Intervention rates are low after direct discharge from the Edinburgh trauma triage clinic

INTERVENTION RATES ARE LOW AFTER DIRECT DISCHARGE FROM THE EDINBURGH TRAUMA TRIAGE CLINIC

Outcomes of 6,688 patients

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ABSTRACT

Aim. The Edinburgh Trauma Triage clinic (TTC) is an established form of Virtual Fracture clinic (VFC) that permits the direct discharge of simple, isolated fractures from the Emergency Department (ED). Small, short-term cohort studies of similar systems have been published, but to detect low rates of complications requires a large study sample and longer-term follow-up. This study details the outcomes of all patients with injuries suitable for a direct discharge protocol over a four-year period, reviewed at a minimum of three years after attendance.

Patients. All TTC records between February 2014 and December 2017 were collated from a prospective database. Fractures of the radial head, little finger metacarpal, fifth metatarsal, toe phalanges and mallet finger injuries were included. TTC outcome, including any deviations from a well-established direct discharge protocol, were noted. All records were re-assessed at a minimum of 36 months after TTC triage (mean 54 months) to ascertain which injuries attended the trauma clinic after initial discharge. Reasons for attendance, the source of referral and any subsequent surgical procedures were identified.

Results. There were 6688 patients with fractures of the radial head (1861), little finger metacarpal (1621), fifth metatarsal (1916), toe phalanges (920) and mallet finger injuries (370). 298 (6%) patients were re-referred after direct discharge and attended trauma clinic at a mean time after injury of 11.9 weeks, of whom 11 (0.2%) underwent a surgical intervention. Serious adverse events, defined as those in which a patient may not have come to harm if early clinical review had been undertaken, occurred in 1 patient (0.01%).

Conclusion. Intervention after direct discharge of simple pre-defined injuries of the elbow, hand and foot is low. Within a TTC system, patients with these injuries can be safely discharged without routine follow-up.

CLINICAL RELEVANCE

- TTC direct discharge protocols significantly reduce in-person fracture clinic appointments for simple, isolated injuries of the elbow, hand and foot.
- Deviations from the protocol result in a significant number of unnecessary appointments.
- Surgical intervention after TTC direct discharge is very low at 0.2% (11 cases).

INTRODUCTION

The Edinburgh Trauma Triage Clinic (TTC) is an electronic triage system that aims to eliminate unnecessary patient review and optimise outpatient pathways. A form of Virtual Fracture Clinic (VFC), the TTC is performed by Orthopaedic Trauma Consultants who evaluate the clinical records and radiographs to ensure each patient is offered appropriate advice, onward referral or surgeon review in a time-appropriate manner, in a sub-specialist trauma clinic where required. We have previously reported that the TTC is a safe and cost effective, whilst also being preferred by patients when compared to a more traditional system where all were reviewed in-person at a fracture clinic. [1,2] A key component of the TTC is the direct discharge (DD) of minor injuries that can be managed with a removeable orthosis, strapping or sling. Simple, closed, isolated fractures of the radial head and neck, little finger metacarpal, fifth metatarsal, toes and tendinous mallet finger injures have been discharged directly from the Emergency Department (ED) since the system came online in February 2014. Patients followed a well-established protocol whereby they are provided with information sheets describing the injury, the expected recovery, and how to contact the orthopaedic trauma service in the event of any problems. The subsequent consultant delivered TTC review offers a safety net whereby the diagnosis made in the ED is analysed to ensure the injury meets the criteria for direct discharge. Where the injury has been potentially underestimated, or in the event of misdiagnosis or inappropriate management, the patient is contacted with advice or offered a fracture clinic appointment.

VFC systems, such as the TTC, have been successfully employed in numerous health boards and trusts with several publications demonstrating excellent patient outcomes in appropriately selected injuries despite reduced clinician contact. [3-6] However, the current literature is limited by small patient numbers and short-term follow up. Since the incidence of adverse events is expected to be low, large sample sizes followed over several years are needed to detect such events. This study aimed to assess the mid-term outcomes of a large cohort of patients suitable for direct discharge from the Edinburgh TTC with stable, isolated injuries of the elbow, hand and foot. Deviations from the protocol, rates of intervention and complications related to inappropriate discharge are reported.

PATIENTS AND METHODS

All patients presenting to any Emergency Department or Minor Injuries Unit in our Health Board Region, who are referred to the TTC, are incorporated into a prospective database that includes clinical diagnosis, history and examination findings, and a link to their radiographs. A bespoke search programme (SAP BusinessObjects, BI Platform 4.1, 2010, SAP, California, United States) was used to analyse the TTC database to identify all patients who presented to our institution over a four-year period between February 2014 and December 2017. Patients included in the study were those 13 years and older who sustained an isolated, closed, extra-articular fracture of the little finger metacarpal, any fracture of the fifth metatarsal, radial head or neck fractures, hallux or lesser toe phalangeal fractures or soft tissue mallet finger injuries. Distinct injuries to the same body part were counted as separate injury episodes.

Demographic, injury and triage Data

The Electronic Patient Records (EPR) of the study group were scrutinized for demographic and injury details. Injures were classified using standard presentation radiographs of the foot, hand or elbow. Fractures of the radial head and neck were classified according to the Mason classification and included occult fractures suggested by presence of a haemarthrosis due to elevated fat pads on the lateral radiograph. [7] Fifth metatarsal fractures were classified according to zones (zone I – base avulsion, zone II – Jones type fracture, zone III – shaft fractures) and little finger metacarpals by anatomical location (base, shaft or neck). [8] Fractures of the toe phalanges and soft tissue mallet finger injuries were not classified.

Patient management

After diagnosis in the ED, patients are provided with an information leaflet regarding the expected recovery and contact details of the nurse and physiotherapy practitioner hotline. Fractures of the fifth metatarsal were treated with a weight bearing ankle orthosis (moonboot). Fractures of the fifth metacarpal were treated with buddy strapping with or without a wrist splint depending on patient discomfort. Hallux and toe phalanx fractures were not commonly immobilised, but buddy-strapping and a flat-bottomed plaster shoe could be provided at the discretion of the ED clinician. Radial head fractures were managed with a collar-and-cuff and advised to commence early mobilisation. Mallet fingers were treated with six weeks of extension splinting followed by two weeks of night-time-only splintage. With the exception of

mallet finger injuries, all patients were instructed to remove the supportive orthosis at the earliest opportunity, when pain allowed.

TTC triage and outcomes

The outcome of TTC triage was documented for each patient. ED referrals with appropriate documentation and radiographs where the triaging consultant agreed with the implementation of the direct discharge protocol received no further contact from the orthopaedic service. Alternatively, follow up could be offered at the discretion of the triaging consultant as either a phone call from the nurse practitioner or a fracture clinic appointment. Injuries triaged to been seen physically at the fracture clinic, rather than directly discharged, were regarded as deviations from protocol. The reason for any deviation was taken from the dictated triage note.

The EPR of each patient was re-assessed at a minimum of three years (mean 54 months, range 36-84 months) after discharge to identify any re-referrals or interventions. Our hospital is the only provider of orthopaedic care in the region, but to mitigate loss to follow up due to patient movement, the Scottish national Carestream Picture Archiving and Communication System (PACS; Kodak Carestream Health) network was reviewed for any out-of-region radiographs of the affected appendage to detect any re-attendance elsewhere in the country. All nurse practitioner enquiry line phone calls, in-person fracture clinic appointments, radiographs, physiotherapy appointments and surgical procedures were noted. The source and reason for re-referral was recorded.

Statistical analysis

Statistical analysis was performed using SPSS version 24 (SPSS Inc., Chicago, Illinois). All continuous variables were tested for normality using the Shapiro-Wilks test. Parametric and non-parametric tests were used as appropriate to assess continuous variables for significant differences between groups. Dichotomous variables between groups were assessed using Chi square test. A p-value < 0.05 was considered as significant.

RESULTS

There were 46,111 referrals to the TTC over the four-year period, of which 6712 referrals were for the injures included in this study. A total of 98 patients subsequently attended with unrelated injuries: 65 with an injury in the same body region and 33 with a remote injury. The breakdown of injury according to grade is show in **Figure 1.**

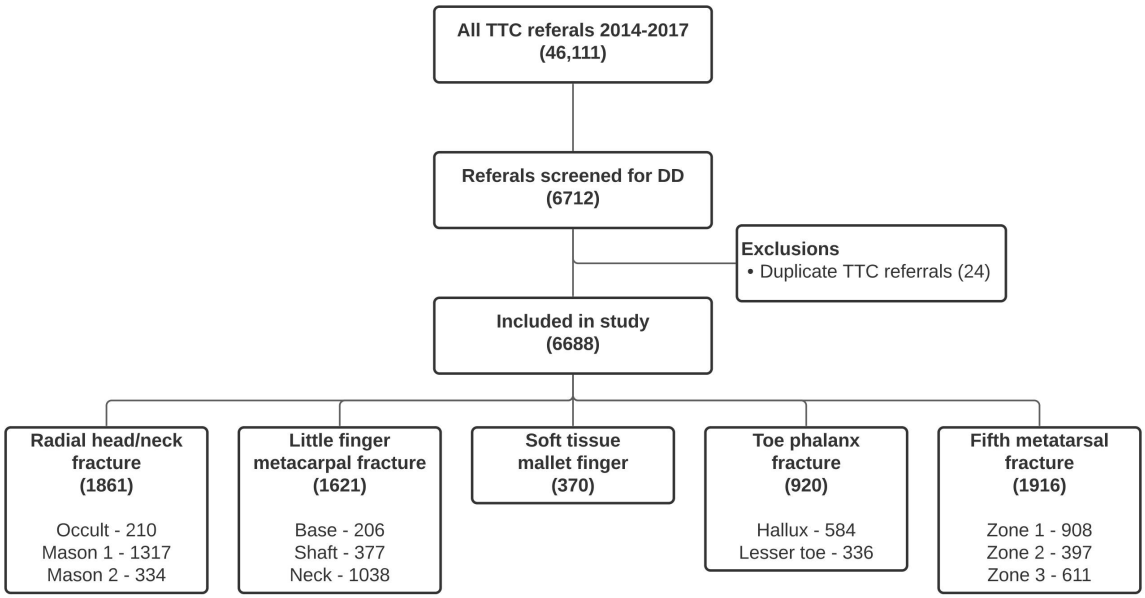

Figure 1: TTC referrals from 2014 to 2017 (inclusive). DD (direct discharge)

Outcome of TTC triage and attendances to fracture clinic

Of the 6688 patients who had injuries potentially suitable for direct discharge, 4810 (71.9%) received no further communication from the orthopaedic service, 927 (13.9%) were contacted by telephone through the nurse practitioner service and 951 (14.2%) were offered in-person review. The rates of discharge and review according to injury grade are detailed in **Table I**. Of the 927 who received a phone call from the nurse practitioner, 47 (5%) patients requested an orthopaedic clinic review due to ongoing problems.

There were 298 physical attendances at fracture clinic for injuries that were initially triaged to direct discharge (6% of 4810), at mean time of 11.9 weeks (range, 0-164). The source of these were 108 (36%) referrals from general practice (GP), 32 (11%) from another allied healthcare professional such as a physiotherapist and 158 (53%) self-referrals to the TTC enquiry line. The injuries, time to attendance and rates of surgery are listed in **Table II.** Of the 298 who

attended clinic, 202 (68%) required only one appointment, with a mean number of appointments per injury of 1.6 (range: 1-10). **Table III** compares the reasons for attendance between the group triaged to a clinic appointment and those who attended after direct discharge**.**

Injury	TTC DD	Protocol deviations		Interventions after fracture clinic review	
	Patients (n,%)	Patients contacted by phone (n,%)	Patients offered in-person review (n,%)	Physiotherapy referral (n,%)	Surgery (n,%)
Radial head/neck fracture (1861)					
Occult	173, 9.3	23, 1.2	14, 0.7	5, 0.3	0, 0.0
Mason 1	1060, 56.9	193, 10.2	64, 3.4	24,1.3	1, 0.1
Mason 2	236, 12.6	36, 1.9	62, 3.3	32, 1.7	3, 0.2
Total	**1469, 78.9**	**252, 13.5**	**140, 7.5**	**61, 3.2**	**4, 0.2**
Little finger metacarpal fracture (1621)					
Base	90, 5.6	41, 2.5	75, 4.6	17, 1.0	4, 0.2
Shaft	181, 1.2	59, 3.6	137, 8.5	24, 1.5	12, 0.9
Neck	869, 53.6	46, 2.8	123, 7.6	21, 2.3	5, 0.3
Total	**1140, 70.4**	**146, 9.0**	**335, 20.6**	**62, 3.8**	**21, 1.4**
Soft tissue mallet finger (370)					
Total	**314, 84.8**	**15, 4.1**	**41, 11.1**	**5, 1.5**	**0, 0.0**
Fifth metatarsal fracture (1916)					
Zone 1 (Base)	725, 37.8	122, 6.4	61, 3.2	19, 1.0	2, 0.1
Zone II (Jones)	288, 15.0	66, 3.4	43, 2.2	14, 0.7	1, 0.2
Zone III (Shaft)	294, 15.3	157, 8.2	160, 8.4	50, 2.6	5, 0.4
Total	**1307, 68.2**	**345, 18.0**	**264, 13.8**	**83, 4.3**	**8, 0.6**
Toe phalanx fracture (920)					
Hallux	367, 39.8	119, 12.9	98,10.6	4, 0.4	1, 0.1
Lesser toe	213, 23.1	50, 5.4	73, 7.9	4, 0.4	1, 0.1
Total	**580, 63.0**	**169, 18.3**	**171, 18.5**	**8, 0.8**	**2, 0.2**
Grand total	**4810, 71.9**	**927, 13.9**	**951, 14.2**	**219, 3.3**	**35, 0.5**

Table I: Outcome of TTC review of dischargeable injures between 2014 and 2017.

Injury	Patients (n,%)	Weeks to clinic attendance (mean, range)	Physiotherapy Referral (n,%)	Surgical intervention (n,%)
Radial head/neck fracture (1469)				
Occult	4, 0.2	6.1, 2-14	2, 0.1	0,0
Mason 1	51, 3.4	15.4, 1-164	27, 0.2	2, 0.1
Mason 2	19, 1.2	18.4, 1-63	12, 0.8	2, 0.1
Total	**74, 5.0**	**14.7, 1-164**	**41, 2.8**	**4, 0.3**
Little finger metacarpal fracture (1140)				
Base	4, 0.3	8.9, 1-14	1, 0.1	0, 0
Shaft	17, 1.4	8.4, 0-44	4, 0.3	1, 0.1
Neck	39, 3.4	9.4, 1-152	12, 1.0	1, 0.1
Total	**60, 5.3**	**8.6, 1-152**	**17, 1.5**	**2, 0.2**
Soft tissue mallet finger (314)				
	47, 16	12.2, 2-18	26, 9	1, 1
Total	**47, 14.9**	**12.2, 2-18**	**26, 8.3**	**1, 0.3**
Fifth metatarsal fracture (1307)				
Zone 1 (Base)	44, 3.4	10.3, 0-65	18, 1.3	1, 0.1
Zone II (Jones)	26, 1.9	11.9, 1-82	13, 1.0	1, 0.1
Zone III (Shaft)	34, 2.6	12.5, 1-164	13, 1.0	2, 0.1
Total	**104, 8.0**	**11.4, 0-164**	**44, 3.4**	**4, 0.3**
Toe phalanx fracture (580)				
Hallux	8, 1.3	7.3. 0-32	3, 0.5	0, 0
Lesser toe	5, 0.8	4.9, 0-10	1, 0.2	0, 0
Total	**13, 2.2**	**8.5, 0-32**	**4, 0.7**	**0, 0**
Total	**298, 6.2**	**11.9, 0-164**	**132, 2.7**	**11, 0.2**

Table II: Attendances, time to attendance and surgical interventions after TTC direct discharge according to injury grade.

Radial head /neck fracture (1860)	Clinical assessment of ROM	48	Pain	24
	Displacement/comminution	31	Clicking	3
	Consideration for surgery	5	Reduced ROM	34
	Cast removal	8	Radial nerve paraesthesia	2
	Inadequate radiographs	25	Patient requested review	3
	No reason documented	23	Chronic elbow instability	1
			No reason documented	7
	Total	**140**	**Total**	**74**
Little finger metacarpal fracture (1621)	Clinical assessment of rotation /deformity	121	Pain	26
	Consideration for surgery	45	Deformity	14
	Inappropriate immobilisation	22	Patient requested review	8
	Inadequate radiographs	58	No advice sheet provided	2
	Patient request	2	No reason documented	10
	No reason documented	87		
	Total	**335**	**Total**	**60**
Mallet finger injury (370)	Clinical assessment	8	Pain	8
	No radiograph in ED	18	Residual deformity	30
	Splint application	2	Reduced ROM	4
	Consideration for surgery	2	Patient requested review	3
	No reason documented	11	No advice sheet provided	2
			No reason documented	1
	Total	**41**	**Total**	**47**
Fifth metatarsal fracture (1916)	Clinical assessment	65	Pain	75
	Risk of non-union	31	Delayed union	3
	Cast removal	8	Non-union	5
	Moonboot application	16	Problem with orthosis	9
	Consideration of surgery	7	Patient requested review	5
	Repeat radiographs	31	No reason documented	7
	No advice sheet provided	1		
	No reason documented	105		
	Total	**264**	**Total**	**104**
Toe phalanx fracture (920)	Clinical assessment	72	Pain	12
	Associated soft tissue injury	11	Patient requested review	1
	Consideration of surgery	9		
	Orthosis application	16		
	Repeat radiographs	25		
	Cast removal	1		
	No reason documented	37		
	Total	**171**	**Total**	**13**
Total	**Total 951**		**Total 298**	

Table III: Reasons for attendance at fracture clinic.

Surgical interventions

Surgical procedures were performed in 46 (0.7%) patients. In those triaged to fracture clinic review, 35 underwent surgery, five of whom had re-attended after discharge. Only 11 procedures were required after TTC direct discharge, giving a surgical intervention rate of 0.2%. Type and rates of surgical procedure according to injury and TTC triage outcome are shown in **Table IV**. Most of the acute surgical procedures were to address significant deformity or to excise bony fragments that might block forearm rotation. One patient developed a serious injury complication after TTC direct discharge: a 48-year-old man who initially was triaged as a minimally displaced Mason II radial head fracture. The patient was referred to the orthopaedic service by his General Practitioner four months later with a chronic elbow dislocation. Examination of the ED referral to the TTC described a simple fall, with no sensation of instability and innocuous-looking radiographs. Review of the presentation radiographs revealed that two anteroposterior projections had been performed; the first demonstrated a benign Mason II radial head fracture, but the second revealed a small bony fragment adjacent to the lateral epicondyle that probably represented an avulsion of the lateral ligament complex. The patient was successfully treated with open reduction and external fixator, with a stable but stiff elbow at final follow up one year later.

Surgical intervention		Surgeries after TTC referral to fracture clinic (n)	Surgeries after TTC direct discharge (n)
Radial head fracture			
Radial head excision		2	2
MUA to assess stability		1	0
Excision of bony fragment		0	1
Radial head replacement		1	0
Elbow stabilisation		0	1
	Total	**4**	**4**
Little finger metacarpal fracture			
Acute fixation		21	0
Delayed fixation		0	2
	Total	**21**	**2**
Mallet finger injury			
Distal interphalangeal joint fusion		0	1
	Total	**0**	**1**
Fifth metatarsal fracture			
Acute fixation		7	0
Fixation for delayed union/non-union		1	3
Excision malunited bone spur		1	1
	Total	**8**	**4**
Toe phalange fracture			
Hallux IPJ fusion for malunion		1	0
MUA & K-wire		1	0
	Total	**2**	**0**
Totals		**35** (0.5% of study group)	**11** (0.2% of study group)

Table IV: Surgical interventions in those patients triaged to trauma clinic review or direct discharge. Manipulation under anaesthetic (MUA), Interphalangeal joint (IPJ).

DISCUSSION

This is the largest study of any VFC system and has demonstrated a very low rate of re-intervention after direct discharge of simple pre-defined injures of the elbow, hand, and foot. In this retrospective review, 71.9% of injuries were directly discharged by the triaging consultant, and only 6% of this cohort sought further review. The mean time to trauma clinic review after TTC direct discharge was three months, with a surgical intervention rate of only 0.2%. Most of the surgical procedures would not have been eliminated by initial fracture clinic review unless a protracted period of observation was routinely employed. This large study provides longer-term outcome data to support the use of this system.

A single serious adverse event occurred after direct discharge of what on first appearance appeared to be an innocuous radial head fracture, but turned out to be an unstable elbow. Subsequent review of the records and discussion at the local morbidity and mortality meeting identified that two AP radiographs had been taken, one of which demonstrated a second, more important fracture. This had not been identified by the treating clinician in ED, or the reporting radiographer, and the patient had been referred as having suffered an innocuous radial head fracture. The second radiograph was then also missed at TTC resulting in an incorrect decision. This was felt to be a multiple-user error rather than a protocol failure. It is possibly as likely that the same mistake might have been made under a more traditional system of face-to-face review in clinic on the day after injury, with the same outcome after delayed re-presentation at four months. Nevertheless, we recommend that those performing triage are particularly vigilant regarding the subtle radiographic signs of soft-tissue instability, particularly at the shoulder, elbow, knee and mid-foot.

A small proportion of patients (14%) attended an in-person fracture clinic after TTC triage. This was an expected finding as the system is designed to allow review based on the consultant's interpretation of the injury, rather than a blanket policy of immediate discharge. While the TTC identified the majority of patients who underwent a surgical intervention (35 of 45, 78%), the rate of conversion to surgery from a TTC initiated clinic was only 3.7%. An iterative process of discussion within our consultant body has subsequently led to greater alignment of opinion as to which injury subtypes should be offered a fracture clinic appointment. In-person review for the injuries included in this study is now limited to those with unusually severe injuries or a high energy mechanism of injury. An additional resource available in the TTC process was the nurse practitioner phone call consultation, which saved

880 appointments (47 patients required an appointment after the phone call). Interestingly, no patient directed to an initial nurse practitioner phone call consultation required intervention, confirming that this is generally deployed in less severe injuries. However, the fact that no injuries contacted in this manner required surgery may indicate that the phone call consultations were overprescribed. This resource is now limited to referrals that have had an inadequate clinical or radiographic assessment in ED, to convey specific off-protocol instructions, or to offer additional support to vulnerable individuals.

A simple google search using the terms “virtual fracture clinic UK” identifies no fewer than 14 bespoke websites or pages for patients based in the United Kingdom, many with details of direct discharge protocols. [9-22] The issue of unnecessary patient contact has never been more important than during the COVID-19 pandemic. In the last 18 months, the incentive to reduce in-person review has changed from a desire to optimise outpatients service to one of patient safety. [23-25] The pandemic will undoubtably change orthopaedic outpatient services in the long term with the wider adoption, and expansion, of TTC review and direct discharge protocols. Despite the reported success of these systems, the current literature regarding patient outcome and re-intervention rates is restricted to studies with small patient numbers and short term follow up, with limited ability to detect complications of low incidence. **Table V** summarises the evidence and details injury type, patient number, follow up and primary outcome. [1, 29-34] Seven studies have focussed on the outcomes of specific injury types, and all report favourable outcomes and patient satisfaction. These data have been summarised in three recent systematic reviews with each espousing the benefit to both patients and health care systems through the reduction of unnecessary in-person reviews, while simultaneously preserving patient safety and reducing cost. [26-28] Initially there had been concerns that limited in-person review after direct discharge would result in an increased rate of repeat presentation to the ED. However, Vardy et al in 2014 reported that no demonstrable increase in ED team workload was evident after the introduction of the Glasgow VFC system. [3] This is supported by the present study where only 24 (0.5%) of patients attended the ED with the same injury twice, with the majority (53%) of fracture clinic attendances after direct discharge coming via the TTC hotline.

The injury that received the highest proportion of in person reviews was little finger metacarpal fractures. One fifth (335 of 1621) of patients with this injury were reviewed in person, 49% (146 out of 335) of whom were recalled to assess for rotation / deformity or to consider surgery. Despite the high rate of review only 21 patients (1.3%) underwent acute fixation. This suggests

that rotational deformity is an uncommon complication of these injuries and demonstrates the safety nets in place within the TTC system.

Authors (Year)	Level of Evidence	Injury/fracture	Patients, (n)	Follow up (months)	Outcome
Brogan et al. (2017) [29]	III	5th Metatarsal	638	6	Intervention: 1.3% overall non-union, 1 surgical intervention
Brooksbank et al. (2014) [30]	III	Mallet Finger	36	10	PROMS: QDASH (mean 2.3) Satisfaction rate: 100%
Ferguson et al. (2018) [31]	III	5th Metatarsal	339	12	Satisfaction: 78%
Gamble et al. (2015) [32]	III	5th Metacarpal	98	22	PROMS: EQ-5D (median 0.87); QDASH (median 2.3) Satisfaction rate: 85%
Jayaram et al. (2014) [33]	IV	Radial head & neck	202	NR	Satisfaction rate: 87%
Mackenzie et al. (2018) [1]	III	Radial head & neck 5th Metacarpal 5th Metatarsal	114 88 87	36	Satisfaction rate: 98%
O'Reilly et al. (2019) [34]	III	Simple 5th Metatarsal Simple 5th Metacarpal Simple Clavicle Simple Radial head Torus fracture Soft tissue mallet finger	2704	NR	Satisfaction rate: 97%

Table V: Summary of published studies examining outcomes and satisfaction.

One area of particular interest prior to this study was the potential of the TTC to miss non-union of the fifth metatarsal, particularly zone II or Jones fractures. This injury is the most represented in the previous VFC outcome studies with a total over 1065 patients reported in the four published studies. [1,29,31,35] All reported satisfactory outcomes, however, the relatively short-term follow-up employed in each paper limited the ability of the authors to comment on rates of intervention for non-union. Brogan et al published the largest single review of fifth

metatarsal fractures reviewed in a VFC system. [29] They reported on 638 fifth metatarsal fractures (251 zone I, 111 zone II, and 276 zone III) with a minimum of six months follow-up, stating a 7% non-union rate in the Jones' fracture cohort (zone II) and only one of eight patients undergoing surgical intervention. Our study includes almost twice as many fifth metatarsal fractures as all the other papers combined (1916 vs 1065) with three times as many Jones fractures as the largest single publication (397 vs 111) and with follow up at least 30 months longer. The true rate of non-union cannot be defined from our data as patients were not routinely followed to union, however, by searching the national radiographic archive we are confident of having identified those patients with symptoms sufficiently intrusive to seek medical evaluation. Our study offers a symptomatic non-union rate of 0.1% in this large cohort of patients managed with early mobilisation in a walking orthosis without follow up.

The strengths of this study include the large number of patients with a minimum of three years follow up. Screening the national radiograph archive improved follow up by identifying those patients who re-presented out with our own region. However, patients who attended centres in other countries or in the private healthcare sector would have been missed. The main limitations are the retrospective design and the lack of radiographic or patient reported outcomes. The large numbers and the relatively benign nature of the injuries included would not allow for routine radiographic assessment in all patients to ensure union. However, patient reported outcomes would have offered greater insight into patient recovery and the potential to identify individuals with complications who had not sought medical attention.

This study demonstrates the mid-term outcomes of TTC direct discharge in the management of simple injuries of the hand, elbow and foot. A large cohort of patients were managed successfully without face-to-face contact with an orthopaedic surgeon, only a small proportion sought review, and an even smaller number required surgical intervention. A single adverse event occurred due to an error in handling radiographs perpetuated at several stages in our system and emphasises the need for vigilance during clinical review of radiographs and records in all settings.

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