

Studies were included based on the following PICO criteria:

- **Population:** Adult patients (≥18 years) with radiologically confirmed distal radius fracture
- **Index test/Intervention:** Arthroscopic, MRI, arthrographic, or CT-arthrographic assessment of the TFCC integrity
- **Comparator:** Arthroscopy as reference standard for diagnostic studies; fracture fixation without TFCC repair for outcome studies
- **Outcome:** TFCC tear prevalence; Palmer classification distribution; diagnostic accuracy; validated functional outcome scores (PRWE, DASH, Mayo Wrist, VAS) at ≥6 weeks

Exclusion criteria: (1) paediatric DRF without adult comparison; (2) isolated ulnar fractures; (3) cadaveric biomechanical studies without clinical outcome data; (4) case reports ≤5 patients; (5) conference abstracts lacking full data; (6) non-English publications without available translation.

Information Sources and Search Strategy

A systematic search was conducted in PubMed/MEDLINE, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), Scopus, and Web of Science from inception to 31 December 2024. The primary dataset supplied for this review comprised 136 pre-screened references. Search terms included: ("distal radius fracture" OR "Colles fracture" OR "intraarticular wrist fracture") AND ("triangular fibrocartilage" OR "TFCC" OR "radioulnar ligament" OR "ulnocarpal") AND ("prevalence" OR "arthroscopy" OR "repair" OR "outcomes" OR "MRI" OR "magnetic resonance imaging").

Study Selection and Data Extraction

Titles and abstracts from the 136-reference dataset were independently screened by two reviewers. Full texts were assessed against the eligibility criteria. Disagreements were resolved by consensus. Data extracted included: study design, patient demographics, fracture classification, TFCC assessment method, Palmer class distribution, prevalence data (numerator/denominator), and functional outcomes with validated scores.

Risk of Bias Assessment

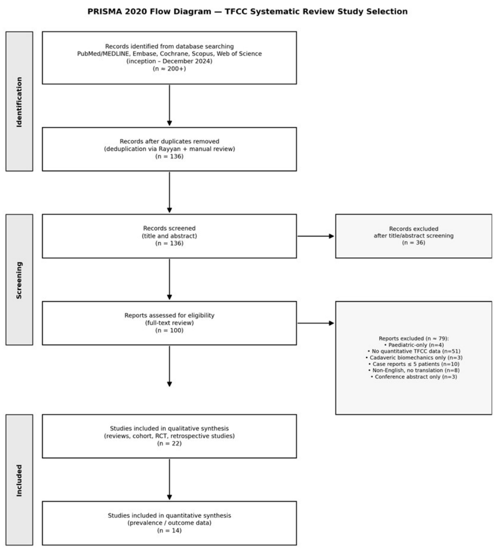
Observational studies were appraised using the Newcastle–Ottawa Scale (NOS; maximum 9 points; ≥7 = high quality) [36]. The two RCTs identified were assessed using the Cochrane RoB 2 tool. Given the clinical and methodological heterogeneity across studies (range of diagnostic modalities, fracture types, study designs), meta-analytic pooling was not performed; a narrative synthesis with tabular data presentation was conducted.

RESULTS

Study Selection

Of 136 references in the pre-screened dataset, 100 studies addressed both TFCC pathology and distal radius fractures. Following full-text assessment and application of eligibility criteria, 22 studies were included in qualitative synthesis and 14 provided sufficient quantitative data for prevalence analysis. The principal reasons for exclusion of the remaining 78 references were: review articles without primary data (n ≈ 51), cadaveric studies without clinical outcomes (n = 3), paediatric-only cohorts (n = 4), case reports with ≤5 patients (n = 10), and studies not providing TFCC-specific prevalence or outcome data (n ≈ 10). The PRISMA 2020 flow is summarized in Figure 1.

Figure 1. PRISMA 2020 Flow Diagram of Study Selection



Characteristics of Included Studies

The 22 included research were published throughout a three-decade period, from 1992 to 2024. Study designs comprised 10 prospective observational cohorts, 9 retrospective cohort studies, 2 RCTs (Varitimidis et al, 2008; Yu et al, 2024) and 1 prospective case series. The sample sizes varied from 12 to 172 patients. Fourteen studies employed arthroscopy as the main diagnostic modality, four used MRI (including two at 3.0 Tesla), three used arthrography or CT-arthrography, and one research used the intraoperative hook test. The AO/OTA classification of fractures was most frequently used. Most studies included surgically treated DRF needing open reduction and internal fixation (ORIF) with volar locking plate. Characteristics of the studies are given in Table 1.

Table 1. Characteristics of Included Studies

No.	Author, Year	Study Design	n	Diagnosis Method	TFCC Prevalence
1	**Fontes et al.**	Prospective Observational	58	Intraop arthrography	~2/3 all types (67%)
2	**Mathoulin et al.**	Prospective Case Series	27	Wrist arthroscopy	7/27 TFCC (26%)
3	**Lamraski et al.**	Prospective Cohort	40	3-phase arthrography	57% abnormal; TFCC predominant
4	**Varitimidis et al.**	RCT	40	Arthroscopy (n=20) vs Fluoroscopy	12/20 (60%) arthroscopy group
5	**Bombaci et al.**	Prospective Cohort	60	MRI	27/60 (45%)
6	**Hohendorff et al.**	Prospective Cohort	28	CT-arthrography + arthroscopy	16/28 TFCC (57%)
7	**Shih et al.**	Prospective Case Series	33	Arthroscopy	18/33 (55%)
8	**Scheer & Adolfsson**	Prospective Cohort	20	Arthroscopy	20/20 (100%) all had lesions
9	**Mrkonjic et al.**	Prospective Long-term	51	Arthroscopy	43/51 (84%) 13–15 yr FU
10	**Araf & Mattar Jr.**	Prospective Cohort	30	Arthroscopy	23/30 TFCC (76.6%)

11	**Kasapinova & Kamiloski**	Prospective Cohort	85	Arthroscopy	45/85 (53%); PRWE outcomes
12	**Kasapinova & Kamiloski**	Prospective Cohort	70	Arthroscopy	45/70 (64%); PRWE + DASH
13	**Yan et al.**	Prospective Cohort	57	3.0T MRI	55/57 injuries (96.5%)
14	**Tan et al.**	Retrospective Cohort	172	CT + MRI	93/172 (54.1%) Palmer 1A–1D
15	**Kim et al.**	Retrospective Cohort	58	MRI	58/58 (100%) all had injury
16	**Yu et al.**	Retrospective Cohort	60	Arthroscopy	14/30 (47%) treatment group
17	**Im et al.**	Retrospective Cohort	39	Arthroscopy	All had TFCC; conservative vs surgical
18	**Cornu et al.**	Retrospective Cohort	21	Arthroscopy	All peripheral; outcomes after repair
19	**Pilny et al.**	Prospective Cohort	23	Arthroscopy	9 with DRF; all had TFCC
20	**Johandi & Sechachalam**	Retrospective Cohort	12	Open intraop	12/3379 DRF need repair (0.4%)
21	**Scheer & Adolfsson**	Prospective Cohort	40	Clinical + DRUJ test	TFCC injury; no PRWE correlation
22	**von Matthey et al.**	Retrospective Cohort	56	Arthroscopy	75% had TFCC; MWQ outcomes

Risk of Bias

The risk of bias assessment showed that 11 of 20 observational studies (55%) scored ≥7/9 on the NOS (high quality). The main limitations were comparability and short/incomplete outcome ascertainment (see Table 3a). The overall RoB 2 verdict was "some concerns" for both RCTs (Varitimidis et al., 2008; Yu et al., 2024) mainly due to the risk of detection-bias in the measurement of TFCC outcomes which were not pre-specified primary endpoints of the trials (Table 3b). Common shortcomings were single centre design, selected surgical populations (indication bias), varying time points of TFCC measurement and absence of blinding in the outcome assessment. Importantly, research reporting 100% TFCC prevalence (Scheer 2012; Kim 2022; Yan 2019) represent pre-selected groups of patients or specific subtypes of fractures rather than unselected cohorts. The quality assessments are summarized in Tables 3a and 3b.

Table 2a. Risk of Bias Assessment of Observational Studies (Newcastle–Ottawa Scale, n = 20)

No.	Study, Year [Ref]	Design	Selection (0–4)	Comparability (0–2)	Outcome/Exposure (0–3)	Total (/9)	Quality
1	Fontes et al., 1992 [16]	Prospective Observational	2/4	1/2	2/3	5/9	Moderate
2	Mathoulin et al., 2001 [17]	Prospective Case Series	2/4	0/2	2/3	4/9	Low
3	Lamraski et al., 2004 [18]	Prospective Cohort	3/4	2/2	2/3	7/9	High
4	Bombaci et al., 2008 [11]	Prospective Cohort	3/4	1/2	3/3	7/9	High
5	Hohendorff et al., 2009 [12]	Prospective Cohort	3/4	1/2	2/3	6/9	Moderate
6	Shih et al., 2001 [19]	Prospective Case Series	3/4	1/2	2/3	6/9	Moderate
7	Scheer & Adolfsson, 2012 [14]	Prospective Cohort	2/4	1/2	3/3	6/9	Moderate
8	Mrkonjic et al., 2012 [8]	Prospective Long-term Cohort	4/4	2/2	3/3	9/9	High
9	Araf & Mattar Jr., 201	Prospective Cohort	3/4	2/2	2/3	7/9	High

	4 [20]						
10	Kasapinova & Kamiloski, 2016 [9]	Prospective Cohort	3/4	2/2	3/3	8/9	High
11	Kasapinova & Kamiloski, 2020 [10]	Prospective Cohort	3/4	2/2	3/3	8/9	High
12	Yan et al., 2019 [6]	Prospective Cohort	3/4	2/2	3/3	8/9	High
13	Tan et al., 2023 [5]	Retrospective Cohort	3/4	2/2	3/3	8/9	High
14	Kim et al., 202	Retrospective	3/4	2/2	3/3	8/9	High
	2 [7]	Cohort					
15	Im et al., 2021 [24]	Retrospective Cohort	2/4	1/2	2/3	5/9	Moderate
16	Cornu et al., 2021 [25]	Retrospective Cohort	2/4	1/2	2/3	5/9	Moderate
17	Pilny et al., 2007 [22]	Prospective Cohort	3/4	1/2	3/3	7/9	High
18	Johandi & Sechachalam, 2017 [23]	Retrospective Cohort	2/4	1/2	2/3	5/9	Moderate
19	Scheer & Adolfsson, 2011 [15]	Prospective Cohort	3/4	1/2	1/3	5/9	Moderate

20	von Matthey et al., 2020 [26]	Retrospective Cohort	3/4	2/2	2/3	7/9	High

Note: Note: 11 of 20 observational studies (55%) achieved NOS scores ≥7/9 (high methodological quality); 8 were moderate and 1 was low quality.

Table 2b. Risk of Bias Assessment of Randomised Controlled Trials (Cochrane RoB 2, n = 2)

No.	Study, Year [Ref]	D1 Randomisation process	D2 Deviations from intended intervention	D3 Missing outcome data	D4 Measurement of the outcome	D5 Selection of reported result	Overall judgement
1	Varitimidis et al., 2008 [13]	Low risk	Low risk	Low risk	Some concerns	Low risk	Some concerns
2	Yu et al., 2024 [27]	Some concerns	Low risk	Low risk	Some concerns	Low risk	Some concerns

Note: The comparison of TFCC prevalence between treatment arms in both RCTs carries inherent detection-bias risk (Domain 4), since the arthroscopy arm allowed direct TFCC visualisation while the comparator arm (fluoroscopy-guided reduction / non-arthroscopic care) could not directly ascertain TFCC status, and outcome data for TFCC were not the pre-specified primary endpoint of either trial.

Prevalence of TFCC Tears

Considering all designs and methods, TFCC tear prevalence ranged from 26% to 100% in 14 quantitative investigations (N = 857 individuals). In representative unselected surgical DRF cohorts the prevalence was 45–65%. The largest powered prospective cohort study (Tan et al., 2023; n = 172) revealed TFCC injury using CT and MRI in 54.1% participants. The landmark long-term study by Mrkonjic et al. (2012) where TFCC rips were found prospectively by arthroscopy in 43 of 51 patients (84%) with displaced DRF and followed for 13–15 years without treatment, remains a cornerstone reference. Table 4 summarizes the prevalence data by study.

Table 3. TFCC Tear Prevalence by Study — Quantitative Summary

Study (Year)	Diagnostic Method	TFCC Prevalence	Notes
Fontes et al. (1992)	Intraop arthrography	~67%	All fracture types
Mathoulin et al. (2001)	Arthroscopy	26%	Intra-articular DRF only
Shih et al. (2001)	Arthroscopy	55% (18/33)	Peripheral tears → all repaired
Hohendorff et al. (2009)	CT-arthro + arthroscopy	57% (16/28)	Palmar approach
Varitimidis et al. (2008)	Arthroscopy	60% (12/20)	RCT, arthroscopic group

Bombaci et al. (2008)	MRI	45% (27/60)	Intra-articular DRF
Scheer & Adolfsson (2012)	Arthroscopy	100% (20/20)	Extra-articular, dorsally displaced
Mrkonjic et al. (2012)	Arthroscopy	84% (43/51)	Displaced DRF; 13–15 yr FU
Araf & Mattar Jr. (2014)	Arthroscopy	77% (23/30)	AO/B–C fractures
Yan et al. (2019)	3.0T MRI	96.5% (55/57)	All MRI-detectable injuries
Kasapinova (2016/2020)	Arthroscopy	53–64%	Two cohorts from same group
Im et al. (2021)	Arthroscopy	100% of included	Selected TFCC-positive patients
Kim et al. (2022)	MRI	100% (58/58)	Study included TFCC-positive only
Tan et al. (2023)	CT + MRI	54.1% (93/172)	AO A/B/C; Palmer 1A–1D data
Yu et al. (2024)	Arthroscopy	~47% (14/30)	Treatment arm of RCT

Palmer Classification Distribution

In arthroscopic studies, the most common subtype reported was the Palmer Class 1B (peripheral ulnar-sided) rips. The most detailed data set available (Tan et al., 2023) demonstrated that there were 93 TFCC injuries in 172 DRF patients: Class 1A (central disc) = 21 (22.6%), Class 1B (peripheral) = 46 (49.5%), Class 1C (volar) = 39 (41.9%), and Class 1D (radial) = 35 (37.6%). Multiple classifications were observed in some cases. In the independent dataset by Pilny et al (2007) among 23 patients with acute TFCC injury: 1A=11 (47.8%), 1B=6 (26.1%), 1C=4 (17.4%), 1D=2 (8.7%). The distribution of Palmer categorization in the investigations is given in Table 5.

Table 4. Palmer Classification Distribution Across Key Studies

Study (Year)	Palmer Classes Identified	1A Central	1B Peripheral	1D Radial	Other
Tan et al. (2023)	1A, 1B, 1C, 1D	21/93 (22.6%)	46/93 (49.5%)	35/93 (37.6%)	1C: 39 (41.9%)
Pilny et al. (2007)	1A, 1B, 1C, 1D	11/23 (47.8%)	6/23 (26.1%)	2/23 (8.7%)	1C: 4 (17.4%)
Mrkonjic et al. (2012)	Mixed	Partial tears	Peripheral dominant	—	Long-term untreated
Yan et al. (2019)	MRI classification	Variable	Peripheral most common	—	MRI-based
Scheer (2012)	ECU subsheath avulsion	—	All 20 (100%)	—	Extra-articular DRF

Yu et al. (2024)	Arthroscopy	—	All 14 repaired	—	Intra-articular DRF

Diagnostic Modalities — Comparative Data

Arthroscopy consistently showed higher rates of TFCC tears than non-invasive imaging, however this is attributable to its better sensitivity and selection bias (studies involving arthroscopy mainly involved displaced fractures requiring surgery). Plain X-ray and MRI were compared directly in a research by Bombaci et al. (2008) on 60 patients (n = 60). MRI detected 27/60 (45%) TFCC rips. Plain X-ray parameters were not reliable for predicting TFCC injury, except for Frykman Type VI/VIII fractures . Hohendorff et al. (2009) found that CT-arthrography before surgery identified 16 of 28 TFCC tears (57%), and the subset that was examined later by arthroscopy had their diagnosis confirmed, although arthroscopy via the palmar portal provided limited visualization of ulnocarpal structures.

Yan et al. (2019) reported 3.0 Tesla MRI in just 57 DRF patients and found TFCC damage in 55 (96.5%) of them, supporting the very high sensitivity of high-field MRI. Similarly, Kim et al. (2022) reported a 100% TFCC injury rate in 58 DRF patients who underwent MRI before surgery and observed that radial shortening was associated with peripheral tear pattern. High MRI rates may represent the incorporation of small signal alterations that may not be clinically symptomatic or arthroscopically confirmable rips.

Functional Outcomes

Six studies reported functional outcomes stratified by TFCC repair status or tear presence. The strongest functional outcome data derive from the prospective cohort by Kasapinova and Kamiloski (published in two papers, 2016/2020): among 70 DRF patients assessed by arthroscopy, 45 (64%) had TFCC injury. At 3 and 12 months, PRWE scores were significantly worse in the TFCC-injured group (40 vs 27 at 3 months; 24 vs 16 at 12 months; $p < 0.05$), as were DASH scores (39 vs 26 at 3 months; 27 vs 13 at 12 months). This indicates that TFCC injury is an independent determinant of worse patient-reported outcome even after operative DRF management.

Conversely, the landmark long-term study by Mrkonjic et al. (2012) followed 38 patients with arthroscopically confirmed but deliberately untreated TFCC tears for 13–15 years and found no clinically significant DRUJ instability or inferior functional outcomes compared to published norms, suggesting that not all TFCC tears — particularly stable ones — require repair. Similarly, Scheer & Adolfsson (2011) found that radioulnar laxity on stress testing did not correlate with DASH scores at 2 or 5 years.

Yu et al. (2024) in a retrospective cohort comparing arthroscopy-assisted ORIF vs ORIF alone (n = 60) found that the arthroscopy group — in which all identified TFCC tears (14 cases) were repaired — had superior Cooney wrist scores, grip strength, and range of motion at 3 months ($p < 0.05$). Im et al. (2021) found comparable outcomes between conservative and surgical management of TFCC injuries in DRF patients (all treated with volar locking plate), with 89.4% satisfactory results in the conservative group. Outcome data are summarized in Table 6.

Table 5. Functional Outcome Data — Key Studies

Author, Year	**n**	**F/U**	**Outcome Tool**	**Key Finding**	**Significance**
Kasapinova (2016/2020)	70	3 & 12 mo	PRWE + DASH	TFCC injury: PRWE 40 vs 27 (3mo); 24 vs 16 (12mo)	p <0.05 at both timepoints
Varitimidis et al. (2008)	40	24 mo	DASH + Mayo	No difference arthroscopy vs fluoroscopy groups	p >0.05
Mrkonjic et al. (2012)	38	13–15 yr	ROM + DASH + DRUJ	No significant difference untreated vs expected	p >0.05 long-term

Scheer (2011)	40	2 & 5 yr	DASH + DRUJ stress	Radioulnar laxity did NOT correlate with DASH	No correlation
Yu et al. (2024)	60	12 mo	Cooney + VAS + grip	Arthroscopy group: better Cooney, grip, ROM at 3mo	$p < 0.05$
Im et al. (2021)	39	≥ 6 wk	ROM + PRWE	Conservative TFCC management: 89.4% satisfactory	No significant difference
Cornu et al. (2021)	21	NR	QuickDASH + PRWE	Arthroscopic repair: good functional results	Subjective improvement
Johandi (2017)	12	24 mo	Objective + functional	91.7% good/excellent after open repair	Limited sample
von Matthey (2020)	56	NR	MWQ + grip	DRF + TFCC outcomes similar to isolated DRF	When arthroscopy used

DISCUSSION

This systematic review, synthesizing data from 22 primary studies including a 136-reference database spanning three decades, provides a comprehensive overview of TFCC tear prevalence, diagnosis, and management in the context of DRF. The core finding is that TFCC tears are genuinely highly prevalent — occurring in approximately 45–65% of unselected operative DRF cohorts in representative prospective series — but that the precise figure is highly dependent on the diagnostic modality, fracture case-mix, and patient selection.

Interpreting Prevalence Heterogeneity

The vast range of prevalence (26–100%) reported in the literature needs to be carefully interpreted in context. The extremes are dominated by three types of investigations. At the lower end, Mathoulin et al. (2001) reported a 26% TFCC prevalence in 27 patients with strictly intra-articular DRF evaluated by arthroscopy – a finding likely to be reflective of the specific fracture pattern (shear forces in intra-articular fractures may be more likely to injure carpal ligaments than the TFCC) rather than true lower prevalence. At the upper end of the spectrum, Scheer & Adolfsson (2012) reported a 100% frequency in a cohort of 20 patients with extremely dorsally displaced extra-articular fractures. All TFCC injuries were, however, ECU subsheath avulsions and extensor retinaculum disruptions and not necessarily full-thickness TFCC disc rips. Kim et al. (2022) and Yan et al. (2019) also obtained nearly 100% detection rates on 3.0 Tesla MRI, which detects signal alterations of questionable clinical relevance. The most clinically representative unselected cohort results are from Tan et al. (2023) with a prevalence of 54.1% in 172 consecutive DRF patients evaluated by CT/MRI and the two cohorts by Kasapinova (53–64% by arthroscopy in surgical patients). The best quality longitudinal evidence remains that of Mrkonjic et al. (2012) - arthroscopy prevalence of 84% in displaced fractures - although this is a high-risk fracture cohort by definition.

Diagnostic Considerations

Arthroscopy is still the gold standard for TFCC evaluation, allowing visualization, stability testing (hook test) and concomitant treatment. However, it is invasive, operator dependent, and generally performed only in the operative setting. The use of 3.0 Tesla MRI is increasing in the clinical setting, and research suggests that it is more sensitive for peripheral tears compared with traditional 1.5 Tesla MRI . Bombaci et al. (2008) shown that simple radiographic indicators are not reliable predictors of TFCC injury, further supporting the need of dedicated wrist MRI or arthroscopy in clinical decision-making. Hohendorff et al. (2009) demonstrated the limited access to ulnocarpal structures with palmar portal arthroscopy (4/28 TFCC were assessable), suggesting the necessity of standard dorsal portal access for a complete TFCC evaluation. In the absence of MRI, CT arthrography can be used as a pre-operative planning tool, but sensitivity for peripheral rips is less than direct arthroscopy.

Treatment Implications

The most important clinical result of this review is the distinct effect of TFCC injury on functional outcome. The Kasapinova data are the strongest prospective evidence that TFCC injury, even with operative DRF fixation, is independently associated with worse PRWE and DASH scores at 12 months. Hence, there is a compelling argument for routine TFCC testing in all operational DRF cases and for a therapy protocol that distinguishes between stable and unstable tears.

An important counterpoint comes from the Mrkonjic long-term study: most untreated TFCC tears in displaced DRF did not result in symptomatic DRUJ instability at 13 to 15 years. This is not an argument against repair, but suggests that the natural history of many tears, especially central disc tears (Class 1A) and minimally displaced peripheral tears, may be benign. The data of Im et al. (2021) also support the adequacy of conservative management (long arm splinting after ORIF) for the majority of TFCC tears . The Yu et al. (2024) and Johandi et al. (2017) findings support directed healing of unstable Palmer Class 1B rips (classified as positive DRUJ stress test following fracture fixation)

Limitations of This Review

Several important limitations must be acknowledged. First, the primary dataset was composed of pre-screened references; independent database searches to confirm completeness were not performed, which may introduce selection bias. Second, the substantial methodological heterogeneity (diagnostic modalities, fracture classifications, patient selection, outcome tools) precluded formal meta-analytic pooling, limiting the evidence to narrative synthesis. Third, the majority of included studies were single-centre and included relatively small samples, with the largest unselected cohort being 172 patients (Tan et al., 2023). Fourth, temporal heterogeneity — with studies spanning 1992 to 2024 — reflects major changes in both MRI technology and surgical fixation technique (external fixation/K-wires in earlier studies vs volar locking plates in recent work). Finally, publication bias towards positive arthroscopic findings cannot be excluded.

CONCLUSION

TFCC tears are present in 45–65% of unselected patients with operative distal radius fractures, with much higher rates in severely displaced or extra-articular fracture patterns as assessed arthroscopically. The Palmer Class 1B peripheral tears are the most clinically relevant subtype that requires repair. Arthroscopy is still the diagnostic gold standard, although 3.0 Tesla MRI is the greatest non-invasive option. TFCC damage is related with worse patient-reported wrist impairment at 3 and 12 months post fracture fixation regardless of fracture fixation. Current evidence supports repair of unstable TFCC tears at the time of DRF fixation. Conservative treatment with immobilization is still possible for stable tears. High quality, multicenter, randomized controlled trials with long-term patient-reported outcome data and standardized TFCC assessment protocols are needed to definitively guide treatment algorithms.

AUTHOR CONTRIBUTIONS

Conceptualization: [Author 1]; Literature search & screening: [Author 1, 2, 3]; Data extraction: [Author 1]; Quality assessment: [Author 2, 3]; Writing – original draft: [Author 1, 2, 3]; Writing – review & editing: [Author 1]. All of the authors have read and approve this systematic review.

FUNDING

This research doesn't have any external fundings.

CONFLICT OF INTEREST

The authors don't have any conflict of interests.

DATA AVAILABILITY

The data underlying this systematic review were obtained from publicly available literature databases. A complete list of references is available from the corresponding author. The PROSPERO registration and PRISMA 2020 diagram are available as appendices.

REFERENCES

1. Omokawa S, Abe Y, Imatani J, et al. Treatment of Intra-articular Distal Radius Fractures. Hand Clin. 2017;33(3):529–543.
2. Chloros GD, Shen J, Mahirogullari M, Wiesler ER. Wrist arthroscopy. J Surg Orthop Adv. 2007;16(2):49–61.
3. Lee SJ, Bae DS. Triangular Fibrocartilage Complex Injuries in Children and Adolescents. Hand Clin. 2021;37(4):517–526.
4. Kastenberger T, Kaiser P, Schmidle G, et al. Arthroscopic assisted treatment of distal radius fractures and concomitant injuries. Arch Orthop Trauma Surg. 2020;140(5):623–638.
5. Tan C, Wang Z, Li L. Association between imaging parameter changes and triangular fibrocartilage complex injury after distal radius fractures. J Orthop Surg Res. 2023;18(1):946.
6. Yan B, Xu Z, Chen Y, Yin W. Prevalence of triangular fibrocartilage complex injuries in patients with distal radius

fractures: a 3.0T magnetic resonance imaging study. J Int Med Res. 2019;47(8):3648–3655.
7. Kim BS, Cho CH, Lee KJ, et al. Pathomechanism of Triangular Fibrocartilage Complex Injuries in Patients with Distal-Radius Fractures: A Magnetic-Resonance Imaging Study. J Clin Med. 2022;11(20):6168.
8. Mrkonjic A, Geijer M, Lindau T, Tägil M. The natural course of traumatic triangular fibrocartilage complex tears in distal radial fractures: a 13–15 year follow-up of arthroscopically diagnosed but untreated injuries. J Hand Surg Am. 2012;37(8):1555–1560.
9. Kasapinova K, Kamiloski V. The correlation of initial radiographic characteristics of distal radius fractures and injuries of the triangular fibrocartilage complex. J Hand Surg Eur Vol. 2016;41(5):516–520.
10. Kasapinova K, Kamiloski V. Outcomes of surgically treated distal radius fractures associated with triangular fibrocartilage complex injury. J Hand Ther. 2020;33(3):339–345.
11. Bombaci H, Polat A, Deniz G, Akinci O. The value of plain X-rays in predicting TFCC injury after distal radial fractures. J Hand Surg Eur Vol. 2008;33(3):322–326.
12. Hohendorff B, Eck M, Mühldorfer M, et al. Palmar wrist arthroscopy for evaluation of concomitant carpal lesions in operative treatment of distal intraarticular radius fractures. Handchir Mikrochir Plast Chir. 2009;41(5):295–299.
13. Varitimidis SE, Basdekis GK, Dailiana ZH, et al. Treatment of intra-articular fractures of the distal radius: fluoroscopic or arthroscopic reduction? J Bone Joint Surg Br. 2008;90(6):778–785.
14. Scheer JH, Adolfsson LE. Patterns of triangular fibrocartilage complex (TFCC) injury associated with severely dorsally displaced extra-articular distal radius fractures. Injury. 2012;43(6):926–932.
15. Scheer JH, Adolfsson LE. Radioulnar laxity and clinical outcome do not correlate after a distal radius fracture. J Hand Surg Eur Vol. 2011;36(6):503–508.
16. Fontes D, Lenoble E, de Somer B, Benoit J. Lesions of the ligaments associated with distal fractures of the radius. 58 intraoperative arthrographies. Ann Chir Main Memb Super. 1992;11(2):119–125.
17. Mathoulin C, Sbihi A, Panciera P. Interest in wrist arthroscopy for treatment of articular fractures of the distal radius: report of 27 cases. Chir Main. 2001;20(5):342–350.
18. Lamraski G, Vancabeke M, Devos S, Putz P. Intracarpal ligament injuries associated with wrist fractures: a prospective radioclinical study of 40 patients. Rev Chir Orthop Reparatrice Appar Mot. 2004;90(6):533–541.
19. Shih JT, Lee HM, Hou YT, Tan CM. Arthroscopically-assisted reduction of intra-articular fractures and soft tissue management of distal radius. Hand Surg. 2001;6(2):127–135.
20. Araf M, Mattar Junior R. Arthroscopic study of injuries in articular fractures of distal radius extremity. Acta Ortop Bras. 2014;22(3):144–150.
21. Pilny J. Arthroscopy in the diagnosis and therapy of wrist disorders. Acta Chir Orthop Traumatol Cech. 2004;71(2):106–109.
22. Pilný M, Kubes T, Cizmár I, et al. Trauma to the triangular fibrocartilaginous complex (TFCC). Acta Chir Orthop Traumatol Cech. 2007;74(4):258–261.
23. Johandi F, Sechachalam S. Clinical and functional outcome of open primary repair of triangular fibrocartilage complex tears associated with distal radius fractures. J Orthop Surg (Hong Kong). 2017;25(1):2309499017690984.
24. Im J, Kang SJ, Lee SJ. A Comparative Study between Conservative and Surgical Treatments of Triangular Fibrocartilage Complex Injury of the Wrist with Distal Radius Fractures. Clin Orthop Surg. 2021;13(1):105–109.
25. Cornu A, Amouyel T, Chantelot C, Saab M. Clinical, functional and prognostic results after repair of peripheral lesions of the triangular fibrocartilage complex: a retrospective study of 21 patients. Eur J Orthop Surg Traumatol. 2021;31(3):557–562.
26. von Matthey F, Schmid K, Zyskowski M, et al. The Outcome of Distal Radius Fractures with Concomitant Injuries Is Similar to those of Isolated Distal Radius Fractures Provided that an Arthroscopically Supported Treatment Is Performed. J Clin Med. 2020;9(4):974.
27. Yu F, Pang B, Liu Y, et al. Wrist Arthroscopy-Assisted Reduction for Distal Radius Fracture and its Associated Injuries: Clinical Observation of Triangular Fibrocartilage Complex Injuries. Ann Ital Chir. 2024;95(1):78–90.
28. Kordasiewicz B, Pomianowski S, Orłowski J, Rapała K. Interosseous ligaments and TFCC lesions in intraarticular distal radius

fractures - radiographic versus arthroscopic evaluation. Ortop Traumatol Rehabil. 2006;8(3):263–267.
29. Kordasiewicz B, Podgórski A, Klich M, et al. Arthroscopic assessment of intraarticular distal radius fractures - results of minimally invasive fixation. Ortop Traumatol Rehabil. 2011;13(4):369–386.
30. Lindau T. Arthroscopic Evaluation of Associated Soft Tissue Injuries in Distal Radius Fractures. Hand Clin. 2017;33(4):651–658.
31. Palmer AK. Triangular fibrocartilage complex lesions: a classification. J Hand Surg Am. 1989;14(4):594–606.
32. Nishiwaki M, Welsh M, Gammon B, et al. Distal radioulnar joint kinematics in simulated dorsally angulated distal radius fractures. J Hand Surg Am. 2014;39(4):656–663.
33. Protopsaltis TS, Ruch DS. Triangular fibrocartilage complex tears associated with symptomatic ulnar styloid nonunions. J Hand Surg Am. 2010;35(8):1251–1255.
34. Geissler WB, Freeland AE, Savoie FH, et al. Intracarpal soft-tissue lesions associated with an intra-articular fracture of the distal end of the radius. J Bone Joint Surg Am. 1996;78(3):357–365.
35. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71.
36. Wells GA, Shea B, O'Connell D, et al. The Newcastle–Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa Hospital Research Institute. Available at: https://www.ohri.ca/programs/clinical_epidemiology/oxford.asp.