

Title

Perceptions and experiences of wrist surgeons on the management of Triangular Fibrocartilage Complex tears: a qualitative study.

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Informed consent

Participants were emailed a participant information sheet and consent form. Written consent was obtained before commencing the interview with the researcher.

1 **Abstract**

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3 There is lack of consensus on the management of triangular fibrocartilage injuries. The aim of this
4 study was to investigate wrist surgeons' experiences and perceptions regarding treatment of
5 triangular fibrocartilage complex injuries and to explore the rationale behind clinical decision-
6 making. A purposive sample of consultant wrist surgeons ($n=10$) was recruited through 'snow-
7 balling' until data saturation was reached. Semi-structured interviews were conducted, digitally
8 recorded and transcribed verbatim. Two researchers independently analysed data using an
9 iterative/thematic approach. Findings suggest that surgeons rely more on their own training and
10 experience, and patient-related factors such as individual expectations, rather than on published
11 material, to inform their decision-making. Current classification systems are largely considered to
12 be unhelpful.

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16 Level of evidence: V

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INTRODUCTION

30 The management of triangular fibrocartilage complex (TFCC) injuries is difficult. Published studies
31 are mostly low-level evidence, biased towards surgical intervention and with limited consensus of
32 opinion. Furthermore, it is not known whether operative intervention gives better results than the
33 natural course of the tear (Chan et al., 2014).

34 There are no longitudinal studies comparing the efficacy of the various non-surgical treatment
35 options (Barlow, 2016; Park et al., 2010). Given the poor evidence that is currently available, little
36 is known about what influences clinical decision-making in the management of TFCC tears.

37 Factors influencing the 'decision to operate' have been investigated in other surgical settings, such
38 as in emergency general surgery (Szatmary et al., 2010). The threshold for choosing surgical
39 management may be affected by differences in clinicians' preferences and beliefs (Birkmeyer et
40 al., 2013), personality (Teunis et al., 2015) and previous operative outcomes (Szatmary et al.,
41 2010). Patient care is largely driven by surgeons' training, experience and judgement when the
42 evidence supporting surgical practices is poor (Tubbs et al., 2006).

43 The aim of this study was to explore the perceptions and experiences of consultant wrist surgeons
44 managing TFCC injuries, with the purpose of understanding the factors informing "expert" clinical
45 decision making. This might help to explain existing variations in TFCC management, guide future
46 research and inform clinical care.

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METHODS

49 This study adopted a qualitative methodological approach. This allows the exploration of
50 experiences, perceptions, meanings, beliefs, attitudes and processes to understand how phenomena
51 of interest are socially constructed (Hansen, 2006). Semi-structured interviews allow in-depth
52 investigation of a topic of interest using a set of pre-determined open questions informed by existing
53 knowledge, for example, experience and published research (Grbich, 1999). They also provide
54 flexibility to pursue new themes as they arise, acknowledging that the researcher does not know all
55 the questions before the start of the study (Rice and Ezzy, 1999). Although time-consuming, this
56 allows the exploration of in-depth accounts and the identification of new topics of interest, which is

57 not feasible with a questionnaire or structured interview. This is an iterative process, with ongoing
58 reflection to 'mature' the interview structure over the course of the interview period with
59 accompanying adaptation of the interview guide (Hansen, 2006). In this study, qualitative semi-
60 structured interviews were used to investigate experts' perceptions and experiences regarding the
61 management of TFCC injuries and explore the rationale behind clinical decision-making in a UK
62 setting.

63 To identify the initial questions for the interview guide, a review of publications on the management
64 of TFCC tears was carried out with the help of an information specialist, who developed the search
65 terms (Table 1); this identified a range of management choices, uncertainty around best practice,
66 and a lack of clear empirical evidence for any particular approach.

67 The initial semi-structured interview guide was developed using this information and the experience
68 of the research team. The nature of the interview process meant that new areas of interest which
69 arose (such as the influence of patients' expectations and clinicians' understanding of the natural
70 history of TFCC tears) were embedded in the final interview guide. Supplementary Document 1
71 (available online) provides the initial and final interview guides.

72 Participants were consultant hand surgeons in the UK with an interest in wrist pathology,
73 experienced in the management of TFCC tears and wrist arthroscopy. Participants were 'purposively'
74 sampled to include a range of surgeons who favoured surgical and non-surgical approaches (Rice and
75 Ezzzy, 1999). Four initial participants were identified by an independent senior hand surgeon. These
76 initial interviewees then identified other potential participants via a sampling process known as
77 "snowballing" (Hansen, 2006); existing participants recommended other individuals within their
78 network of UK hand surgeons. Participants were recruited via personal email addresses and sent an
79 information sheet and consent form. Reply to the principal investigator (VR) was used to establish a
80 date for the interview.

81 The researcher (VR) obtained written consent and conducted, digitally recorded and transcribed
82 verbatim all interviews. Data collection and analysis was an iterative and emergent process; new
83 themes were added to the interview guide as they arose and recruitment stopped once 'saturation'
84 of emerging themes was achieved. Data saturation is considered the point at which no new themes
85 arose from the data (Bryman, 2004; Strauss and Corbin, 1998), suggesting that further interviews
86 would be unlikely to add significant information.

87 Participants were allocated 4 weeks to reply to the recruitment email. Two to three participants
88 were recruited at a time and their interview data were analysed before further recruitment. No new
89 themes arose during analysis of the eighth and ninth interviews. To confirm with confidence that
90 data collection had reached saturation point, two further potential participants were emailed but
91 only one replied. This was the only time in the recruitment process when a reply was not received. It
92 was evident, however, that data saturation had been achieved after the tenth interview as this was
93 the third consecutive time that no new themes had arisen during data analysis, and therefore no
94 further recruitment was required.

95 Data were analysed independently by two authors (VR, AF) using a thematic analysis: "a method for
96 identifying, analysing and reporting data" (Braun and Clarke, 2006). This approach involved six
97 stages starting with familiarization with the data (stage 1), followed by the identification of
98 recurring areas of interest, known as 'themes' (stage 2). Transcripts were then re-read and an
99 interpretative analysis of the initial themes was done to create sub-themes (stage 3). Stage 4
100 involved combining the independent analysis of the two authors and stage 5 resulted in the
101 culmination of a finalized list of agreed themes which were approved by the senior author (CD), to
102 improve rigour (Hansen, 2006). The final stage of interpretation (stage 6) involved creating the
103 narrative report in which the themes were discussed relative to the existing evidence base and the
104 research question.

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RESULTS

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The review of publications used to develop the initial interview guide revealed various

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controversies in the current management of TFCC tears.

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Controversies about the management of central TFCC tears:

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- Studies fail to agree on the relative merits of arthroscopic debridement or an ulnar shortening procedure for central tears. This uncertainty is further complicated when assessing the benefits of each treatment option in the context of a neutral (or negative) ulnar variance (UV) and when there is a positive UV when ulnocarpal abutment would be more likely (Minami et al., 1996; Moldner et al., 2015; Nishizuka et al., 2013; Osterman, 1990; Tomaino and Weiser, 2001;).

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- Ulnar shortening is done either by an extra-articular ulnar shortening osteotomy (USO) or an arthroscopic intra-articular 'wafer' resection. There is no consensus on the criteria for each procedure, nor whether one is better than the other. Both techniques were considered to be successful in a retrospective review of 22 patients; however, the cases studied were not matched for UV (Constantine et al., 2000).

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Controversies about the management of peripheral TFCC tears:

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Combined case-series evidence supports successful outcomes for repair in cases with distal

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radioulnar joint (DRUJ) instability (Atzei, 2009; Atzei et al., 2015; Corso et al., 1997; Shih et al.,

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2002). Despite this consensus, there is controversy about other aspects of peripheral tear

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management:

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- The role of surgical repair for peripheral tears with a stable DRUJ. Four case-series studies support favourable outcomes for repair (; Reiter et al., 2008; Trumble et al., 1996; Wysocki et al., 2012; Yao and Lee, 2011) whilst a retrospective case-series of 31 stable 1B tears demonstrated satisfactory-to-excellent outcomes after arthroscopic debridement, comparable to those of repair (Cardenas-Montemayor et al., 2013).

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134 • The merits of using arthroscopic techniques over open surgery in peripheral tears remains
135 inconclusive (Anderson et al., 2008; Luchetti et al., 2014).

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137 In this qualitative study, the ten consultant wrist surgeons are referred to as Participants (P) 1 to
138 10. They were interviewed between May and July 2016. Experience as a consultant varied from
139 3.5 to 24 (mean, 13) years and participants were from different regions of England. The mean
140 duration of interview was 52 (range, 31-87) minutes.

141 Three main themes, patient factors, expert assessment and evidence base emerged as
142 underpinning clinical decision-making in the management of TFCC injuries (Table 2). The themes
143 and subthemes are further presented below.

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145 **Patient factors:**

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147 Patient-related factors were important when formulating a management plan. Identifying normal
148 age-related findings and the presence of hyperlaxity were the key biological factors discussed, and
149 psychosocial elements such as patients' own values and expectations were also considered.

150 ***Psychosocial issues: Patient values and expectations***

151 All participants reported the importance of addressing patients' values and expectations in the
152 management of TFCC tears. They highlighted problems in 'labelling' patients with a tear because to
153 patients, this may imply something that requires 'mending'.

154 *"They usually expect surgery and the problem is that the majority of patients now who get*
155 *referred with TFCC repairs, particularly now from general practice, have got a bit of a perforation*
156 *that probably doesn't need an operation. So, over the age of 40/50 nearly everyone has got some*
157 *sort of central perforation and I'm trying to get away from calling it a tear because tear makes*
158 *people think it needs putting back together and repairing."* (P3)

159 Occupation and sporting demands were considered particularly important in influencing
160 management. A number of the participants ($n=6$) felt there was a greater expectation from those
161 with demanding jobs to have interventions that were curative and/or required minimal time off
162 work.

163 "You have to compare a professional sports athlete with a farmer or self-employed person. They
164 all have, sort of, Formula 1 type' expectations and they need to go back quickly into their jobs."
165 (P9)

166 **Biological issues: age-related findings and co-existing pathology**

167 The importance of correctly identifying incidental degenerative TFCC lesions, which may represent
168 normal age-related changes in older patients with ulnar-sided wrist pain, was discussed ($n=3$).
169 Increasing age, per se, was not considered a contraindication to treatment but the importance of
170 recognizing normal variants was emphasized to avoid unnecessary procedures:

171 "I think you can get central perforations in the TFCC which are normal and part of ageing, perhaps
172 associated with degenerative type tears...I think they are often over-reported as pathological
173 problems that need treatment and might guide you or coerce you into, you know, active treatment
174 where none is necessary." (P2)

175 Hyperlaxity was identified by all participants (except P10) as a common finding in patients with
176 ulnar-sided wrist pain suspicious of a TFCC injury. These cases were reported to require a more
177 conservative approach, in view of having an underlying connective tissue disorder which would not
178 necessarily be addressed by surgical management and may result in symptoms which recur or
179 persist;

180 "I try very hard not to operate on them. One: because I don't think it's necessary and two:
181 because some of them, there is a 'material' problem, so even if you do it, it's going to work for a
182 while and may recur." (P6)

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184 **Expert assessment**

185 Surgeons' individual perceptions and experiences were a key factor influencing the treatment
186 options selected. The role of clinical expertise in establishing a working diagnosis was discussed.
187 Variations were reported in surgeons' perceptions of pain pathophysiology for both central and
188 peripheral tears and therefore differences in management choices for each tear type were also
189 observed.

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192 ***The role of clinical examination and investigations***

193 The importance of establishing a working diagnosis, by relying on individual expertise such as
194 history-taking and clinical examination skills, was advocated. A key aspect of clinical examination,
195 recommended by all participants, was assessment of DRUJ stability by 'ballottement' in keeping
196 with the techniques described by Garcia-Elias (2012) and Rhee et al. (2014). Seven participants
197 also described using an impingement test in line with those described by Ahn et al. (2006) and
198 Rhee et al. (2014) to elicit symptoms of ulnocarpal abutment. The emphasis was placed on further
199 imaging being used mostly as a confirmatory tool, to support diagnosis and direct future
200 management ($n=3$).

201 *"If you don't make a diagnosis on taking a history and examination, and you just send them for an*
202 *MRI scan, or an arthroscopy without knowing exactly what the clinical question is, you are going to*
203 *have lots of incidental findings."* (P6)

204 *"I would not go on a fishing trip with an arthroscope. Unless I was convinced of definite clinical*
205 *signs. I try to use arthroscopy as a confirmatory investigation."* (P2)

206 ***Perceptions of pain pathophysiology***

207 There was no consensus opinion on the underlying pathophysiology causing pain in both central
208 and peripheral TFCC tears. Various potential causes were discussed by participants.

209 Impingement from ulnocarpal impaction/abutment (P6; P7) and synovitis ($n=6$) were both
210 reported as possible causes of pain in central tears;

211 *"I suspect that in central tears, the pain is caused by a degree of impaction...I guess its ulnocarpal*
212 *impaction, being an impingement-type problem I suspect, but, we don't know"* (P7).

213 *"Why that hurts, I don't know I'm assuming it's synovitis because the discs shouldn't hurt"* (P1).

214 DRUJ instability (P5; P6), ongoing traction on the tear (P7) or synovitis ($n=5$) were suggested as
215 potential causes of pain in peripheral tears.

216 *"In terms of peripheral tears, I would assume there are some nerve endings there, there's ongoing*
217 *traction on a tear and that causes it, does the abnormal joint movement cause pain? We don't*
218 *know do we?"* (P7).

219 *"I don't think that a peripheral tear without instability is going to cause symptoms, now OK yes*
220 *there might be some that have a bit of synovitis in that area where it is just a bit inflamed"* (P5).

221 ***The management of central lesions***

222 Immobilization/splinting ($n=10$) and steroid injections into the ulnar arthroscopy '6R' portal ($n=4$)
223 were recommended as non-surgical management options for central TFCC tears.

224 *"On the degenerative side, often splinting them for a bit, or even a steroid injection may settle the*
225 *synovitis they have, may take the pain away and settle them for a while, occasionally*
226 *permanently."* (P6).

227 After an unsuccessful trial of non-surgical treatment, participants reported using measurements of
228 UV and signs of ulnocarpal abutment to help guide management. The notion that ulnocarpal
229 abutment may occur in the absence of positive UV was an important discussion point, and was
230 attributed to a dynamic mechanism of impaction ($n=3$) or to having a thicker TFCC ($n=3$).

231 *"If you screen them with a fluoroscan, and you get people to make a grip, the difference in ulna*
232 *length varies 3 to 4 mm and that is very significant, which proves that the ulnocarpal abutment is*
233 *a dynamic problem."* (P6)

234 *"People who have a shorter ulna usually have a thicker TFCC. So in essence the space is still the*
235 *same, it's just that there is more TFCC and less bone. So just because you've got a normal length*
236 *ulna doesn't mean you can't have ulnar impaction."* (P5)

237 Half of the participants suggested initial arthroscopic debridement or wafer procedure before
238 considering USO, whereas the other half recommended USO, for cases with either positive UV or
239 ulnocarpal abutment.

240 *"My treatment for them is much more likely to be an ulnar shortening osteotomy. I tend to go for*
241 *that first... to see if that settles it down and then I think about arthroscopically debriding the TFCC*
242 *and doing a wafer excision as a secondary thing".* (P3).

243 *"Simple debridement first of all. And then also if they are very ulnar positive I'll try and shave their*
244 *ulnar head arthroscopically... An ulnar shortening osteotomy is a pretty big operation...you are*
245 *actually breaking the bone and putting a big plate on them... Technically I think it's a challenging*
246 *operation and there is a non-union rate associated with it. So, I tend to try and do it simple if I*
247 *can".* (P10)

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250 ***The management of peripheral lesions***

251 In cases with a stable DRUJ, all participants supported splinting/immobilizing acute TFCC injuries.
252 Steroid injections were also reported as a conservative management option ($n=4$). Debridement
253 was suggested for some incomplete/partial peripheral tears ($n=3$). Surgical repair of a peripheral
254 TFCC tear with a stable DRUJ was only recommended by six participants, due to variations in
255 perceptions of pain pathophysiology.

256 *"If you get a dorsal tear...there tends to be a gap where synovitis can creep through and maybe*
257 *it's not instability but you do get pain, so I repair those."* (P1)

258 *"If they don't have instability, to me the TFCC doesn't need repairing. They've got pain for some*
259 *other reason."* (P6)

260 In cases with DRUJ instability, all participants agreed that surgical repair of the TFCC is a
261 successful management option. Two participants favoured a mini-open approach, seven favoured
262 open repair and one preferred arthroscopic repair (converting to open repair if needed).

263 *"I have not been able for the last 15 years to even consider doing arthroscopy because I can't*
264 *safely reproduce the results I have with an open technique."* (P9)

265 *"Once you get good at arthroscopy it's easier for you to do it arthroscopically than to do it*
266 *openly."* (P1)

267 Six participants suggested that some tears with DRUJ instability may be successfully treated with
268 an initial trial of non-surgical management. In particular, successful outcomes were reported with
269 splinting/immobilization ($n=5$) and with physiotherapy ($n=5$). However, P5 refuted a role for
270 physiotherapy in the management of TFCC tears.

271 *"With a splint or a cast for about 4 to 5 weeks and reassess them. Because quite a few of them do*
272 *scar up enough to be stable enough."* (P7)

273 *"Physiotherapy can help for the instability ones. If you strengthen them a bit, they may be able to*
274 *control the joint dynamically themselves, particularly sporty people, they have good forearm*
275 *muscles so that is worth trying."* (P6)

276 Perceptions of the natural history and long-term consequences of chronic DRUJ instability also
277 influenced the choice between surgical or non-surgical management.

278 *"My concern about a chronically unstable joint is that over time it can potentially cause*
279 *degenerative change within the joint and that's a much more difficult problem to deal with. So, I*
280 *suppose the way I would discuss it with the patient is...it's probably better for the joint if it's made*
281 *stable rather than left alone."* (P5)

282 *"If you look at long-term series of TFCCs not treated, the answer is they don't develop*
283 *osteoarthritis."* (P6)

284

285 **Evidence-base**

286 All participants placed a stronger emphasis on patient preferences and their own clinical
287 experience and judgement rather than on published evidence. This was reflected in most
288 participants using their own descriptive terminology, rather than published classification systems,
289 for diagnosis. Significant knowledge gaps in the available evidence were well described, in
290 particular the unknown natural history of TFCC tears.

291 **Classification systems**

292 Palmer's classification (Palmer, 1989) was mostly considered unhelpful in guiding management
293 ($n=7$) and was reported to cause confusion between the radial-sided 1A and 1D subtypes ($n=4$):

294 *"The Palmer classification is one of those classifications where it tries to fit everything in, it doesn't*
295 *really guide treatment. I'm not sure how reproducible it is and I suspect it's never been properly*
296 *assessed in terms of inter-observer reliability."* (P2)

297 *"The 1A or the 1D is sometimes mixed and misunderstood. And that means that when we try to*
298 *talk about management, if we don't agree on what 1A and 1D is, then of course management will*
299 *be completely different."* (P9)

300 Participants reported using their own personalized descriptive methods to describe tears, instead
301 of Palmer's classification ($n=7$);

302 *"Degenerative and traumatic, and whether they are central or more peripheral, and whether they*
303 *are contributing to instability or not."* (P3)

304 **Publications versus experience**

305 All participants reported relying more on their own experience and training, including their
306 personal surgical successes and complications, rather than on current published literature, to

307 inform their clinical decision-making for TFCC lesions. The available studies were largely
308 considered to be of poor quality with little evidence which actually influences clinical practice
309 (n=4). The only studies reported to aid decision-making were the low-level evidence supporting
310 repair in DRUJ stability (P6) and the case-series which report technical procedures (P1).

311 *"It's largely my own experience, the experience of close colleagues, discussing cases, some*
312 *literature, discussing cases in forums, at meetings, but largely experiential I would say"* (P2)

313 *"It's definitely not by the literature, because I think the literature is heavily biased...I just don't*
314 *believe the literature and it's just on my own personal experiences."* (P10)

315 **Knowledge gaps/future research**

316 Significant knowledge gaps were reported in the current evidence base by all participants. The
317 importance of understanding the natural history of TFCC lesions, before further clarifying the role
318 of existing surgical and other interventions was advocated (n=5). Other suggested areas of future
319 research included comparing the various surgical management options for central tears with
320 ulnocarpal abutment (n=3) and investigating the benefits of arthroscopic versus open repair
321 techniques for peripheral tears (n=4). The need for a clear classification was recommended as a
322 prerequisite for further clinically-relevant research (n=3).

323 *"I don't think there are any good longitudinal studies looking at the actual natural history of low*
324 *grade triangular fibrocartilage tears at all, or none that I've come across and I don't think there is*
325 *much in the literature."* (P2)

326 *"You have central tears with abutment, so one of the recommended treatments is debridement of*
327 *the tear. And that would be a good experiment, if you are going to do a shortening anyway, just*
328 *debride the tear in half of them, and don't debride the tear in the other half."* (P6)

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DISCUSSION

331 This study has highlighted key controversies in TFCC management and explored the rationale
332 behind these reported differences in clinical decision-making. the findings suggested that
333 surgeons rely more on their own training and experience, along with patient-related factors such
334 as individual expectations, rather than on published material, to inform decision-making in TFCC
335 management. These findings support those of Tubbs et al. (2006) who suggested that surgeons

336 use their own judgment when the evidence-base is weak, as well as the findings of Jacklin et al.
337 (2008) that imply that surgeons use 'intuition and experience' when faced with uncertainty. Thus it
338 would appear that in the light of a poor evidence-base, as is the case with TFCC management,
339 surgeons rely on the remaining areas of an EBM model; patient values and expert opinion
340 (Sackett, 1997) and reflect a model of 'shared' decision-making with the patient (Montgomery et
341 al., 2001; Vranceanu et al., 2009).

342 Although there are limited reports discussing the role of non-surgical management for TFCC
343 injures (Barlow, 2016; Park et al., 2010; Watanabe et al., 2010) some participants advocated non-
344 surgical management as first-line treatment, even in the context of DRUJ instability. However,
345 there is lack of consensus regarding the multiple non-surgical treatment options currently in use
346 and the suitability of these options for each tear type is unknown. Indications for wrist
347 immobilization varied between surgeons, depending on individual perceptions of symptom
348 aetiology and natural history. Immobilization was considered particularly useful in settling episodes
349 of synovitis, but perhaps also in cases with DRUJ instability. The role of splinting remains unclear
350 in the current evidence available (Barlow, 2016; Park et al., 2010).

351 Physiotherapy was mostly supported in cases with a clinically unstable DRUJ, to improve dynamic
352 stability by strengthening forearm muscles. However, there are no studies investigating this in the
353 current evidence base and P5 denied successful outcomes with physiotherapy in his experience of
354 TFCC management.

355 The indications for steroid injection also varied between surgeons, based on their perceptions of
356 pain aetiology and natural history. Some participants reserved steroid injections for degenerative
357 lesions and to settle synovitis. Others reported resolution of symptoms with steroid injections for
358 some painful peripheral tears. However, although steroid injections are mentioned as a
359 conservative treatment option for TFCC lesions (Watanabe et al., 2010) there have been no
360 studies of the results.

361

362 The merits of arthroscopic versus open TFCC repair, the role of arthroscopic debridement versus
363 ulnar shortening surgery for central lesions, and the surgical management of peripheral tears
364 (without DRUJ instability) varied between participants. The decision-making process behind
365 whether to carry out an arthroscopic or open TFCC repair appeared to be influenced by previous
366 surgical outcomes and complications (Szatmary et al., 2010), risk-avoidance behaviours (Tubbs et

367 al., 2006) and personal confidence in the ability to perform each technique. Although it was
368 suggested by P1 that, with increasing experience, it may be easier to perform repairs
369 arthroscopically rather than via an open approach, such a trend was not fully supported by the
370 more senior surgeons in the cohort. This reflects how aspects of surgical management may be
371 influenced by differences in clinicians' preferences and beliefs (Birkmeyer et al., 2013). Despite
372 the general trend towards arthroscopic surgery, the results of using arthroscopic over open
373 techniques for TFCC repair have not been shown conclusively to be better (Anderson et al., 2008;
374 Luchetti et al., 2014).

375 The studies supporting the surgical management of central lesions are inconsistent (Minami et al.,
376 1996; Möldner et al., 2015; Nishizuka et al., 2013; Osterman, 1990; Tomaino and Weiser, 2001).
377 Our findings also showed variations in the reported management of central lesions that did not
378 respond to non-surgical treatment. Central tears with positive UV or signs of ulnocarpal abutment
379 were reported to require ulnar shortening. However, some surgeons advised trying arthroscopic
380 debridement or a wafer procedure first, to avoid the risks of an USO. This shows that decision-
381 making in this context appears to be influenced by previous operative outcomes, (Szatmary et al.,
382 2010), perceived risks (Tubbs et al., 2006) and technical difficulties associated with each
383 treatment option. These findings support the suggestion by Watanabe et al. (2010) that surgeons
384 may currently base their preference for a particular type of ulnar shortening procedure on their
385 personal experiences and training, as published results are inconclusive (Constantine et al., 2000).

386 It is unclear whether clinically stable peripheral tears that do not respond to conservative
387 management warrant either surgical repair (Reiter et al., 2008; Trumble et al., 1996; Wysocki et
388 al., 2012; Yao and Lee, 2011) or debridement (Cardenas-Montemayor et al., 2013). This lack of
389 agreement was noted in our participants and seemed to depend on individual perceptions of
390 associated pain pathophysiology. Debridement was suggested to be reasonable for some partial
391 tears and repair was recommended by participants who felt that peripheral tears without DRUJ
392 instability may still cause pain, perhaps through inflammatory synovitis. This underlines the
393 importance of understanding the underlying pathophysiological process and natural history of
394 these tears.

395 The surgical repair of peripheral tears with DRUJ instability was well-accepted and reported by all
396 participants in our dataset. However, a key question generated through this study, is the suitability
397 of non-surgical management in DRUJ instability, especially given the unknown natural history of

398 this condition. Decision-making behind the management of DRUJ instability was related to
399 perceptions of the natural course of the TFCC tear and whether chronic instability would lead to
400 later degenerative disease. Although studies generally report successful outcomes for repair of
401 unstable tears (Atzei, 2009; Atzei et al., 2015; Corso et al., 1997; Shih et al., 2002), the key
402 question is whether repair is indicated if conservative management can resolve symptoms without
403 long-term degenerative consequences. An important consideration in all the above cited studies is
404 that they were unclear whether conservative management was trialled before surgery. Although
405 evidence for the natural course of TFCC lesions is lacking, Mrkonjic et al. (2012) suggest that
406 unstable TFCC tears sustained at the time of fracture of the distal radius do not lead to long-term
407 subjective instability or degeneration. The controversy about the suitability of non-operative
408 management in DRUJ instability is an important area for further investigation, as having an
409 awareness of 'when not to operate' is essential to clinical practice (Spencer, 1979).

410 The importance of distinguishing relevant TFCC lesions from normal variants and incidental
411 anomalies on MRI or during diagnostic arthroscopy (Chan et al., 2014) was reported in our
412 dataset, highlighting the need to establish a working diagnosis through clinical assessment before
413 further investigations. However, although most participants reported the use of similar clinical
414 examination tests, their reproducibility, sensitivity and specificity are unknown.

415 Palmer's classification was deemed unhelpful in guiding TFCC management. It does not take DRUJ
416 instability into account, a pivotal factor in the clinical decision-making process. Problems with
417 misclassification were reported and inter-observer reliability is unknown. In particular, the
418 misinterpretation of radial-sided 1A as 1D lesions may misguide management. 1D tears are
419 peripheral and should be amenable to repair. Shih et al. (2002) showed good outcomes after
420 repair of 1D lesions. However, reviews by Crosby and Greenberg (2015) and Ahn et al. (2006)
421 suggest that either debridement or repair may be suitable for 1D tears. In view of participants'
422 comments on the confusion in misdiagnosing radial-sided 1A lesions as 1D, similar problems may
423 arise when classifying such tears in studies, perhaps explaining the reported variation in the
424 management of 1D tears in some papers. This highlights the need for a reproducible classification
425 system.

426 As far as we know, this is the first study to address TFCC injury management through a qualitative
427 interview approach. It explored the rationale behind clinical decision-making in TFCC management.
428 The consolidated criteria for reporting qualitative research (COREQ) (Tong et al., 2007) were

429 followed. Nevertheless the study has some limitations. Had the interview series continued further,
430 new themes might have arisen; however in this sample of ten, data saturation was achieved. Our
431 sample was limited to England, potentially reducing the generalizability of the results. Qualitative
432 research interviews are the 'data collection tool' (Hansen, 2006); the impression made by the
433 interviewer may affect interviewer-participant interactions (Richards and Emslie, 2000) and
434 subsequent data analysis.

435 This study suggests that the natural history of TFCC injuries requires clarification to assess the role
436 of current interventions. Given the complexities of diagnosis and classification highlighted, there
437 would be many difficulties in carrying out a longitudinal study to clarify the natural history of
438 traumatic TFCC tears. A simple, descriptive classification (which includes the status of DRUJ
439 stability) is required to allow reproducibility and improve communication between researchers.

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Table 1. Search strategies.

Electronic database	Platform	Search terms
PubMed	OVID	"triangular fibrocartilage"[MeSH Terms] OR "triangular fibrocartilage" OR "triangular cartilage" OR "triangular fibrocartilaginous" OR TFCC
Embase	OVID	triangular fibrocartilage/ OR "triangular fibrocartilage" OR "triangular cartilage" OR "triangular fibrocartilaginous" OR TFCC
Cochrane Central Register of Controlled Trials (Cochrane CENTRAL)	Wiley	"triangular fibrocartilage" OR "triangular cartilage" OR "triangular fibrocartilaginous" OR TFCC

Table 2. Themes and sub-themes.

Themes	Sub-themes
Patient factors	<p data-bbox="810 421 1294 510">Psychosocial issues: patient values and expectations</p> <p data-bbox="810 555 1374 645">Biological issues: age-related findings and co-existing pathology</p>
Expert assessment	<p data-bbox="810 689 1257 779">The role of clinical examinations and investigations</p> <p data-bbox="810 824 1251 857">Perceptions of pain pathophysiology</p> <p data-bbox="810 902 1241 936">The management of central lesions</p> <p data-bbox="810 981 1283 1014">The management of peripheral lesions</p>
Evidence base	<p data-bbox="810 1048 1082 1081">Classification systems</p> <p data-bbox="810 1126 1267 1160">Published material versus experience</p> <p data-bbox="810 1205 1209 1238">Knowledge gaps/future research</p>