SCOOTT Trial Protocol

Full title: Surgery versus Conservative OsteOarthritis of Thumb Trial (SCOOTT): An RCT to determine clinical and cost effectiveness of treating arthritis of the base of the thumb, with or without surgery, and to determine the clinical and cost effectiveness of trapeziectomy versus base of thumb joint replacement

Short title: Surgery versus Conservative OsteOarthritis of Thumb Trial (SCOOTT)

Protocol version: 1.1 dated 19/08/2025

Trial registration:

ISRCTN number: 76656598

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REC reference: 24/WA/0237

Funder: This study was funded by the National Institute for Health and Care Research (NIHR) Health Technology Assessment (HTA) Programme (Reference: NIHR154694)

Sponsor: South Tees Hospitals NHS Foundation Trust

This protocol has regard for the HRA guidance.

Signature Page

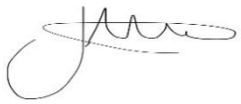
The undersigned confirm that the following protocol has been agreed and accepted and that the Co-Chief Investigators agree to conduct the trial in compliance with the approved protocol and will adhere to the principles outlined in the GCP guidelines, the Sponsor's (and any other relevant) SOPs, and other regulatory requirements as amended.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the clinical investigation without the prior written consent of the Sponsor.

I also confirm that I will make the findings of the trial publicly available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the trial will be given; and that any discrepancies and serious breaches of GCP from the trial as planned in this protocol will be explained.

For and on behalf of the Trial Sponsor:

Signature: Date: 01.10.2025



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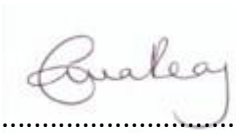
Position: Sponsor and Governance Manager

Co-Chief Investigators:

Signature: Date: 01.10.2025



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Name: Ms Emma Reay

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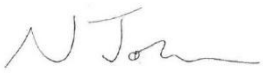

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Trial Contacts, Roles and Responsibilities

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	Trial Management Group: *Chair*: Ms Emma Reay / Mr Nick Johnson	

Table 2: Other Co-applicants

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Mrs Victoria Jansen University Hospitals of Derby and Burton NHS Foundation Trust	**Professor Catherine Hewitt** University of York
Mr Jack Allport Northumbria Healthcare NHS Foundation Trust	**Dr Lucksy Kottam** Academic Centre for Surgery, South Tees Hospitals NHS Foundation Trust
Professor Avril Drummond Loughborough University	**Mr Christopher Coapes** South Tees Hospitals NHS Foundation Trust
Dr Alexia Karantana The University of Nottingham	**Mrs Nicola Crampton** Public contributor

Abbreviations and Glossary

AE	Adverse event
API	Associate principal investigator
APR	Annual progress report
AUSCAN	Australian Canadian Osteoarthritis Hand Index
BAHT	British Association of Hand Therapists
BOA	British Orthopaedic Association
BSSH	British Society for Surgery of the Hand
BTOA	Base of thumb osteoarthritis
CCA	Complete case analysis
CDC	Centres for Disease Control
CEAC	Cost-effectiveness acceptability curves
CI	Chief investigator
CMCJ	Carpometacarpal joint
CMCJR	Carpometacarpal joint replacement
CONSORT	Consolidated Standards of Reporting Trials statement
CRF	Case report form
CVA	Cerebrovascular accident
DMC	Data monitoring committee
EDI	Equality, diversity and inclusion
ENGAGE	Enhanced Non-surGical management
EOI	Expression of interest
EQ-5D-5L	EuroQol 5 dimensions 5-level score
GCP	Good clinical practice
GDPR	General data protection regulation
HEAP	Health economics analysis plan
HES	Hospital episode statistics
HRA	Health Research Authority
HPI	Hand pain index
HTA	Health technology assessment
IRAS	Integrated Research Application System
ISF	Investigator site file
ISRCTN	International Standard Randomised Controlled Trial Number
ITT	Intention-to-treat
MCID	Minimal clinically important difference
MHRA	Medicines and Healthcare Regulatory Authority
MI	Myocardial infarction
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health and Care Research
OA	Osteoarthritis
ONS	Office for National Statistics
PEM	Patient evaluation measure
PI	Principal investigator
PiiAF	Public Involvement Impact Assessment Framework
PIS	Patient information sheet
PPI	Patient and Public Involvement
PPIE	Patient and public involvement and engagement
PROM	Patient reported outcome measure
PSEQ-2	Pain Self-Efficacy Questionnaire - 2 item
PSS	Personal social services

QALYs	Quality-adjusted life years
RCS	Royal College of Surgeons
RCT	Randomised controlled trial
REC	Research ethics committee
REDCap	Research electronic data capture
SCOOTT	Surgery versus Conservative OsteOarthritis of Thumb Trial
SAE	Serious adverse event
SAP	Statistical Analysis Plan
SIV	Site initiation visit
SOP	Standard operating procedures
STT	Scaphotrapeziotrapezoid
TMF	Trial Master File
TMG	Trial Management Group
TSC	Trial steering committee
UK	United Kingdom
UKHR	UK Hand Registry
VTE	Venous thromboembolism
YTU	York Trials Unit

Contents

List of Tables

List of Figures

Amendment History/Changes from Previous Version

Table 3: Amendment History

Amendment Number	**Revised Protocol Version Number and Date**	**Details of key changes made** *(including justification if required)*
NA (Change from Detailed Project Description)	1.0 dated 21/05/2024	**Eligibility Criteria:** Adult defined as patient aged ≥16 years. Several exclusion criteria have been reworded as inclusion criteria to reduce ambiguity when applied in practice. **Outcome measures:** PSEQ-2 added to patient reported outcome measures (PROMs) at all questionnaire timepoints. **Ensuring equality, diversity and inclusion:** Study materials will not be translated into other languages. The ENGAGE therapy package developed for the trial needs to be tested in English speaking patients before it can be translated into other languages.
Non-Substantial Amendment 6	V1.1 dated 19/08/2025	**Signature page/Trial Contacts:** Contact details have been updated for the trial sponsor, qualitative researcher, statisticians and a co-ap. **Eligibility Criteria:** 'treating clinician' has been changed to 'clinician' in the eligibility criteria to avoid the confusion that only the treating clinician can confirm eligibility. **4.6.2 ENGAGE** Clarification has been added to confirm who can deliver the ENGAGE package and the training required. Details added to how adherence to the ENGAGE package will be monitored and what the essential elements are **4.10.1 Recruitment Optimisation:** Information from decliner sites will now be gathered through discussions rather than telephone interviews. **4.11.1 Recruitment Strategy** Recruitment numbers updated to be in line with the pilot figures for progression. **4.12 Screening and Recruitment** Clarity has also been added to confirm any clinician who can list patients for surgery can confirm eligibility.

		Clarified that patients may be re-screened in future as appropriate Clarified that patients who contact the SCOOTT team directly can be recruited via a referral to their nearest SCOOTT participating trust. **4.13 Informed Consent:** Clarify that patients who initially decline to take part in the study but would like to reconsider can be re-approached if appropriate. **4.1.6 Participant payment:** Patient vouchers will be emailed or posted out rather than given to them in person. **5.5.1 Method of randomisation:** This paragraph has been deleted as it repeats details given in 4.14 Randomisation and enrolment procedure **7.4 Participant confidentiality:** Updated wording to reflect that primarily records will be electronic **12 References:** Reference number 61 has been updated to a more relevant reference.

Trial Synopsis

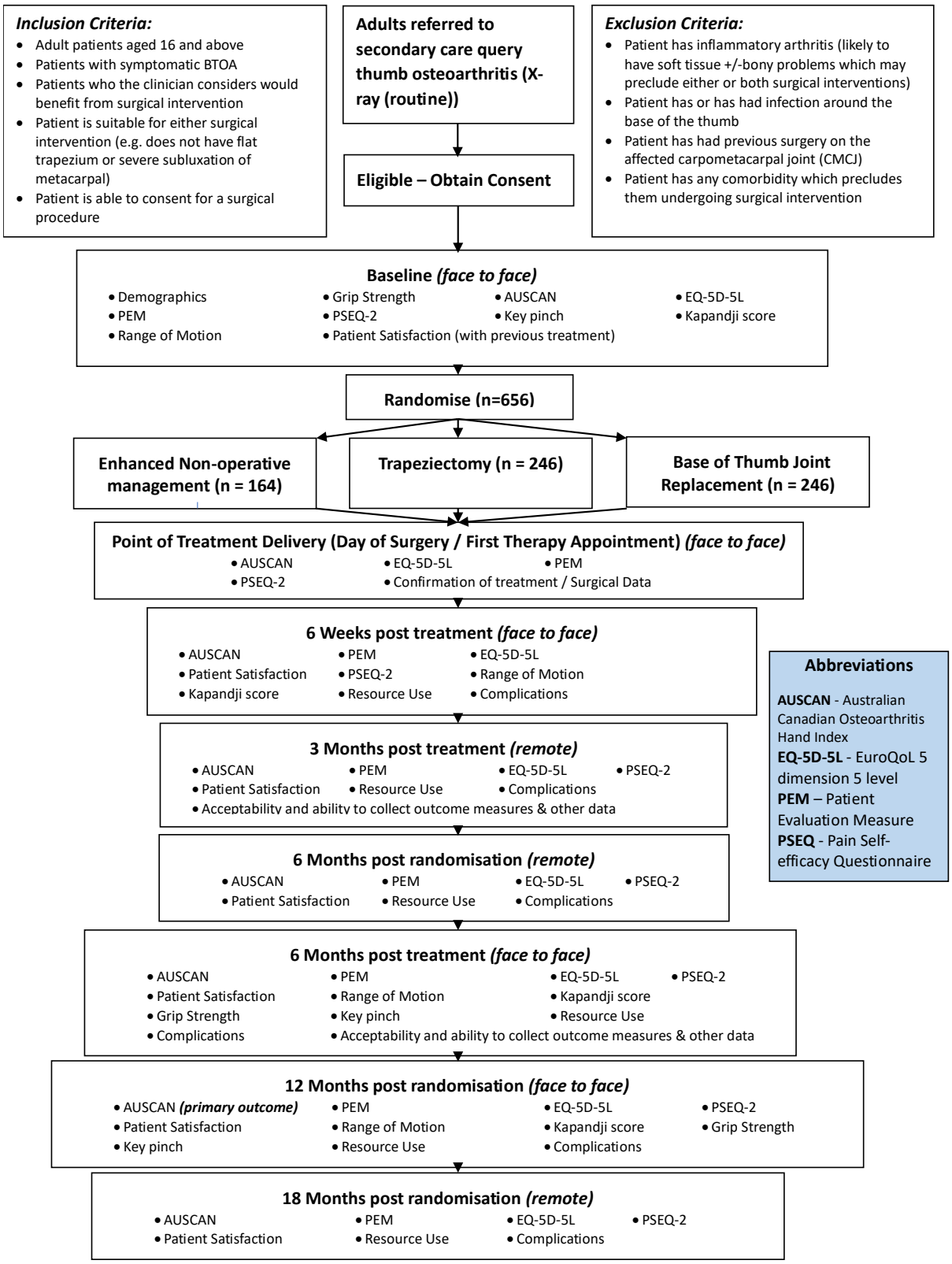
Table 4: Trial Synopsis

Acronym	SCOOTT
Long Title	Surgery versus Conservative OsteOarthritis of Thumb Trial (SCOOTT): A randomised controlled trial to determine the clinical and cost effectiveness of treating arthritis of the base of the thumb, with or without surgery, and to determine the clinical and cost effectiveness of trapeziectomy versus base of thumb joint replacement.
Type of Trial	Non-CTIMP
Study Design	Multi-centre, superiority and non-inferiority three-arm randomised controlled trial (RCT) with an internal pilot, economic evaluation and nested qualitative study.
Setting	20 secondary care NHS sites, offering hand surgery and therapy services representing diverse populations across the UK.
Target Population	Adults with symptomatic base of thumb osteoarthritis (BTOA) who may benefit from surgery according to the clinician
Intervention	Trapeziectomy, carpometacarpal joint replacement (CMCJR)
Control	Enhanced Non-surGical manAGEment (ENGAGE)
Primary Outcome	The Australian Canadian Osteoarthritis Hand Index (AUSCAN) at 12-months post-randomisation
Secondary Outcomes	Pain (AUSCAN) at other time points to 18 months, hand function and stiffness index (AUSCAN), grip strength, key pinch and span (measurement of function of thumb), range of thumb movement, Kapandji score (measurement of thumb range of movement), Patient Evaluation Measure (PEM) score, health-related quality of life (EQ-5D-5L), pain self-efficacy questionnaire – 2 item (PSEQ-2), patient acceptability (qualitative and global question), health and social care resource use and complications.
Estimated Recruitment Period	24 months
Duration per Patient	18 months
Estimated Total Trial Duration	54 months (January 2024 – June 2028)
Planned Trial Sites	Up to 20
Planned Sample Size	656 (Randomisation 3:3:2 basis to receive Trapeziectomy, CMCJR or ENGAGE)

Main eligibility Criteria	**Participant Inclusion Criteria** • Adult patients aged 16 and above • Patients with symptomatic BTOA • Patients who the clinician considers would benefit from surgical intervention • Patient is suitable for either surgical intervention (e.g. does not have flat trapezium or severe subluxation of metacarpal) • Patient is able to consent for a surgical procedure **Participant Exclusion Criteria** • Patient has inflammatory arthritis (likely to have soft tissue +/- bony problems which may preclude either or both surgical interventions) • Patient has or has had infection around the base of the thumb • Patient has had previous surgery on the affected carpometacarpal joint (CMCJ) • Patient has a comorbidity which precludes them undergoing surgical intervention

Trial Flow Chart

Figure 1: Trial Flowchart



Study Assessment Schedule

Table 5: Study Assessment Schedule

Assessment	Baseline[1]	Randomisation	Day of Surgery / Therapy	6 Weeks PT	3 Month PT	6 Month PT	6 Month PR	12 Month PR	18 Month PR
Mode of Visit	*face-to-face*		*face-to-face*	*face-to-face*	*remote*	*face-to-face*	*remote*	*face-to-face*	*remote*
Allowed variation in days				+/- 7 days	+/- 14 days	+/- 14 days	+/- 14 days	+/- 14 days	+/- 14 days
Eligibility Screen	X								
Informed Consent	X								
Demographics	X								
Randomisation		X							
Surgical Data			X						
Confirmation of Treatment				X					
AUSCAN	X		X	X	X	X	X	X	X
PEM	X		X	X	X	X	X	X	X
EQ-5D-5L	X		X	X	X	X	X	X	X
PSEQ-2	X		X	X	X	X	X	X	X
Patient Acceptability	X			X	X	X	X	X	X
Range of Motion	X			X		X		X	
Kapandji	X			X		X		X	
Grip Strength	X					X		X	
Key pinch	X					X		X	
Resource Use	X		X[2]	X[2]	X[2]	X[2]	X	X	X
Complications				X	X	X	X	X	X

[1] Baseline measures will be collected prior to randomisation

[2] Resource use collected from hospital records only

Note: PT = post treatment, PR = post randomisation

1. Background and rationale

1.1 General Introduction

BTOA is a common condition with a radiographic prevalence of 21% by age 40 years and 45% by age 80 years [1, 2]. BTOA causes significant morbidity in this large population. Symptoms include pain, tenderness and stiffness. People with BTOA experience difficulty with essential 'pinching' tasks such as writing, dressing and opening packets because the greatest load is taken through the basal thumb joint during these activities [3]. There are a variety of non-surgical and surgical treatments available for BTOA. If non-surgical treatment fails, then surgical options can be offered: trapeziectomy (the most common surgical treatment) and CMCJR [4]. However, there is a lack of high-quality trial evidence comparing these currently used treatment options.

1.2 Rationale and Justification for the Study

This topic is a research priority highlighted by the Royal College of Surgeons (RCS) and the James Lind Alliance priority setting Partnership for Common Condition of the Hand and Wrist with the British Society for Surgery of the Hand (BSSH) [5]. We held discussions with ten patient and public involvement (PPI) contributors with BTOA who were treated non-surgically and surgically. Our PPI group reported their condition affected all aspects of life and was physically and mentally draining; we exchanged ideas about the condition, treatment options, recovery and which outcomes were most important to them.

The National Institute for Health and Care Excellence (NICE) guidelines advocate a stepped care approach for BTOA starting with non-surgical treatment progressing to surgery [6]. However, only 21 to 45% of patients referred to secondary care have received non-surgical management and this treatment is variable [7]. Our audit of referrals demonstrated similar findings with only 39% of patients having undergone any non-surgical management (Jansen, unpublished).

We conducted a survey of hand surgeons at 20 National Health Service (NHS) Trusts. This confirmed the variation in current availability and adequacy of non-surgical management for patients with BTOA. Only 66% of patients had received any form of non-surgical management at presentation to secondary care and only 30% of surgeons felt this treatment option was adequate. Of the clinicians surveyed, 30% already use CMCJR in patients with BTOA and 70% of the hand surgeons surveyed would consider expanding their practice to include CMCJR. Currently there is no high-quality evidence to support the use of CMCJR over the established surgical treatment of trapeziectomy despite rapidly increasing numbers of centres and surgeons in the United Kingdom (UK) offering CMCJR. Over 500 CMCJR implants were purchased by UK NHS Hospitals in 2021. However, these implants are not as yet required to be registered on the National Joint Registry and there is therefore no formal repository of outcomes. 80% of hand surgeons surveyed would recruit to a trial which compares trapeziectomy with CMCJR.

Evidence explaining why this research is needed now

Which Surgical Procedures to Compare?

Trapeziectomy is a simple and effective procedure. As it is the most commonly performed surgical procedure for BTOA, it should be included as an arm in the trial. It has been shown to improve function and quality of life in previous RCTs and is routine clinical practice in the UK [8, 9]. However, recovery time after trapeziectomy is lengthy and can take up to a year [10]. Only 75% of patients who undergo trapeziectomy would have the procedure again [11].

CMCJR is increasingly being carried out in the UK. A systematic review in 2015 reported variable outcomes with some good long-term results, but also some studies showing a high failure rate [12]. Since then, newer implants have been developed using similar designs to hip replacements [13]. Mid to long term studies of the newer implants are now being published with low complication rates and excellent functional outcome, improved pinch strength and good patient satisfaction [14-16]. Ten-year implant survival of 93% and 95% has also been reported [17, 18]. Comparative studies and a small RCT comparing CMCJR with trapeziectomy have shown faster recovery of function with CMCJR [19-21]. In addition, patients prefer the appearance of their thumb after CMCJR as compared to trapeziectomy [20]. Although a recent meta-analysis suggested that CMCJR may provide quicker improvement in function and better mid to long term function, pain relief and strength than trapeziectomy, it was noted there was a higher risk of complications [22]. Consequently, there is still a need for high quality evidence to establish whether CMCJR is as effective and cost effective as trapeziectomy.

Over 29 hospitals in the UK now routinely offer CMCJR for BTOA and this is increasing, and therefore the timing is appropriate to include this as a treatment arm in a trial. Moreover, our PPI group felt it

was important to include CMCJR in a RCT, especially as hip and knee replacements are very common; they would be happy to participate in such a trial. In our clinician survey, 70% of surgeons supported CMCJR being included in the trial and they would be prepared to randomise patients to it.

Superiority or non-inferiority?

Non-surgical treatment can involve analgesic and/or anti-inflammatory medicines, education, exercise, splints and steroid injections. However, although this can be delivered in a consistent, evidence based, effective package [23], current delivery varies considerably across NHS centres. A systematic review of RCTs of non-surgical treatments for BTOA concluded high quality evidence shows physical therapy treatments can result in clinically important improvements in pain and function [24]. As such, clinicians (supported by our surgeon survey) and PPI representatives agree that for patients to undergo a trapeziectomy or CMCJR with the risk of complications and high healthcare resource use, surgery must be superior to non-surgical treatment in terms of patient reported pain relief and function. Therefore, we have powered the study on the basis of superiority between surgical and non-surgical treatment. An enhanced package of care (ENGAGE) will combine both an evidence-based package of education and exercise [23] with education in pain coping strategies. This approach has not been used specifically in hand osteoarthritis (OA) before but has been effectively used in arthritis [25] and is an important component of the successful ESCAPE-pain programmes for knee and hip OA [23, 26, 27]. Where there is variation, standardising the non-surgical care pathway has been shown to be effective [28, 29]. Our literature review has suggested differing advantages and disadvantages of trapeziectomy versus CMCJR [1, 3, 11, 13, 15, 30-35].

CMCJR surgery costs more than trapeziectomy but requires less hand therapy rehabilitation. Our PPI group reported trapeziectomy as being 'horrifically painful'. Given the potential benefits of CMCJR over trapeziectomy, a direct comparison of the two procedures is required to establish whether CMCJR is at least as effective as a trapeziectomy and is cost effective. Therefore, we have powered the study to assess non-inferiority between the two surgical arms.

1.3 Risks and Benefits of Surgical intervention

Both surgical interventions will have the general surgical risks of wound infection, haematoma, bleeding, wound healing problems, damage to the adjacent structures such as nerves, blood vessels and tendons. Further key complications associated with the surgical interventions are infection, dislocation, complex regional pain syndrome and pain and thumb weakness.

Risks to participants from either surgical treatment are not increased through trial participation. Measures, such as our emphasis on good practice and standardised protocols/care pathways throughout, are likely to reduce risk and could bring additional benefits.

In the unlikely event that new information arises during the trial that may affect participant's willingness to take part, the Trial Steering Committee (TSC) will review this information to determine whether changes are required to the patient information leaflet. A revised consent form will also be produced if necessary.

Trial staff will be asked to report unexpected events they become aware of during the study. Reporting procedures will be made clear during the training and will be contained in site files for all those involved in the study.

1.4 Risks of Trapeziectomy

Trapeziectomy is a predictable procedure with mainly good outcomes. Long term revision rate is less than 5% [36-39]. Specific complications include subsidence of the thumb metacarpal, instability, weakness, tendonitis and untreated arthritis of adjacent joints. Excision of the trapezium can cause the thumb metacarpal to subside proximally into the space previously occupied by the trapezium.

This can lead to pain and weakness with the thumb metacarpal impinging against the scaphoid or trapezoid. Some surgeons perform soft tissue procedures with the aim of preventing impingement using tendons to suspend the thumb metacarpal or as interposition material. There is no evidence that this improves outcome [40, 41]. Suspensionplasty using the Flexor Carpal Radialis tendon can cause tightening of the tendon leading to painful tendonitis [42]. Untreated arthritis at the scapho-trapezoid joint may cause ongoing pain or develop later.

1.5 Risks of CMCJR

Complication and revision rates for CMCJR are higher than for trapeziectomy [43]. Historically dislocation rates were high but recent evidence suggests the dislocation rate of new, dual mobility implants is much lower [16, 44]. Early dislocation is often due to technical error. Loosening of the implant or implant failure may occur. This may be due to technical error or bone quality if it occurs early. Longer term loosening is related to wear leading to an inflammatory reaction causing bone loss and loosening. Ten-year modern implant survival rate is reported as 93-95% [45]. Lengthening of the thumb with CMCJR can lead to De Quervains tenosynovitis in up to 18% of patients [46, 47]. Fracture may occur due to trauma or intra-operatively. Fractures while reaming and inserting the implant are more common at the trapezium due to its relative fragility. CMCJR does not directly treat the scaphotrapeziotrapezoid (STT) joint. Arthritis at the STT joint could cause ongoing pain after CMCJR and to some surgeons it is a contraindication to the procedure. Many surgeons now believe CMCJR unloads the STT and it should not be a contraindication [48, 49].

1.6 Risks of Enhanced Non-Surgical Management (ENGAGE)

Risks from non-surgical treatment are likely to be extremely low. Complications that might occur are minor e.g. temporary increased pain after doing exercises; the enhanced pain coping skills are not expected to carry any risks. A large study with 349 participants comparing splints and self-management for BTOA reported ten adverse events which were mostly related to hand pain after carrying out exercises [23]. There were eight splint deficiencies related to wear and tear. Some patients may undergo a steroid injection for pain. Possible complications include skin changes, steroid flare, infection and systemic effects. A large study of over 19,000 patients undergoing an intra-articular steroid injection for BTOA reported a risk of serious complications of 0.04% within 90 days [9].

1.7 Potential Benefits

Within the trial, participants allocated to trapeziectomy may experience benefit through fewer complications than those allocated to CMCJR, though the purpose of the study is to provide evidence regarding this.

Within the trial, participants allocated to CMCJR may experience benefit through earlier recovery and return to work, than those allocated to trapeziectomy, though the purpose of the study is to provide evidence regarding this.

Within the trial, participants allocated to receive the ENGAGE therapy may experience benefit through not being exposed to the risks associated with surgery and the associated inconvenience for the patient.

2. Aims and Objectives

2.1 Aim

The aim of this multi-centre, randomised three arm trial is to answer two important questions:

1) Is surgery (trapeziectomy or CMCJR) superior to enhanced non-surgical management?

2) Is CMCJR non-inferior to trapeziectomy?

2.1.1 Primary Null Hypothesis

1) There is no difference in the AUSCAN score at 12 months post randomisation between adults (≥16 years old) with BTOA treated with surgery versus non-surgical management.

2) CMCJR is inferior to trapeziectomy for the treatment of BTOA in adult patients (≥16 years old) as measured by the AUSCAN score at 12 months post randomisation.

2.2 Objectives

The trial objectives are presented in Table 6.

Table 6: Trial Objectives

Objectives	Outcome measures	Timepoint(s)
Primary objective:		
To quantify and draw inferences on observed differences in pain, as measured by the AUSCAN hand pain index between treatment groups at 12-months post-randomisation	AUSCAN	12 months PR
Secondary Objectives: Comparison between the three groups of:		
Hand function	AUSCAN hand function and stiffness index PEM	Baseline, day of surgery/therapy, 6 weeks PT, 3 months PT, 6 months PT, 6 months PR, 12 months PR, 18 months PR
Pain at other time points	AUSCAN, PSEQ-2	Baseline, day of surgery/therapy, 6 weeks PT, 3 months PT, 6 months PT, 6 months PR, 12 months PR (PSEQ-2), 18 months PR
Range of motion	Kapandji score Goniometry	Baseline, 6 weeks PT, 6 months PT, 12 months PR
Grip and pinch strength	Jamar dynamometers	Baseline, 6 months PT, 12 months PR
Healthcare and broader resource implications and comparative cost effectiveness	Participant self-report and hospital completed forms	Baseline, 6 weeks PT, 3 months PT, 6 months PT, 6 months PR, 12 months PR, 18 months PR
Health related quality of life	EQ-5D-5L	Baseline, day of surgery/therapy, 6 weeks PT, 3 months PT, 6 months PT, 6 months PR, 12 months PR, 18 months PR

Patient acceptability	Qualitative	Qualitative interview during follow-up period
	Global question	day of surgery/therapy, 6 weeks PT, 3 months PT, 6 months PT, 6 months PR, 12 months PR, 18 months PR
Complications	Complications and adverse event data	6 weeks PT, 3 months PT, 6 months PR, 12 months PR, 18 months PR

Note: PT = post treatment, PR = post randomisation

3. Trial Design

The trial objectives will be addressed using a multi-centre, superiority and non-inferiority three-arm RCT with an internal pilot, economic evaluation and nested qualitative study. The study has a total 24-month recruitment period, including an internal pilot phase of 12 months at the start followed by the main recruitment period. Recruitment will take place at up to 20 participating NHS Trusts.

Following randomisation, all participants will be followed up for 18 months. This includes five face-to-face clinic visits for data collection at baseline, the day of surgery/start of therapy, six weeks post-treatment, 6-months post-treatment and 12-months post-randomisation. It also includes three remote follow-up visits at 3-months post-treatment, 6-months post-randomisation and 18-months post-randomisation. Visits should align with standard care visits where possible.

Participants will be asked to self–report outcome data via completion of questionnaires at baseline, 6-weeks, 3-months and 6-months post treatment and 6-, 12- and 18-months post randomisation either online or by post or telephone, as per the study flow chart (Figure 1) and schedule of assessments (Table 5).

3.1 Pilot Study

We will undertake a 12-month internal pilot study to test our assumptions about recruitment to confirm whether the trial is feasible to deliver. Table 7: Progression Criteria for Internal Pilot over a 12 Month Duration. Table 7 provides details of the internal pilot progression criteria.

The internal pilot will be reviewed by the Data Monitoring Committee (DMC), the TSC and the funder to determine whether the study progresses to the full trial.

Screening data will be kept by participating centres throughout the trial. We will collect data on the: number of eligible patients; eligible patients approached for consent; eligible patients not approached and reasons why; patients approached who provide consent; patients approached who do not provide consent and reasons why; patients providing consent who are not randomised. We will also collect data on the number of patients randomised who do not receive the randomly allocated treatment and reasons why.

Table 7: Progression Criteria for Internal Pilot over a 12 Month Duration

Progression Criteria	Target	Green	Amber	Red
Site setup	10 sites set-up	100% (10)	60 to 99% (6-9)	<60% (<6)
Participant recruitment	134 participants recruited	100% (134)	60 to 99% (80-133)	<60% (<80)
Recruitment rate per site per month	Average of 2 participants recruited per site per month	1.7	1 to <1.7	<1

4. Methods

4.1 Participants

Adults with symptomatic BTOA who have been referred to secondary care and who the clinician considers may benefit from surgery.

4.2 Study Setting

Patients will be recruited from 20 secondary care NHS sites, offering hand surgery and therapy services representing diverse populations across the UK.

A list of all study sites will be maintained by the trial management team and held in the trial master file.

4.3 Selection of Patients

Eligible individuals, usually present to primary care due to BTOA causing pain and loss of function. Initial treatment in primary care follows a stepwise approach of non-surgical measures, with referral to a hand surgeon for consideration of surgery when significant BTOA symptoms persist despite non-surgical management. At a consultation with a hand surgeon, we will identify and screen potentially eligible patients. All adult patients who present to or who are already being seen in a hand surgery clinic in secondary care, for further treatment of their BTOA, who the clinician thinks would benefit from surgical intervention, will be screened against the eligibility criteria. All those who meet all inclusion criteria and none of the exclusion criteria will be invited to participate and their consent obtained. The patient is likely to have already received some of the following; oral or topical analgesia, splintage, and/or community based rehabilitation. Screening data will be recorded in REDCap (Research Electronic Data Capture) to document the reasons for patient exclusions and refusal to take part. The consent will be taken by trained staff, either research nurses/practitioners or clinicians.

4.4 Ensuring equality, diversity and inclusion for study participants

Our comprehensive equality, diversity and inclusion (EDI) strategy will be informed by the NIHR INCLUDE roadmap [50, 51]. Key issues pertaining to EDI relevant to this research will be addressed within all components of the trial design, delivery and dissemination. In particular, at study set up, an Equality Impact Assessment will be conducted to ensure all patients have an equal opportunity to take part. We have chosen our 20 sites to ensure diversity and to reach underserved populations in our research. As part of the site initiation visit, equipoise and equality training will be delivered. Sites will be selected based on feasibility of trial delivery and geographical location. Participant diversity will be monitored throughout the trial.

During the project set up phase, we will convene a meeting of the research team (representing orthopaedic surgery, hand surgery, physiotherapy, occupational therapy, and trial methodology) to

discuss the 'Questions to guide research teams in designing inclusive research', as suggested in the NIHR INCLUDE roadmap[51]. We consider this meeting as one of the first steps in our approach to EDI, which will be regularly revisited throughout the duration of the project by the research team, supported by the PPI. EDI will be included as a standard agenda item at our trial management group (TMG) meetings. In this research we aim to align our study participants (both the trial and the nested qualitative study) to the population the research will serve i.e., those who are eligible for surgery for BTOA. We have also incorporated strategies to enhance representation of the underserved populations within this patient group through a combination of i) site selection, ii) our methods of approach and information provided to potential participants, and iii) through use of a variety of data collection formats (e.g. electronic, paper and telephone) to maximise retention rates by addressing the preferences of trial participants. Our initial approach will be to monitor the characteristics of those who are randomised, compare these to those who decline to consent and compare this to the background clinical population. Any under-representation will be considered on a site-by-site basis and, where appropriate, (and with insight and advice from PPI members and organisations including Centre for Black and Minority Ethnic Health), we will seek to introduce strategies to optimise EDI participation. Examples may include the requirement for translation/interpretation services, producing materials appropriate for individuals with low literacy or learning disabilities or recruiter training.

We have selected the AUSCAN as the primary outcome measure, which has multiple benefits from an EDI perspective as it has been shown to have validity for use across different population subgroups [52].

4.5 Eligibility Criteria

4.5.1 Participant Inclusion Criteria

- Adult patients aged 16 and above
- Patients with symptomatic BTOA
- Patients who the clinician considers would benefit from surgical intervention
- Patient is suitable for either surgical intervention (e.g. does not have flat trapezium or severe subluxation of metacarpal)
- Patient is able to consent for a surgical procedure

4.5.2 Participant Exclusion Criteria

- Patient has inflammatory arthritis (likely to have soft tissue +/-bony problems which may preclude either or both surgical interventions)
- Patient has or has had infection around the base of the thumb
- Patient has had previous surgery on the affected carpometacarpal joint (CMCJ)
- Patient has any comorbidity which precludes them undergoing surgical intervention

Bilateral BTOA will not be an exclusion. A 'study thumb' will be determined by the clinician in conjunction with the patient. Patients will not be allowed to enter the trial more than once (e.g. if referred for treatment of the alternate (non-study) thumb.

4.5.3 Co-Enrolment

We will not exclude participants who are enrolled in any other study that allows co-enrolment provided that there is no direct conflict between the two studies or likely influence on the outcome of the SCOOTT study.

4.6 Interventions

Eligible and consenting participants will be randomly allocated, on a 3:3:2 basis to receive trapeziectomy, CMCJR or ENGAGE.

Patients allocated surgery will undergo standard surgical intervention and rehabilitation according to the usual practice of treating surgeons and therapy teams. ENGAGE is a package of evidence-based interventions designed to be comprehensive and deliverable.

4.6.1 Surgical Treatment

Both surgical treatments are typically performed as day case procedures and can be performed under general anaesthesia, regional anaesthesia or local anaesthesia depending on surgeon and patient choice. Both trapeziectomy and CMCJR require post operative review and rehabilitation (see section 4.7).

4.6.1.1 Trapeziectomy

This will be performed as per the treating surgeon's preferred surgical technique, with or without ligament reconstruction, using an anaesthetic technique appropriate for the patient and postoperative rehabilitation as per the treating surgeon and therapists' usual practice. Previous randomised trials have compared several different trapeziectomy techniques and ligament reconstructions and have not demonstrated superiority of one technique over another [31, 53, 54].

4.6.1.2 Base of Thumb CMCJR

This will be performed as per the treating surgeons' preferred surgical technique and implant, using an anaesthetic technique appropriate for the patient. The postoperative rehabilitation will be as per the treating surgeon and therapists' usual practice.

4.6.2 ENGAGE

This is a programme of personalised, psychologically informed non-surgical treatments, supported by evidence based, online and paper educational materials, and this will be delivered by trained hand therapists. With a focus on teaching participants how to self-manage their BTOA, it will follow a shared decision-making approach as recommended by treatment guidelines [55]. The essential elements to this programme are: hand exercises; education about the condition and its management; and personalised task modification. Task modification training teaches participants how to reduce or alter aggravating activities and how to use their hands in more healthy postures. Time will be taken to ensure that agreed goals and plans are agreed with each participant. Each participant will be supported to build confidence in their ability to understand their condition and to carry out the components of self-management.

Thumb splints may be prescribed as part of this intervention. There is no evidence to suggest one splint type is superior to another [56], so the choice of using a splint and splint type will be a shared decision between participant and therapist. Some participants may require a steroid injection for additional pain relief, as per routine care, if the other measures have not been sufficiently effective at reducing pain.

Therapists delivering the ENGAGE package should have prior experience of treating patients with base of thumb osteoarthritis and should treat these patients routinely. ENGAGE therapists must undergo thorough training in the ENGAGE package, this includes a minimum of 4 hours of self-directed learning to cover the online materials and attending a 2 hour ENGAGE training session to reinforce prior learning and answer any questions. Once trained, therapists can be delegated to deliver the ENGAGE package. There will be ongoing support available for all therapists to access as

required, including regular therapist drop-in sessions, a therapist WhatsApp group and access to the online materials.

This programme is designed to be comprehensive and deliverable, with 17 NHS sites having delivered a similar programme in a recent multi-centre trial [23]. As a minimum, each patient will receive a 1-hour face to face appointment with their hand therapist following randomisation and will be followed by a telephone call at 2 weeks with a further follow-up face to face therapy appointment at 4 weeks, and at 6 weeks their appointment can be either face to face or telephone, depending on need. Participants may have the option of additional appointments as per local therapy practice and open appointments for 6 months to return if further treatment is required.

Data will be collected on adherence to each element of the ENGAGE package through tick boxes. Delivery of the essential elements for ENGAGE will also be monitored, these are:

1. Education of OA and task modification
2. Exercises assessed and reviewed at each appointment, at least level 1, 3 x per week most weeks, reported by patients.
3. Pain coping skills training introduced & reviewed/ discussed at each appointment, participant has done their own practice most weeks and has at least 1 strategy to use ongoing at the end of the programme.
4. Minimum 4 Appointments, increases with optional elements and specific needs, if > 4 appointments are required to cover the programme this is fine.

The programme is considered complete if the essential elements of the ENGAGE package are complete and an open appointment is given with no planned review, or the participant is being referred back to a surgeon having attended ENGAGE appointments.

Clinical co-applicants involved in this previous trial felt the design of the intervention and the educational materials used supported the provision of a more consistent, comprehensive high quality of care but it has not yet been routinely and comprehensively adopted for all patients. Alongside this optimised non-surgical treatment, the programme will be enhanced further by the addition of self-directed online pain coping skills education carried out weekly over six weeks. A handbook will be provided and can be used instead of online education, according to individual preference. Participants will receive face to face appointments and telephone calls from their hand therapist as part of their care (described above), these will also be used to support them to work through the pain coping skills programme.

Optional online peer support drop-in sessions with a therapist moderator will be offered to participants every 2 months.

ENGAGE has been co-designed with our PPI group after they shared their concerns that BTOA is not taken as seriously as other conditions. It is structured to address the unmet need of chronic pain in hand and BTOA, and to be less onerous and inclusive to those who do not want to attend group sessions.

A collection of multimedia resources, aimed at patients as well as resources for hand therapists to facilitate delivery of the standardised enhanced hand therapy programme with pain coping skills will be produced. These resources will be specifically designed to allow the patient to engage with the hand therapy programme to suit their individual preferences and level of health literacy, thereby optimising the inclusivity of the intervention. Patients will have a choice on the type of resource they

want to use as the content is presented in a variety of different formats to maintain engagement (e.g. printed materials and web based digital resources). The design and content of the resources will facilitate equity of access for the diverse population of patients that need varied support. These resources will be prepared with feedback from stakeholders and Patient and Public Involvement and Engagement (PPIE). Therapists will also be supported with access to an online peer support drop-in sessions for therapists coordinated centrally once every two months by the lead therapist; access to paper and web-based training and educational resources.

4.7 Rehabilitation and Hand Therapy

Patients allocated to the surgical interventions will undergo rehabilitation and follow-up according to the usual practice of treating surgeons and therapy teams at the recruiting site in order to be pragmatic.

Patients undergoing both trapeziectomy and CMCJR may be immobilised following the surgery in line with the routine practice of the treating surgeon/local protocol. Patients will usually be reviewed at 2 weeks postoperatively for the removal of the cast and sutures and, in the case of trapeziectomy, may undergo a further period of immobilisation in the form of a cast or splint. Patients undergoing CMCJR may also receive a postoperative radiograph. Rehabilitation will then commence as per the policy of the treating team.

4.8 Assessments and Follow-Up

Trial participants are expected to be enrolled in the study for up to 18 months for follow-up. The study assessment schedule is provided at the beginning of the protocol (see Table 5). All participants will be followed up on the day of their surgery/therapy, and again at 6-weeks, 3-months and 6-months post-treatment and 6-months, 12-months and 18-months post-randomisation (PR). Alongside the visit on the day of surgery/therapy, visits at baseline, 6-weeks PT, 6-months PT and 12-months PT will take place where possible as a face-to-face visit.

Trial participants should also attend any routine clinical appointments that may be scheduled outside of trial visits, in line with the routine care pathway at the participating site.

4.8.1 Imaging Assessments

The routine imaging performed prior to or during admission will be used to confirm the presence of STT joint arthritis at baseline and also to grade the severity of CMCJ OA (determine Eaton Littler Score).

Information may be collected from routine imaging performed following surgical treatment e.g. whether the implant is situated correctly for those patients receiving CMCJR. X-ray guidance may also be used for any steroid injections given as part of routine care.

Although there are no x-rays additional to standard care, under Ionising Radiation (Medical Exposure) Regulations (2017), appropriate approvals will be obtained to ensure risk is minimised.

4.9 Outcomes

4.9.1 Primary Outcome

The AUSCAN hand pain index will be used as the primary outcome at 12-months post-randomisation [30].

This is a patient-reported, disease specific, and hand-specific questionnaire. Total score ranges from 0 to 20 and higher scores indicate more pain. AUSCAN is reliable and responsive to change in

patients with hand OA and has established construct validity as an instrument for use in BTOA [57]. Its use has been supported by our PPI review panel, who felt it accurately captured their symptoms.

The AUSCAN is a 15-item scale measuring pain (5 items), stiffness (1 item), and function (9 items) during the preceding 48 hours. AUSCAN scores have total scores that range from 0 to 60, pain subscales that range from 0 to 20, stiffness subscales that range from 0 to 4, and function subscales that range from 0 to 36; higher scores indicate a greater level of intensity.

AUSCAN will also be collected at baseline, the day of surgery / first therapy session, 6-weeks, 3-months, 6-months post-treatment and 6-, 12- and 18-months post-randomisation in line with the study assessment schedule (see Table 5). Collection of the primary outcome at the start of treatment for all participants will help us take account of the probable differential waiting times between the intervention groups given the NHS waiting times at the time of submission of the application.

4.9.2 Secondary Outcomes

Secondary outcomes will be collected at various time points within the 18-month follow up period, in line with the study assessment schedule (see Table 5).

These timepoints will enable identification of early complications and gather data to inform resource use and work impact.

- AUSCAN: time points other than the primary point at post-randomisation.
- Grip strength: (Pain free) Grip Strength will be measured with a JAMAR Dynamometer and recorded in kilogrammes. Both hands will be assessed. Three recordings will be performed and the maximum of these three readings will be used. The measurement will be done with the subject seated, arm by the side, elbow bent at 90 degrees and the wrist in neutral position for rotation[58, 59].
- Pinch Strength: (Pain free) Key pinch will be measured using a JAMAR pinch meter and recorded in kilogrammes. Both hands will be assessed. Three recordings will be performed on each side and the maximum of these three readings will be used. The measurement will be done with the subject seated, arm by the side, elbow bent at 90 degrees and the wrist in neutral position for rotation [60].
- Range of Thumb Movement: Radial and palmar abduction will be measured actively and recorded in degrees for the affected hand only. Two measurements will be taken of each span, using goniometry [61].
- Kapandji Opposition Score: A simple and widely used method for recording opposition [62, 63]. This will be recorded as a 0-10 score for the affected hand, based on the participants' observed ability to touch the fingers of the same hand with their affected thumb.
- PEM Score: The questionnaire assesses the process of treatment, current state of the hand, and a general assessment. The PEM asks questions relating to symptoms, satisfaction and general disability, which generates a percentage, ranging from 0%-100%, to determine a disability score [64].
- EQ-5D-5L: measures health-related quality of life in terms of 5 dimensions: mobility, ability to self-care, ability to undertake usual activities, pain and discomfort, anxiety and depression. The EQ-5D-5L will be scored according to the User Guide [65].
- PSEQ-2: A valid and reliable 2-item short form of the PSEQ [66].
- Patient Acceptability: Qualitative interviews and Global Question.
- Healthcare and social care resource use: Patient-reported questionnaires and hospital forms will be designed to collect information on hospital stay (initial and subsequent inpatient

episodes, outpatient hospital visits and A&E admissions); primary care consultations (e.g. GP, nurse and physiotherapy); work impact of the three interventions; and return to work and return to normal activities.

- Complications: Information on all complications will be collected. Expected complications that will be recorded will include (but not be limited to) deep wound infection, (using Centres for Disease Control and Prevention (CDC) definition), superficial infection (using CDC definition), re-hospitalisation, nerve and skin problems. Refer to Table 9.

4.10 Qualitative Study

4.10.1 Recruitment Optimisation

Participant recruitment remains a key challenge for RCTs. Trials of surgical interventions, especially those that compare surgical and non-surgical interventions, face additional challenges due to the irreversibility of surgical treatments and issues with surgeon and patient equipoise [67]. The preliminary work we have undertaken to prepare for the application (the national survey and audit) has given us confidence in our trial design in terms of recruitment and randomisation. However, we wish to mitigate as far as possible any recruitment issues that may arise due to: the number of patients who have already received some form of primary care management and who may be reluctant to receive additional non-surgical approaches; the number of surgeons currently performing CMCJR and how candidates for CMCJR are routinely selected in current practice; variable recovery and waiting times between intervention arms; and known treatment preferences amongst surgeons.

Many of the commonly identified barriers to trial recruitment are underpinned by a lack of equipoise [68]. Our experience of surgeon surveys undertaken for other, similar NIHR funded studies of surgical interventions [68] is that whilst surgeons may acknowledge community equipoise by expressing a willingness to participate in a trial through a survey, a lack of personal equipoise may act as a barrier to participation during recruitment [69]. Recent work undertaken by the research team, suggests that failure to consider the role of equipoise at an early stage (i.e. pre-pilot) may influence our ability to successfully conduct surgical trials [69]. This tallies with our experience on other NIHR funded surgical trials and the research literature which shows that despite a growing number of recruitment optimising interventions, only marginal gains are noted once a trial is 'open', and when protocols are finalised and eligibility criteria are established [69]. Existing recruitment optimization interventions are also costly and resource intensive [69] or still happen after key design decisions have been made [34]. We have therefore devised a low-cost, rapid, recruitment optimisation package, which will make use of routinely collected trial information and rapid qualitative work to mitigate against the potential for recruitment problems in our trial.

This mixed methods recruitment optimization work will be undertaken during the trial's set-up phase - mostly the work will be conducted in the pre-pilot phase so that any findings can feed directly into our trial procedures and documentation (months 1-9). This research will extend into the early stages of the pilot phase of the trial (months 9-12) to resolve any outstanding issues and allow us to adapt any strategies we have developed as we approach sites for participation and open the first few pilot sites. Overall, our findings will have the potential to impact directly on how trial sites can be recruited, site staff training and patient recruitment. Data collection will be as follows:

1. N ≈ 10 brief qualitative interviews with key stakeholders (including chief investigators, clinical co-apps and hand surgeons/hand therapists from outside the trial team). There are a relatively small number of hand surgeons in England and so we will use the clinical co-applicants, our links with the BSSH and contacts we have obtained through the NIHR funded

FLARE (NIHR133784) and FIRST (NIHR NIHR133582) studies to identify potential participants to approach for qualitative interviews. Interviews will gather intelligence relating to wider stakeholder views on the trial from a clinical, scientific and practical viewpoint. We will explore capacity and willingness to participate in the trial, in the context of other current hand surgery trials. We will actively seek to work with interviewees to overcome identified issues that may impact on recruitment. We will make particular efforts to interview individuals who are known to be hesitant about participation to understand the reasons for this and learn how these barriers to participation could be overcome at our participating sites.

2. Record and review TMG meetings to keep abreast of any challenges that are occurring during the trial's set up period. The team will then develop strategies to overcome any identified issues.
3. Record/review expression of interest (EOI) forms that will be sent to all eligible sites. EOI forms will be reviewed and tailored to enable sites to include any concerns they may have around participating (e.g. capacity/willingness to perform CMCJR, ability/willingness to facilitate the enhanced non-surgical arm). Discussions with 'decliner sites' will establish reasons why they have chosen not to participate and will provide the basis for adaptation of future approaches to new potential sites.
4. Record/attend approaches to sites/site initiation visits (SIV) and compare and contrast within and across sites, what works well, what the common issues/barriers to inform development of the most efficient method of delivering these SIVs in an engaging and efficient manner going forward.
5. For those sites recruited in the early pilot phase (up to three sites), verbal feedback will be sought from key individuals at each site to identify early challenges. The trial team will work with sites to identify solutions to the issues raised and these solutions will be incorporated into the set-up of future sites.

Analysis of this information will be rapid and undertaken concurrently with data collection to allow initial troubleshooting. To facilitate this a standing agenda item on all TMG meetings, along with weekly project meetings will be held to facilitate the development of strategies for overcoming any issues identified. Where patient related factors are raised, PPI members will be engaged to strategize solutions.

At month nine, prior to the start of the pilot study, all information collected during the initial recruitment optimisation exercise will be integrated into the trial procedures. These research informed trial processes will be monitored over the coming months as the internal pilot phase commences and will be under ongoing review and adapted further as appropriate. Feedback will be given directly to sites in this phase of the work via meetings with the trial team/chief investigators where issues emerge.

4.10.2 Treatment Acceptability

A nested qualitative interview study will examine trial participants' experience and acceptability of the SCOOTT trial interventions and trial processes. Interviews will also explore adherence to treatment, such as post operative rehabilitation regimes. Approximately 10-15 trial participants from each of the 3 possible intervention pathways will be interviewed during the trial's follow-up period. Participants will be purposely selected to achieve maximum variation according to key patient (e.g. age, gender, socio-demographic characteristics and initial pain score) and site (geographical location, hospital type) characteristics. We are committed to recruiting under-served populations into the qualitative study and we will select participants according to NIHR INCLUDE

principles where possible. Interviews will focus on acceptability of the enhanced non-surgical management (given most patients will have experienced some previous non-surgical management) and the two surgical options in terms of the participants' experience of surgery, and the associated rehabilitation. Topic guides will be co-produced with PPI members who have also indicated they would be willing to help with the development of strategies to facilitate recruitment from under-served populations.

Interviews with clinicians (hand surgeons/hand therapists/physiotherapists/occupational therapists will also be conducted (n=15-20). Clinicians will be sampled to represent a range of NHS sites across England and will be purposively selected to achieve maximum variation according to key site (e.g. geographical location, hand unit size and type) and clinician characteristics (specialty, professional role, grade, age, gender). We will include both clinicians who have been involved in recruiting participants to the trial, as well as those at non-participating SCOOTT sites. Including clinicians who are not involved in the SCOOTT trial will provide a wider understanding of current treatment for BTOA and the acceptability of trapeziectomy, CMCJR and non-surgical management. Interviews with clinicians will also be used to understand the challenges surrounding the implementation and adoption of trial findings into practice and willingness of surgeons to change their practice, according to the findings of the RCT. More broadly, data collection will focus on clinician views on trapeziectomy versus CMCJR and associated rehabilitation from a surgical perspective, alongside views on enhanced non-surgical management, and the challenges/facilitators associated with the sustainable delivery of this. Wider issues relating to the trial outcomes will be discussed, including implications for the care pathway, and what information/training would be required to implement the trial findings across the NHS.

Qualitative data analysis will follow the principles of thematic analysis, providing an interpretive exploration of the experiences, attitudes, and beliefs of different stakeholder groups [70].

4.11 Participant Recruitment

The research team will work closely with the clinicians and research staff at each recruiting site to optimise the screening and recruitment procedures for their local circumstances.

All members of staff involved in eligibility sign-off and the informed consent process (including surgeons) will have training in Good Clinical Practice (GCP) or study specific training.

The NIHR Associate Principal Investigator (API) scheme will be utilised at participating sites to involve aspiring researchers to co-ordinate study recruitment. The APIs will be trained in study processes and will be supervised by the PI at the site.

Potential participants will be provided with information about the study including a patient information sheet (PIS) at the earliest possible opportunity following presentation.

4.11.1 Recruitment Strategy

The recruitment projection is based on 20 active centres recruiting 2 patients per month based on our survey data (with an assumed consent rate of 50% of eligible patients). With staggered centre set-up and fewer recruits in the first two months of site set-up, 134 patients will be recruited by month 12. The remaining patients will be recruited over a further 12 months.

4.12 Screening and Recruitment Procedures

Eligible patients usually present to a hand surgeon in secondary care for further treatment of their BTOA. All patients referred to a hand surgeon for treatment of their BTOA should be screened for eligibility. Patient eligibility must be confirmed by a surgeon or other clinician who routinely lists

patients for surgery and who is delegated to complete the eligibility assessment. All patients screened and who meet all of the trial eligibility criteria should be approached for participation in SCOOTT. Patients who are screened and do not meet all the eligibility criteria at the time, may be rescreened in future.

Patients who contact YTU or members of the trial team directly, having seen information about the trial on the trial website or information elsewhere within the public domain can be advised to request a referral from their GP to a hand surgery clinic at their nearest SCOOTT-participating NHS Trust.

4.13 Informed Consent

Informed consent will take place prior to the baseline assessment being undertaken, and before randomisation or delivery of allocated treatment. If a patient declines consent to take part in the study but would like to reconsider at a later date, they can be reapproached for this purpose. If a patient is reconsidered for consent 6 weeks or more after their initial screening date, they should be re-screened.

Patients will be provided with a detailed written or online PIS, outlining the nature of the study and what it will involve for them. The information provided will clearly explain the risks and benefits of trial participation. It will be clearly stated that participants are free to withdraw from the study at any time and for any reason without prejudice to future care. Permission will be sought to inform the patient's GP of their participation in the study.

The patient information will be made available in different formats as required (e.g., electronic or paper PIS, narrated, and animation). For patients with sight or reading difficulties, narrated versions or voice-assisted software will be used as available through the NHS given that patients will be recruited in hospital settings. For patients unable to speak English, sites will use either a translator or telephone translation service depending on local availability.

Responsibility for obtaining and recording written or electronic informed consent will be with the site Principal Investigator (PI), or research staff or clinicians designated by the PI, who conducted the informed consent discussion. Designated responsibility should be recorded on the site delegation log.

Potential participants will be given a contact phone number, so that they have the opportunity to ask questions of clinical staff and to discuss the trial with friends/family prior to agreement to take part. Patients will have the opportunity to ask questions to the clinical and local research team before written or electronic consent for the study is obtained. The patient will be asked at the time of approach whether they have had sufficient time to consider participation and whether they agree to consent at that time; if required, they will be given further time to reach a decision on whether to take part.

Participants will have the right to withdraw from the study at any time. The reason for withdrawal will be recorded, where given, in the data collection tool. Specific consent will be sought to enable the sharing of identifiable data with York Trials Unit (YTU), based at the University of York as part of the study in order to facilitate the collection of outcome data.

Consent for participation in the qualitative element of the study will be sought separately. Written and/or verbal consent will be taken for all participants prior to the start of each interview. Where verbal consent is taken, this will be recorded by the research team separately to the interview.

Consent will be sought from participants for follow-up beyond the duration of the trial using linkage to routinely collected data sources such as Hospital Episode Statistics (HES) and Office of National Statistics (ONS) data and UK Hand Registry (UKHR). This will enable the longer-term outcome following intervention to be identified from both the perspective of serious adverse events (SAE) and patient reported outcome measures (PROMs).

In the unlikely event that new information arises during the trial that may affect the participants' willingness to take part, this will be reviewed by the TSC and DMC for addition to the PIS. A revised consent form will also be completed if necessary.

All consent forms will be stored in accordance with local requirements. A copy of the signed consent form will be given or emailed to the participant, a further copy filed in the patient medical records and if paper forms are used the original signed copy kept in the Investigator Site File (ISF). A copy of consent received in writing will be sent through an agreed secure method to YTU or uploaded onto the data collection database (REDCap) for central monitoring purposes.

4.14 Randomisation and Enrolment Procedure

When patients have provided consent (either written or electronic consent) and their baseline forms have been completed, an authorised and delegated member of the clinical or research team will access the randomisation area of the REDCap system managed by YTU.

The randomisation instruments within REDCap will require the recording of information and a check of patient eligibility to avoid inappropriate entry of patients into the trial. The REDCap system will implement the independent and concealed random allocation, stratified by centre. The randomisation schedule will be generated by a statistician in STATA v17 or later.

The patient will be allocated to either trapeziectomy, CMCJR or ENGAGE using an allocation ratio of 3:3:2 using computer generated permuted blocks of random sizes.

We will collect data on patient preferences and account for whether patients received their preferred treatment in a secondary analysis. All recruiting centres will have surgeons who are familiar with the two surgical techniques and perform them as part of NHS care.

4.15 Blinding

Patients, clinicians and the site recruitment teams will be informed of the treatment allocation. Due to comparing two surgical treatments to a non-surgical intervention, it is not possible to blind patients, surgeons or outcome assessors.

4.16 Participant Payment

The pragmatic nature means that the majority of study visits align with visits that are part of routine care.

Participants receiving the ENGAGE package will be reimbursed travel expenses for attending two therapy appointments.

For all participants, travel expenses for attending two clinic appointments will be reimbursed.

Participants will report outcomes online. In the event of postal data collection pre-paid envelopes will be provided.

Participants will be sent two vouchers of £15 by either email or post, as a good will gesture. One after the 6-month post treatment questionnaire and one after the 12 months post-randomisation questionnaire has been completed.

5. Data Management

5.1 Data Collection Methods

Data will be collected at baseline, on the day of surgery/therapy, 6-weeks, 3-months and 6-months post-treatment and 6-, 12- and 18-months post-randomisation. Baseline data will be collected at recruiting sites by a member of clinical and/or research staff. Data collected at the follow-up visits (6-weeks, 3-months and 6-months post-treatment and 6-, 12- and 18-months post-randomisation) will be collected by delegated hand therapists and/or research staff. PROMs will be collected via questionnaire completion at baseline, on the day of surgery/therapy, 6-weeks, 3-months and 6-months post-treatment and 6-, 12- and 18-months post-randomisation via email, telephone or postal questionnaire.

YTU will manage the participant reported data collection.

All reporting of data collection will be undertaken in line with the Consolidated Standards of Reporting Trials (CONSORT) statement. To minimise attrition, we will use multiple methods to keep in touch with participants. We will ask participants for full contact details (including mobile phone number and email address if available) for the purpose of data clarification and data collection follow up.

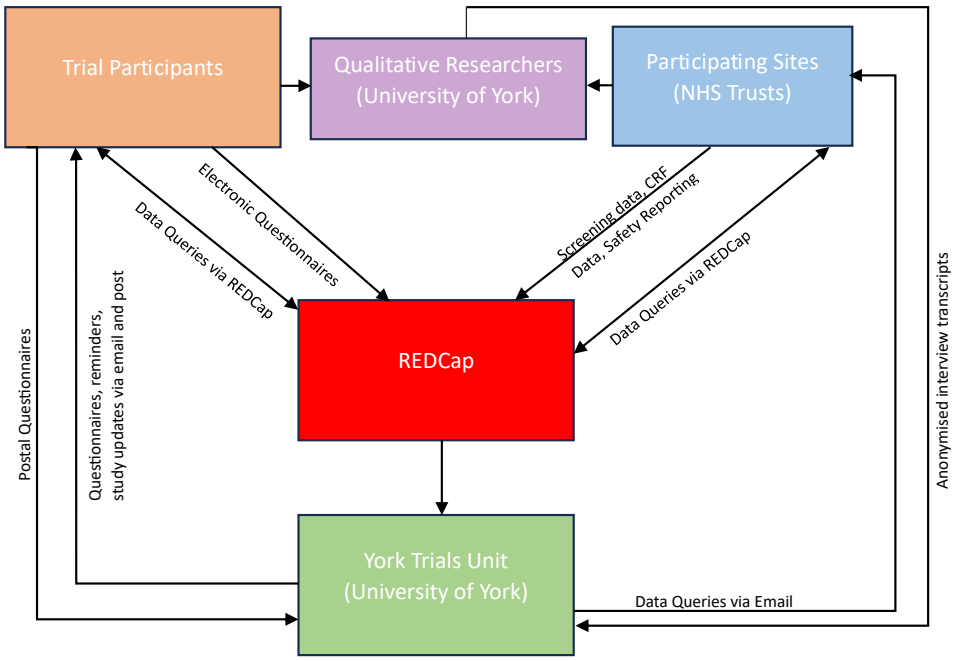
For participant questionnaires that are not returned, email or postal reminders will be sent at 2 and 4 weeks after their due date. Where these methods fail there will be a final attempt to obtain data via telephone, prioritising the primary outcome measure. If a questionnaire is returned to YTU and the primary outcome data are incomplete or contain errors, we may telephone participants for clarification or completion of missing data.

We will also send newsletters via email or post during the trial to keep the participants informed and engaged with the trial, which can enhance response rates.

The data management aspects are summarised in

Figure *2*.

Figure 2: SCOOTT Data Flow Diagram



5.2 Data Entry

The data collected by sites will be entered onto REDCap, a secure online interface, specifically developed for this study [71, 72]. For data that are collected via participant report only the study data in REDCap will be the source data.

Data not captured on REDCap, will be stored and transferred following YTU standard operating procedures (SOPs) and/or University of York policies. The staff involved in the trial (both at the sites and YTU) will receive training on data protection. The staff will be monitored to ensure compliance with privacy standards.

Computerised data cleaning and validation checks will be used in addition to manual review to check for discrepancies and to ensure consistency of the data.

Data will be checked according to procedures detailed in the trial specific Data Management Plan or REDCap specification document.

An electronic audit trail system will be maintained within the data collection system to track all data changes in the database once the data has been saved initially into the system or electronically loaded.

5.3 Data Storage

All Investigators and study site staff involved with this study must comply with the requirements of the General Data Protection Regulation (GDPR) (2016/679) (2018), the Data Protection Act (2018), and the Caldicott Principles with regard to the collection, storage, processing and disclosure of personal information and will uphold the core principles of the regulation(s).

Data will be collated in REDCap with participants identified by a unique identification number (i.e. the participant identification number) only. A Trial Enrolment Log at the sites will list the participant identification numbers. YTU will maintain a list of participant identification numbers for all trial participants at each site.

At the University of York, data will be held securely on the cloud-hosted REDCap server. Access to the study interface will be restricted to named authorised individuals granted user rights by a REDCap administrator at YTU.

Data not within REDCap will be hosted on University of York servers. All YTU data recorded electronically will be held in a secure environment at the University of York, with permissions for access as detailed in the delegation log.

Backups are taken daily and stored in a separate location. Snapshots are also taken at regular intervals throughout the day.

The University's backup policy can be found here: https://www.york.ac.uk/it-services/services/backups/#tab-4

All study files will be stored in accordance with GCP guidelines. Study documents (paper and electronic) held at the YTU will be retained in a secure (kept locked when not in use) location for the duration of the trial.

All essential documents, including source documents, will be retained for a minimum period of five years after study completion. The separate archival of electronic data will be performed at the end of the trial, to safeguard the data for the period(s) established by relevant regulatory requirements. All work will be conducted following the University of York's data protection policy which is publicly available (https://www.york.ac.uk/records-management/dp/).

5.4 Data Quality Assurance and Quality Control

South Tees Hospitals NHS Foundation Trust have agreed to be the Sponsor for this project and take overall responsibility for the quality of study conduct. This study will be fully compliant with the UK Policy Framework for Health and Social Care Research [73] and MRC GCP Guidance [74].

A rigorous programme of quality control will be undertaken. The day-to-day management of the trial will be the responsibility of the Trial Manager/Coordinators based at YTU. Regular meetings with the TMG will be held and will monitor adherence to the trial protocols at the trial sites. Quality assurance checks will be undertaken by YTU to ensure integrity of randomisation, study entry procedures and data collection.

5.4.1 Direct Access to Source Data/Documents

The Investigator(s)/institution(s) will permit authorised representatives of the Sponsor and applicable regulatory agencies direct access to source data/documents to conduct trial-related monitoring, audits and regulatory inspection. Trial participants are informed of this during the informed consent discussion. Participants will consent to provide access to their medical notes.

Essential trial documentation (i.e. the documents which individually and collectively permit evaluation of the conduct of a clinical trial and the quality of the data produced) will be kept with the Trial Master File (TMF) and ISF. The Sponsor will ensure that this documentation will be retained for a minimum of five years after the conclusion of the trial to comply with standards of GCP.

At YTU, the CRF data will be stored for a minimum of five years after the conclusion of the trial as paper records and in electronic format in accordance with guidelines on Good Research Practice [75]. All paper records will be stored in a secure storage facility or off-site by YTU. All electronic records will be stored on a password protected server.

The PI at any participating site will archive the trial essential documents generated at the site for the agreed archiving period in accordance with the signed Clinical Trial Site agreement or Organisational Information Document.

Once reporting and analysis are completed and published in all intended scientific journals, the anonymised data will be made available for other researchers if requested.

In principle, anonymised data will be made available for meta-analysis and, where requested by other authorised researchers and journals, for publication purposes. Requests for access to data will be reviewed by the co-Chief Investigators, study Sponsor and trial team.

5.4.2 Source Data List

The data collected by sites will be entered onto a secure online REDCap interface. For data that are collected via participant report only the questionnaire (completed on paper or in REDCap) will be the source data. Table 8: Source Data provides details of the data to be collected and source documents.

Table 8: Source Data

Type of Data	**Source Document**
Informed Consent	Informed Consent Form (online or paper)
Relevant Medical History and Current Medical Conditions	Patient Medical Records
Fulfilment of Eligibility Criteria	Patient Medical Records
Demographics	Patient Medical Records/Patient Self-Report
AUSCAN	Patient Completed Questionnaires
PEM	Patient Completed Questionnaires
EQ-5D-5L Questionnaire	Patient Completed Questionnaires
Grip strength, ROM, Pinch strength	Patient Medical Records / REDCap
Health Economic Data (Resource use)	Patient Medical Records / Patient Completed Questionnaires
Treatment and Rehabilitation Data	Patient Medical Records and Patient Questionnaires

5.5 Statistical Considerations

5.5.1 Determination of Sample Size

In the non-inferiority comparison, for 90% statistical power, 234 participants are required to establish non-inferiority of CMCJR compared with trapeziectomy within a margin of 1.5 points on the AUSCAN pain subscale (SD=5), based on the lower limit of a 95% two-sided confidence interval (equivalent to a one-sided 97.5% confidence interval) [76]. Assuming 20% attrition at 12 months follow-up, and a pre-post correlation=0.4, this gives the total target sample size as 246 per group. For the superiority comparison, assuming an MCID=2, SD=5, 90% power, alpha=0.05 and 20% attrition, requires 164 in the enhanced non-surgical management group [23, 76]. Hence, the final allocations will be to recruit 246 to each of the two surgical groups and 164 to the enhanced non-surgical management group, which is an allocation ratio of 3:3:2.

There is no widely accepted minimal clinically important difference (MCID) for the AUSCAN hand pain index (HPI). NICE proposed a ballpark standardised effect size of 0.5 for the adoption of interventions for OA management. Assuming a standard deviation of 5 points based on data reported in a RCT of splints for BTOA [23], would mean we would look for an MCID of 2.5 points in the AUSCAN HPI. However, a large observational study of patients with OA found that over the course of 12-18 months, the AUSCAN HPI decreased by 1.7 points, which is equivalent to a

standardised effect size of 0.34. We assumed a MCID of 2 points for superiority comparison comparing each of the surgical groups to the non-surgical group at 12 months, equivalent to a standardised effect size of 0.4. Research suggests that CMCJR, compared to trapeziectomy, may provide quicker and less painful return to function, and result in better thumb strength and movement. However, further research is needed to ensure that patients undergoing CMCJR experience similar long-term pain relief to patients undergoing trapeziectomy. A non-inferiority margin of 1.5 points was chosen, enabling us to assess whether the difference in hand pain between the two surgeries at 12 months lies within MCID for AUSCAN HPI.

5.5.2 Pilot Phase Analysis

The recruitment rate and 95% confidence interval will be estimated from the data collected. A CONSORT diagram will be constructed to show the flow of participants through the study and the following outcomes calculated: number of patients screened, number of eligible patients; proportion of eligible patients approached for consent; proportion of eligible patients not approached and reasons why; proportion of patients approached who provide consent; proportion of patients approached who do not provide consent; proportion of patients providing consent who are randomised; proportion of patients randomised who do not receive the randomly allocated treatment; proportion of patients dropping out between randomisation and follow-up; proportion of participants for whom a primary outcome is recorded. Data will be summarised on the reasons why eligible patients were not approached, reasons for patients declining to participate in the study; reasons why randomised participants did not receive their allocated treatment and reasons for drop-out, if available. Results will be compared against the study's recruitment assumptions and progression targets using a traffic light system.

5.5.3 Statistical Analysis

For the analysis of the main trial, a CONSORT flow diagram will be provided to display the flow of participants through the study. The number of participants withdrawing from the trial will be summarised with reasons where available.

Baseline characteristics will be presented descriptively by group. All outcomes will be reported descriptively at all collected time points. Continuous data will be presented using means and standard deviations or medians and ranges as appropriate, and categorical data will be presented using frequencies and percentages.

The primary analysis will be on an intention-to-treat (ITT) basis, analysing patients in the groups to which they were randomised. The primary analysis will compare the primary outcome between groups using a covariance pattern mixed-effect linear regression model, incorporating all post-randomisation timepoints. Treatment groups, time point, treatment-by-time interaction and clinically relevant baseline covariates will be included as fixed effects. Participants will be included as a random effect to account for repeated observations per patient and site will also be included as a random effect. The superiority comparisons will compare each of the two surgical interventions (CMCJR and trapeziectomy) with enhanced non-surgical management. The non-inferiority comparison will compare CMCJR with trapeziectomy. Estimates and 95% confidence intervals for superiority comparisons (or one-sided 97.5% confidence interval for noninferiority comparisons) will be extracted from the model, with the primary endpoint at 12-months post-randomisation. Non-inferiority of CMCJR to trapeziectomy at 12-months post-randomisation will be accepted if the lower bound of the one-sided 97.5% confidence interval lies within the non-inferiority margin of 1.5 points on the AUSCAN pain subscale.

Completeness of data at follow-up will be reported by group. For the non-inferiority comparison, the ITT analysis could bias towards the null, which may lead to false claims of non-inferiority, hence we will undertake both ITT and CACE (complier average causal effect) analyses. CACE analyses will also be carried out for the superiority comparisons.

The primary analysis model will include the post-randomisation timepoints only, in order to allow for the treatment policy effect to be estimated i.e. the treatment regardless of if the participant has reached the top of the waiting list and commenced treatment or whether additional treatment was received [32]. Sensitivity analyses will be carried out in order to assess the impact of intercurrent events on the primary analysis.

A subgroup analysis will be carried out to explore whether the treatment effects vary by sex. A further subgroup analysis will be carried out exploring whether the treatment effects vary by the baseline value of the primary outcome, in order to answer some clinicians' concerns that non-surgical management may not be as effective as surgical treatment for patients with more advanced disease and as a result worse pain. In addition, it is also thought that patients with arthritis at the STT joint will not get as much pain relief from CMCJR than those without STT arthritis, due to CMCJR not treating arthritis at the STT. However, in theory trapeziectomy should prevent pain in both the STT and CMCJ. Therefore, we will do a subgroup analysis exploring the treatment effects vary by presence of STT arthritis pre-randomisation.

A secondary analysis will be carried out, repeating the primary analysis but with the addition of outcomes collected on the day of treatment and post-treatment. This will allow for the assessment of within-group trends in the primary outcome from the point of treatment starting. Continuous secondary outcomes will be analysed in a similar manner to the primary outcome. Full analyses will be detailed in the trial's statistical analysis plan (SAP), which will be reviewed and approved by the TSC and DMC.

5.5.4 Health Economic Analysis

The economic evaluation will assess the relative cost-effectiveness of treatment for BTOA by comparing enhanced non-surgical treatment, trapeziectomy and CMCJR to determine which intervention offers the best value for money for the NHS. An NHS and personal social services (PSS) costing perspective will be taken in the base-case analysis; relevant costs will include participant level NHS resource use, medication use and complications.

Firstly, the costs of providing the interventions, including staff time, overheads, and consumables, will be recorded. We will collect these costs prospectively alongside the RCT and apply local unit costs to the quantities of each resource utilised. Secondly, following NICE guidance [77], we will collect health care utilisation data for contacts with the NHS and PSS using a bespoke service use questionnaire. Quantities recorded are multiplied by national average unit costs [78] to derive a cost profile for each patient in each arm of the trial [79-81].

Research shows that pain and functional limitations resulting from BTOA are associated with impaired work participation and daily activities, potentially leading to substantial lost productivity and societal costs [82-84]. To explore the impact of the productivity costs and unpaid activities on cost-effectiveness results, we will conduct a secondary analysis from a wider societal perspective in addition to the base-case analysis. Days of missed work and unpaid activities will be collected using patient self-administered questionnaires. The wider cost data does not form part of the base case but can be submitted as supplementary evidence.

EQ-5D-5L questionnaire [85] will be administered at baseline and each follow up. The UK social tariff at the time of the analysis will be applied to EQ-5D-5L responses to derive quality-adjusted life years (QALYs) using the area under the curve approach [86, 87]. QALYs will be used as the primary outcome for the economic evaluation, as recommended by NICE [77].

Patient costs are combined with QALYs to estimate the incremental cost-effectiveness ratios (ICERs) in terms of cost per QALY of for each intervention compared to others, with the primary endpoint at 12 months post-randomisation. Regression methods will be used for the incremental analysis as this allows differences in prognostic variables [88]. The results will then be compared against the NICE recommended maximum acceptable incremental cost-effectiveness ratios of £20,000 to £30,000 per QALY to determine the cost-effectiveness of the three interventions [89].

Underlying uncertainty around the decision to adopt the optimal intervention will be assessed using a non-parametric bootstrap re-sampling approach. Bootstrapping is an efficient method for calculating the confidence limits for the ICERs as its validity does not depend on any specific form of underlying distribution. We will perform the bootstrap 5,000 replications and construct the 95% confidence intervals for the ICERs based on the bootstrapping results. Cost-effectiveness acceptability curves (CEAC) will be constructed based on the bootstrap iterations [90] to estimate the probability that each intervention is cost-effective at different threshold values for one QALY.

A range of sensitivity analyses will be conducted to test the robustness of the results under different scenarios. In the main analysis, missing data will be imputed using Rubin's multiple imputation method, assuming data are missing at random [91]. As part of the sensitivity analysis, we will conduct an additional set of analyses using the complete case analysis (CCA) to be consistent with the statistical analysis, whereby results are analysed only for those participants who had both the completed cost and outcome data at the same time.

The health economic analysis will aim to extrapolate the long-term cost-effectiveness of the three interventions beyond the trial period, using both trial data and secondary data from published sources. We plan to employ a Markov state-transition model [92] to estimate the long-term QALYs and patient NHS costs associated with each intervention. This model will be populated with baseline patient characteristics and treatment history and will consider the risk of recurrence and the need for further treatment based on data availability. Probabilistic sensitivity analysis will be conducted using Monte Carlo simulation to assess the uncertainty of the model parameters [93] and the results will be presented in CEACs.

A detailed health economics analysis plan (HEAP) will be developed prior to the end of data collection in order to maintain the integrity and neutrality of the heath economic analysis. The plan will pre-specify the methods used for the cost-effectiveness analysis, data-sources and outcomes for analysis.

5.6 Project Management and Data Monitoring

5.6.1 Project Management

The project will be sponsored by South Tees Hospitals NHS Foundation Trust.

Each site will have a site PI who will be responsible locally for the study and where possible an API who will be a trainee surgeon or another appropriate member of the research team. APIs will be encouraged to register with the NIHR API scheme.

YTU is undertaking the duties formally delegated by the trial Sponsor.

The trial manager at YTU will be responsible for all aspects of trial management. They will be supported by a trial co-ordinator(s), who will be responsible for the day-to-day support of trial sites, coordinate recruitment, data handling, and the management of the administrative trial team. The team at YTU will meet on a regular basis during the study and will work closely with the co-chief investigators (CIs), particularly at the start of the project and during the internal pilot of the study, including regular tele- or videoconferences to ensure that all aspects of preparation of study material, study site setup and the start of recruitment progress smoothly. They will keep in close contact via email and telephone throughout.

The primary responsibility for monitoring the safety of participants in clinical trials lies with the trial Sponsor. Data monitoring will be undertaken by the TMG, TSC, and DMC, on behalf of the Sponsor and Funder. The project will also be overseen by the Sponsor for whom a representative will be invited to attend the TMG and TSC meetings. The minutes/records of these meetings will be stored at YTU and will be shared with the sponsor on a routine basis.

5.6.2 Trial Management Group (TMG)

A TMG has been established to monitor the day-to-day management (e.g. protocol and ethics approvals, set up, recruitment, data collection, data management) of the study. Chaired by the Co-CIs, membership will include the co-applicants, co-investigators, members of YTU (trial manager, statistician) and other research staff on the project. Throughout the project there will be regular tele- or video conference contact supplemented by face-to-face meetings where required (at least annually). Frequency of meetings will vary depending on the stage of the trial but at least monthly during the early stages and pilot.

5.6.3 Trial Steering Committee (TSC)

Independent oversight of the study will be conducted by the TSC which will provide overall supervision for SCOOTT on behalf of the Sponsor and Project Funder and ensure that the project is conducted to the rigorous standards set out in the UK Policy Framework for Health and Social Care Research and the Guidelines for GCP. The TSC will monitor the progress of the trial and provide independent advice. This committee comprises of an Independent Chair, independent clinicians and health service researchers, independent statistician, a public contributor, and the co-CIs. A Sponsor representative will also be invited to attend the TSC meetings. Other study collaborators may also attend the meeting with the agreement of the Chair. The TSC will meet at least annually and will work to a Charter which has been agreed.

5.6.4 Data Monitoring Committee (DMC)

The study will be regularly reviewed by the independent DMC comprising of an independent statistician, independent clinicians and health service researchers with appropriate expertise. The role of the DMC is to review accumulating trial data and advise the sponsor (directly or indirectly) on the future management of the trial.

The DMC will meet at least annually or more frequently if the committee requests, to provide project oversight to the trial. The DMC will review safety and efficacy data as well as quality and compliance data. The DMC will review all serious adverse events which are thought to be treatment related and unexpected. The independent members of the DMC committee will be allowed to see unblinded data.

The DMC will adopt a DAMOCLES charter [94] which will define its terms of reference and responsibilities in relation to oversight of the trial.

6. Safety Monitoring

6.1 Definitions

An adverse event (AE) will be defined as the following: any untoward medical occurrence in a trial participant to whom a research treatment or procedure has been administered (intervention or control) and which does not necessarily have a causal relationship with the treatment. For the purposes of SCOOTT, we will only collect AE data for events that are related to the BTOA and unexpected.

Complications, which might be expected with this condition and treatments, are detailed in Table 9: Expected complications associated with (section 6.2) should **not** be reported as an adverse event. These are well known complications of surgery of which the specialist clinical care teams will be experienced in managing. These complications however will be recorded in the SCOOTT data collection system.

Where repeated adverse events of similar type are observed, these will be discussed with the DMC and will be onward reported to Sponsor and Research Ethics Committee (REC) should concerns be raised in relation to the type of event and/or frequency observed.

A SAE will be defined as any untoward occurrence that:

- Results in death.
- Is a life-threatening event (that is it places the participant, in the view of the Investigator, at immediate risk of death).
- Requires unplanned hospitalisation or prolongation of existing hospitalisation (unplanned refers to emergency hospitalisations resulting in an inpatient stay; prolonged hospitalisation is deemed to be where a participant's stay is longer than expected).
- Results in persistent or significant disability or incapacity (substantial disruption of one's ability to conduct normal life functions).
- Is another important medical condition.

Important medical events that may not be immediately life-threatening, result in death or hospitalisation but may jeopardise the participant or may require intervention to prevent one of the outcomes listed in the definition of an SAE will also be considered serious.

In the context of this study, SAEs will only be reported to YTU if they appear to be related to the original injury or an aspect of taking part in the study.

Other than for fatalities, this procedure does not apply to any other SAEs which may occur during the trial which are unrelated to original injury or the trial procedures.

6.2 Collection, Recording and Reporting of Adverse Events

An appropriate member of the research team will record all directly observed AEs and all AEs reported by the trial participant up to six months following their trial treatment.

In addition, sites should follow their own local procedures for the reporting of any adverse events linked to clinical care.

All AEs requiring reporting will be recorded on an (S)AE form or REDCap data collection tool and will be reported to YTU according to the agreed timelines.

The severity and likely relationship to study treatments of any adverse events will be documented by the designated site clinician.

An event is defined as 'related' if the event was due to the administration of any research procedure. Whereas an 'unexpected event' is defined as a type of event not listed in the protocol as an expected occurrence.

All non-serious AEs, whether expected or not, should be recorded in the participant's medical notes.

Related and unexpected AEs will be recorded on the study AE data collection tool by the research staff and sent to YTU within an agreed timescale (usually five days). SAEs should be notified to the PI and to YTU within 24 hours of the research staff or clinical team becoming aware of the event.

At the time of reporting, the PI or delegated clinician will be asked to record an assessment of causality (to trial treatment) selecting an option from the list below:

- Definitely related- there is clear evidence to suggest a causal relationship, and other possible contributing factors can be ruled out.
- Probably related- there is evidence to suggest a causal relationship, and the influence of other factors is unlikely
- Possibly related- there is some evidence to suggest a causal relationship (e.g. the event occurred within a reasonable time after administration of the trial procedures). However, the influence of other factors may have contributed to the event (i.e. the participant's clinical condition, other concomitant events).
- Unlikely to be related- there is little evidence to suggest there is a casual relationship (e.g. the event did not occur within a reasonable time after administration of the trial procedures). There is another reasonable explanation for the event (e.g. the participant's clinical condition, or other concomitant treatments).
- Unrelated- there is no evidence of any causal relationship.

Once received, causality and expectedness will be confirmed by a Co-CI. SAEs that are deemed to be unexpected and related to the trial will be notified to the REC and Sponsor within 15 days.

All such events will be reported to the TSC and DMC at their next meetings. All participants experiencing SAEs will be followed up as per protocol until the end of the trial.

Table 9: Expected complications associated with trial treatments

General surgical complications	
Deep wound infection	Superficial infection
Bleeding /haematoma	Suture abscess
Surgical site infection	Rehospitalisation
Delayed wound healing / wound dehiscence	Unexplained pain
Tourniquet related nerve injury	Nerve injury
Complex regional pain syndrome	Scar problems
Tendon injury	
Anaesthetic-related complications	
Myocardial infarction (MI)	Block related nerve lesion
Cerebrovascular accident (CVA)	
Venous thromboembolism (VTE)	Local anaesthetic toxicity
Complications specific to Trapeziectomy	
Thumb weakness/ instability	Tendon problems
Carpal instability	Persistent pain
Complications specific to CMCJR	
Dislocation	Fracture
Loosening	Failure

Tendon problems	Thumb weakness
Nerve injury	Persistent pain
Hand Therapy-related Complications	
Skin problems related to splint fitting	Sustained pain after exercises

7. Research Governance

7.1 Ethical Considerations and Approval

We do not anticipate any major ethical concerns with this trial. Extensive engagement with patients and clinicians has demonstrated approval of the research question and proposed design. Research participants will be adults with the capacity to provide informed consent.

The study will be conducted to protect the human rights and dignity of the patient as reflected in the Declaration of Helsinki [75].

Formal NHS REC approval will be sought via the Health Research Authority (HRA). Local R&D approvals (confirmation of capacity and capability or management approval) will be obtained for participating sites. Any further amendments to the trial protocol will be submitted and approved by the HRA and REC where required.

7.2 Competent Authority Approvals (Proposed action to comply with the Medicines for Human Use (Clinical Trials) Regulations 2004)

The study does not involve medicinal products and therefore does not require prior authorisation by the UK Competent Authority, the Medicines and Healthcare Regulatory Authority (MHRA).

The devices (implants) used in this study will be CE marked medical devices. We do not therefore require prior authorisation by the MHRA, under the Medical Devices Regulations (Great Britain, 2002).

The surgical techniques under investigation are well-recognised and accepted surgical procedures.

7.3 Regulatory Compliance

The trial will comply with the principles of the Declaration of Helsinki [75]. It will also be conducted in compliance with the approved protocol, and the principles of GCP and in accordance with the SOPs and policies of the York Trials Unit, which adhere to UKCRC regulations.

An agreement will be in place between the site PI and the Sponsor, setting out respective roles and responsibilities.

All deviations from the protocol or GCP will be reported by PIs or designated site staff to YTU. The site must inform the PI as soon as they are aware of a possible serious breach of compliance, so that the sites can report this breach to the trial Sponsor (via YTU) with onward reporting to ethics and regulatory bodies as necessary. For the purposes of this regulation, a 'serious breach' is one that is likely to affect to a significant degree:

- The safety, physical or mental integrity of the participants in the trial, or
- The scientific value of the trial.

Processing of all trial data will comply with the GDPR (2016/679) (2018) and the Data Protection Act (2018).

7.4 Participant Confidentiality

The researchers and clinical care teams must ensure that participants' anonymity will be maintained and that their identities are protected from unauthorised parties. Participants will be assigned a unique identification number and this will be used on all data collection tools; participants will not be identified by their name

Any paper records and consent documents will be secured safely in locked locations. Data collection and consent forms will primarily be electronic via REDcap and access restricted to study personnel (see 5.3). Clinical information will not be released without written permission, except as necessary for monitoring by the trial monitors.

At the end of the study, data will be securely archived by participating sites and the University of York for a minimum of five years.

7.5 Trial Closure

The end of the trial will be defined as the last participant contact which will occur at approximately 18 months after the end of the recruitment period (end of follow-up for the last participant) and after all the data is entered and queries resolved.

An end of study declaration form will be submitted to the REC and Sponsor within 90 days of trial completion and within 15 days if the trial is discontinued prematurely. A summary of the trial report and/or publication will be submitted to the REC, Sponsor and Funders within one year of the end of the trial.

7.6 Annual Progress Reports

An Annual Progress Report (APR) will be submitted to the REC which gave the favourable ethics opinion 12 months after the date on which the favourable opinion was given and thereafter until the end of the study (if applicable).

7.7 Urgent Safety Measures

The site PI may take appropriate urgent safety measures in order to protect research participants against any immediate hazard to their health or safety. These safety measures should be taken immediately and may be taken without prior authorisation from the REC.

7.8 Indemnity

This study will be sponsored by South Tees Hospitals NHS Foundation Trust. If there is negligent harm during the trial, when the NHS Trust owes a duty of care to the person harmed, NHS Indemnity covers NHS staff and medical academic staff with honorary contracts only when the trial has been approved by the R&D department.

NHS indemnity does not offer no-fault compensation and is unable to agree in advance to pay compensation for non-negligent harm.

8. Patient and Public Involvement and Engagement

We will work with patient co-applicant(s) and a PPIE group with lived experience of BTOA. The aim is to secure patient and public input to the study recruitment, retention, interpretation of results and its dissemination (refer to Table 10).

The SCOOTT PPIE group will consist of up to 10 members and advise the trial team throughout the trial. The diversity of this group will reflect those recruited to the trial and the wider BTOA

community and include members in different geographical regions. This will be monitored by the PPIE lead.

Initially, a learning needs analysis will be carried out, by the PPIE lead for each PPIE participant. Study training, including the NIHR learning for involvement online courses will be offered as well as on-going support and mentoring.

The majority of PPIE activity will be carried out virtually enabling representatives to attend regardless of geographical location and is the preferred option for those who planned the study with us. However, some face-to-face PPIE activity has also been costed to ensure those not able to attend virtually can contribute and have a choice in how they are involved in the trial conduct.

Patient representatives will sit on the independent steering committee and trial management group. The PPIE group will co-develop all patient-facing trial documentation; input into design of qualitative interview guides, training/information videos, equipoise statement and recruitment strategy. We have planned additional PPIE meetings throughout the trial to discuss matters that arise at each stage. The study recruitment and retention strategy will be co-produced by the SCOOTT PPIE group to enable the trial management group to understand enablers and barriers.

Newsletter and webinar feedback for study participants, about recruitment and results will be guided and supported by our PPIE representatives who are keen to be involved in this aspect. Additionally, the PPIE group will help in dissemination through supporting the video content on professional society webinars and social media.

PPIE members also felt it was important to have dissemination leaflets available at GP surgeries for those who do not access digital technologies and offered to assist with this.

At the close out and write up phase, we will seek PPIE input into the final study report to aid with the interpretation and triangulation of the results, including qualitative data. To capture and evaluate the PPIE impact overall, an impact log will be maintained by the PPIE lead throughout the trial based on the Public Involvement Impact Assessment Framework (PiiAF). The Guidance for Reporting Involvement of Patients and the Public (GRIPP2) reporting checklist will be used to publish the contribution and impact of PPIE during the study and will be included in the final study report.

Table 10: PPIE Schedule

Time Point	Meeting/Duties	Activity	PPIE Members
Ethics and Trial Set Up	• Review ethics of trial processes. • Review ENGAGE package. • Review patient information documents.	• Panel Meeting. • Email of documents for comment.	All
Mid-way through Recruitment Stage	• Review of any recruitment issues. • Review of any other trial issues.	• Discussion with panel members on individual basis.	All
Study Closure/Set Up of Full Trial	• Final evaluation of any recruitment or patient issues during trial.	• Panel meeting	All

	• Forward planning to improve upon full trial design.		
Monthly Trial Management Meetings	• Provide patient perspective on any issues or changes proposed during the course of the trial. • Feedback to other panel members at panel meetings.	• Either meeting attendance or via email update.	Public co-applicant
Note: Panel members may also be invited to review changes in patient information documents on an ad hoc basis via email, should changes be required between scheduled meetings.			

9. Finance

This research is funded by the NIHR HTA programme (NIHR154694)**.**

The financial arrangements for the study will be contractually agreed between the funder (HTA), and the Sponsor (South Tees Hospitals NHS Foundation Trust). Separate collaboration agreements will be put in place between the Sponsor and each of the collaborating organisations.

10.Dissemination and Publication Policy

The trial will be registered with the International Standard Randomised Controlled Trial Number (ISRCTN) registry. The protocol will be published on the NIHR HTA website and in an open access journal. On completion of the study, publication of the main paper will be undertaken in a high impact journal. The NIHR threaded publication model will be followed with a synopsis submitted for publication in the NIHR HTA Journal. Dissemination will follow best practice outlined by the NIHR Centre for Engagement and Dissemination.

A dissemination and publication policy will be developed with an agreement between partners including ownership and exploitation of intellectual property, and publication rights. The publication policy and the agreement will ensure that any intellectual property generated during the project is protected and that the publication process is organised in a fair, balanced and transparent manner. The TMG will be responsible for overseeing these arrangements. The creation and signature of the agreements will be the responsibility of the coordinating centre (University of York). It will be ensured that all partners have input into the document.

We have identified three key target audiences for dissemination:

Patients. Our PPIE group will help generate a plain language summary, explainer video and infographic for patients and the public. These documents will be available in hard copy, online and formatted for social media. We will work with arthritis charities to help disseminate these documents to patients with BTOA, providing information about our findings and helping empower BTOA sufferers to discuss treatment options with healthcare professionals. A dedicated trial website, which will be open to all participants and their carers, will have up to date information on progress of the study and subsequently the results. We will also engage with charities such as Versus Arthritis to maximise dissemination to patients to ensure we provide the information to help empower our patient group to discuss their preferred treatment.

Policy makers. The study will be registered and the protocol, statistical and health economics analysis plan and results, will be published in high impact open-access journals. Publications will be targeted to inform commissioning decisions, and we will work with NICE, the BSSH, BAHT and healthcare commissioners to inform national guidelines. This will be in collaboration with our PPI group.

Healthcare workers. Our study group contains members who are well-placed to disseminate findings and implement change through membership of national specialist society committees – including BSSH, British Association of Hand Therapists (BAHT), British Orthopaedic Association (BOA) and RCS. We will disseminate results at the annual meetings of these specialist societies as well as at the general BOA Conference. Slide decks of results will be made available to all PIs to enable local and regional presentation of results at each participating site.

Our study group members have established regional peripheral training networks as well as national and international networks. We will share videos/infographics on social media for the global online hand community where ideas and research is exchanged and debated, e.g Pulvertaft Hand Centre webinars reaching 1,000 international delegates weekly. This is easily accessible internationally for junior doctors and hand therapists. Our PPIE group will be invited to share their lived experience as part of this dissemination.

11.Department of Health and Social Care Disclaimer

The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

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13.Appendices

13.1 Appendix 1 – Study Timeline

Table 11: SCOOTT Planned Study Timeline

Activity	Trial Months
Set Up	Months 0-6
Internal Pilot	Months 7-18
Recruitment to Main Study	Months 19-30
12 Month Post Randomisation Follow Up	Months 19-42
18 Month Post Randomisation Follow Up	Months 25-48
Recruitment to Qualitative Study (patients)	Months 19-48
Analysis and Reporting	Months 49-54