NETSCC, HTA

6 March 2012

UK FASHIoN

Feasibility study of a trial of **A**rthroscopic **S**urgery for **H**ip **I**mpingement compared with **N**on-operative care

Protocol version 12.1

12 February 2012

Ethical approval

NRES West Midlands

REC reference number 11/WM/0389

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Funding

Health Technology Assessment

Ref number 10/41/02

Sponsorship

This study is jointly sponsored by the University of Warwick and the University Hospitals of Coventry and Warwickshire NHS Trust.

Registration

The study will be registered with the current controlled trials database

Dates

Study start date: March 2012

Study end date: September 2013

Abbreviations

AE – Adverse Event

BEEP – Benefits of Effective Exercise for Knee Pain

BNF – British N**a**tional Formulary

BHS – British Hip Society

CA – Conversation analysis

CI – Chief Investigator

ConDuct – Collaboration and Innovation in Difficult and Complex Randomised Controlled Trials

CONSORT - Consolidated Standards of Reporting Trials

CRF – Clinical Reporting Form

CT – Computed Tomography

CTU – Clinical Trials Unit

DMC – Data Monitoring Committee

EQ-5D - EuroQol

FAI - Femoro-acetabular impingement

FASHIoN - Feasibility of arthroscopic surgery for hip impingement compared with non-operative care

HTA- Health Technology Assessment

iHOT-33 - International Hip Outcome Tool

HOS – Hip outcome score

IQR – Integrated Qualitative Research

MR – Magnetic Resonance

MRC – medical research council

NAHS – Non-arthritic Hip Scale

NHS – National Health Service

NICE – National Institute for Health and Clinical Excellence

PACS - Picture Archiving and Communications System

PI – Principal Investigator

PIS – Patient information sheet

PSSRU – Patient Social Services Research Unit

QA – Quality Assurance

QALY – Quality Adjusted Life Year

RCT- Randomised Controlled Trial

REC – Research Ethics Committee

RF – Research Fellow

SAE – Serious Adverse Event

SAP – Statistical Analysis Plan

SD – Standard Deviation

SOP – standard operating procedures

SF 36 – Short Form health survey 36

TMG – Trial Management Group

TSC – Trial Steering Committee

UHCW – University Hospitals Coventry and Warwickshire

WOMAC – Western Ontario and Mcmaster University Osteoarthritis index

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TBC	(independent member)
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Data monitoring committee

TBC

2. Background

2.1 Literature Review

Management of hip pain in young adults

Until recently, the management of hip pain in young adults has been largely conservative. A minority of such patients had established osteoarthritis, inflammatory arthritis, avascular necrosis or fractures, and their care sometimes included surgery. But the majority had no specific diagnosis and received multidisciplinary non-operative care, provided by a combination of physiotherapists (probably the largest contribution), rheumatologists, orthopaedic surgeons, sport and exercise medicine physicians, and general practitioners.

Femoroacetabular Impingement (FAI)

In the last few years there has been increasing recognition of the syndrome of FAI, which seems to account for a large proportion of the previously undiagnosed cases of hip pain in young adults.[1,2] Subtle deformities of the hip combine to cause impingement between femoral neck and anterior rim of the acetabulum, most often in flexion and internal rotation.[3] The deformities may include: asphericity of the femoral head; widening of the femoral neck; over-coverage of the antero-superior acetabular wall, and abnormal version of the femur or acetabulum.[3] Excess contact forces between the proximal femur and the acetabular rim during terminal motion of the hip lead to lesions of acetabular labrum and the adjacent acetabular cartilage.[3] FAI seems to be associated with progressive articular degeneration of the acetabulum, usually starting from the antero-superior rim and accelerating medially and posteriorly.[4]

Open surgery for FAI

In 2001, Ganz et al [5] described a surgical technique to dislocate a hip joint without damaging the blood supply to the femoral head. This allowed the development of surgical techniques to correct the shape abnormalities of FAI. The technique involved a major operation, with a trochanteric osteotomy and a prolonged period on crutches. Ganz described a total of 213 surgical hip dislocations, of which in 164 the indication was FAI. There was a gradual development of interest in the international orthopaedic community in the problem of hip pain in young adults, and an increasing recognition of FAI. Improved imaging, especially magnetic resonance imaging, allowed more confident diagnosis of FAI[6], and surgeons began to visit Ganz to learn the technique. Several case series were published describing good clinical results for surgical dislocation for FAI. For example Beck et al reported a mean improvement in Merle d'Aubigne Score of 2.4 points with 68% patients reporting a clinically good or excellent outcome in their case series of 19 patients who underwent an open hip dislocation for FAI, with a mean follow-up of 4.7 years.[4] However, only a few centres began to offer this treatment for patients, perhaps because the likely benefit, as perceived by surgeons and patients, was insufficient to justify the invasiveness and risks of such an extensive surgical procedure

Arthroscopic surgery for FAI

Since the early 1990s there has been a slowly developing interest in arthroscopic surgery in the hip. Confined to just a few centres around the world, it seemed to be only rarely indicated, and of doubtful clinical usefulness. In the early 2000s, a few surgeons, including one of us (Griffin) began to explore the possibilities of arthroscopic surgery in the management of FAI. In 2006, Guanche et al reported on 10 patients with FAI treated by arthroscopy. The results showed that 8 patients had a good outcome on the Non-arthritic Hip Scale (NAHS) at a mean follow up of 16 months.[7] The following year Ilizaliturri et al described a case series of patients who underwent hip arthroscopy for FAI. Fourteen hips (13 patients) had a mean improvement of 9.6 points in their Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC scores). The mean follow up was 2.3 years.[8] In the same year Philippon et al reported on the 45 cases treated for FAI.[9] The subjects were all professional athletes. The mean follow up was 1.6 years and he reported a 93% rate of return to professional sport postoperatively. Since then numerous authors have published favourable outcomes for arthroscopic management of FAI.[10-12] All authors have pointed out that hip arthroscopy is technically a demanding procedure. It is very technology dependent, requiring considerable investment in equipment. Although the general risks of hip arthroscopy are low, the specific complications of arthroscopy for FAI can be severe.[13]

In Warwick, we have also demonstrated the clinical effectiveness of arthroscopic surgery for FAI in patients at UHCW. For example, 100 patients were studied before and at intervals up to 3 years after surgery.[14] Quality-of-life was assessed with the NAHS, a validated patient-derived instrument in which 100 points represents a perfect hip, and zero points represent an extremely painful, non-functioning hip joint. The mean NAHS before surgery was 53 points; after 3 years was 92 points.[14] In this group, cost effectiveness was estimated to be £3600 per QALY, far below £30,000, which the National Institute for Health and Clinical Excellence (NICE) usually use as a threshold for affordable cost-utility.

A recent systematic review of observational studies reported good results for the surgical treatment of FAI.[15] The outcomes of open and arthroscopic surgery are similar, and one RCT showed no difference between them.[16] Overall, a recent systematic review of hip arthroscopy judged the evidence to support this treatment of FAI only as 'fair'.[17] The underlying message from systematic reviews is that better evidence for any sort of surgery is needed, ideally a well designed, randomised trial of FAI surgery versus conservative care.

Conservative treatment of FAI

With the majority of current literature focusing on the surgical management of FAI, there is little information about non-operative treatment regimes. We performed a systematic review of the English language literature since 1990 to identify primary research into the effect of non-operative treatment of FAI. We found five papers, all of level 3 evidence or below.[18-23] Three suggested a good clinical outcome with non-operative treatment.[22,23] One case-series reported poor outcomes for non-operative management compared to surgery.[21] However, the groups were not similarly matched with more pre-existing degenerative disease present in those treated non-operatively. Only one of these papers formally outlined a non-operative treatment regime for FAI and reported the outcomes.

Several articles describe techniques to adjust the patient's pelvic inclination and avoid impingement positions. A reduction in pelvic inclination could reduce anterior coverage and anterior impingement.[24] There is already some evidence that this can be achieved and has been employed in the treatment of lower back pathology.[25] Posture modification to encourage lower limb abduction and external rotation may be sufficient to avoid repetitive impingement. Gait modification may have a role in the non-operative management of FAI. Kennedy et al observed the gait patterns of patients with FAI and a control group.[26] The FAI group had a significantly lower peak hip abduction and an attenuated pelvic frontal roll possibly secondary to limited mobility at lumbosacral joint.[26] Physiotherapy based treatment strategies that attempt to address these issues may be beneficial. A randomised trial compared two different physiotherapy regimes for treating hip pain in runners.[27] One group received mobilisation to the involved hip while the other group had a manipulative technique known to affect sacroiliac joint dysfunction. Patients were evaluated with a pain questionnaire, which showed significantly less pain at follow up in those patients treated with sacroiliac manipulation. It is likely that a significant proportion of these patients would have had FAI given their demographics (age 15-35, athletic population, no established arthritis).

In summary, the current literature related to conservative treatment also indicates the need for a robust, randomised clinical trial.

Clinical outcome measures

A variety of outcome measures have been used for FAI. Some, such as WOMAC and the Modified Harris Hip Score were intended for patients with more severe symptoms having hip arthroplasty, and tend to exhibit ceiling effects. Newer instruments have been designed in an attempt to capture a clinically relevant surgical outcome, but have only recently been validated and not suffered the same scrutiny as the older outcome measures.

A recent review of hip-specific patient-reported instruments for FAI[28] recommended that, of established instruments, the NAHS and the Hip Outcome Score (HOS) had the strongest clinimetric evidence to support their use as primary outcome instruments in studies for the effectiveness of treatment of FAI. NAHS is a short, self-administered instrument designed for use in younger patients with higher demands and expectations than older patients with degenerative joint disease. The scoring system has 20 multiple-choice questions divided into four domains: pain, mechanical symptoms, physical function and level of activity. The score is valid compared to other measures of hip performance, internally consistent and reproducible.[29]

Likely difficulties in recruitment to a trial of treatment for FAI

Pragmatic multi-centre RCTs are acknowledged to be the best design for evaluating the effectiveness of health care interventions as they provide robust evidence of effect, but they often encounter recruitment difficulties.[30-33] RCTs in surgery face particular challenges including: many surgeons have limited experience of RCTs; there are often learning curves for particular procedures; surgeons sometimes adopt idiosyncratic individual techniques; and the natural comparison might be a very different and more conservative type of management.[34,35] In order to participate in RCTs, all clinicians involved (surgeons and physiotherapists) need to accept at least collective uncertainty or equipoise between treatments, including the possibility that surgery is no more effective than best conservative care. For patients, the idea that there is uncertainty over the comparative effectiveness of surgical treatments and conservative care, can be very difficult to accept. Lack of clinician and patient equipoise could both be major barriers to recruitment in this trial of surgery versus conservative care for FAI, especially since many patients may well feel that they have already had a period of conservative care. Trials comparing orthopaedic surgery with conservative care show widely varying recruitment rates.

- A trial of surgery versus conservative treatment for carpal tunnel found that 201 patients refused to enter any study and a further 207 refused to enter the trial but would enter an observational study. A total of 116 patients were randomised. Therefore the recruitment rate for the trial was 22%.[36]
- A trial of vertebroplasty versus conservative treatment in acute osteoporotic vertebral compression fractures recruited 202 of 479 eligible patients (42%).[37]
- A trial of arthroscopic surgery versus physiotherapy for osteoarthritis of the knee recruited 188 patients out of 219 (86%).[38]
- A trial of surgery versus conservative treatment of acromioclavicular joint dislocation recruited 78 patients out of 86 (91%).[39]

Qualitative research methods can be used to understand recruitment difficulties and inform the development of strategies to improve recruitment to RCTs.[40-42] In the HTA funded ProtecT (Prostate testing for cancer and Treatment) study, for example, the findings from an integrated qualitative study led to the rate of randomisation of eligible participants rising from 30% to 70% over a 12 month period.[40] The ProtecT trial was expected to be challenging for recruitment for reasons including strong treatment preferences by patients and clinicians. The qualitative research integrated within a feasibility study[43] enabled a nuanced understanding of the recruitment process from the perspectives of potential participants, clinicians and trialists, including reasons for treatment preferences and unexpected misinterpretations of information.[40] Strategies were developed that led to improvements in levels of randomisation and informed consent. The research methods used in the ProtecT study were then developed into a complex recruitment intervention[44] which has been applied to several other RCTs in different contexts, leading to insights about recruitment issues and the development of targeted recruitment strategies.[41,42] This research is a major theme of the MRC ConDuCT methodology hub, which specialises in working with RCTs likely to be challenging for recruitment, such as this trial.

2.2 Relevance of project

Theoretical arguments have been made that surgery for FAI may prevent the development of arthritis[1,4], but there is no evidence for this. Surgery might be indicated to relieve current symptoms, but an equally strong argument can be made that a well-constructed regime of conservative care will reduce the symptoms of hip impingement.

Hip arthroscopy is a rapidly expanding area of surgery, and FAI is one of the most frequent indications. The key elements of surgery for FAI that have been developed through open surgery are achievable by hip arthroscopy. Avoiding the more invasive procedure and prolonged periods of nonweight-bearing of open surgery have apparent advantages for patients. But arthroscopic FAI surgery has evolved quickly – more quickly than our understanding of the natural history of the disease[45-48], so it is now not clear whether surgery offers real benefit over a package of best conservative care.

In this context, an RCT to compare arthroscopic surgery and post-operative rehabilitation with best conservative care would be appropriate. However, it is a rapidly developing field, currently practiced by relatively few surgeon-innovators and specialists in non-operative care: These groups may not be in

equipoise. This presents special problems in the performance of a trial.[34] In addition, patients are likely to have strong views about whether they would prefer surgical or conservative treatment, raising questions about their preparedness to be randomised.

In addition we have referred to our own experience of a study with some similarities - the UK Heel Fracture study, which had a recruitment rate of 30%. Before a full RCT could proceed we believe it would be essential to determine the likely recruitment rate. The proposed feasibility study will explore whether a substantive trial could succeed, and if so, how best it might be designed. It is not designed to measure clinical effect, but to estimate the most important parameters that will be needed to design a substantive trial. It includes a pilot to agree the intervention protocols, test the proposed processes of a substantive trial, and, crucially, to estimate recruitment rate.

3. Study design

3.1 Research Question

Is it feasible to undertake a randomised controlled trial of hip arthroscopy versus conservative care for femoroacetabular impingement?

3.2 Objectives

The study objectives are to:

- Estimate the annual number of patients offered hip arthroscopy for FAI in the UK;
- Develop a consensus of opinion for conservative and surgical care protocols among clinicians who manage patients with FAI;
- Develop trial procedures, surgeon and patient information to maximise recruitment rate to an RCT of arthrocopic surgery versus conservative care for FAI;
- Estimate recruitment rate to an RCT of arthrocopic surgery versus best conservative care for FAI.

3.3 Study summary

We plan to establish whether it is feasible to undertake an RCT of hip arthroscopy versus best conservative care for femoroacetabular impingement (FAI). There are many potential barriers to undertaking a full randomised trial, in particular a study of this type that compares an operative and non-operative intervention. Our feasibility study will be undertaken in two stages. Initially, pre-pilot work will establish the number of surgeons performing this type of surgery within the UK, the individual case-load that they each undertake, and their attitudes to an RCT. A specialist group of hip arthroscopy surgeons and chartered physiotherapists will be approached to determine a consensus of opinion for the surgical indications, intra operative technique, postoperative rehabilitation and best conservative care for patients with FAI. Using this information a protocol and patient information material will be designed and finalised for a randomised pilot study comparing hip arthroscopy versus best conservative care. We will refine this protocol and patient information material using an expert panel of patients who have already been treated by surgery or conservative care.

A pilot study will then be undertaken and used to estimate recruitment rates for a full study. During the trial, an integrated qualitative study of recruitment will be performed among both patients and clinicians to determine the barriers to and solutions for completing a full randomised controlled trial.

3.4 Prepilot work

Surgeon survey

We will liaise with NHS Trusts, the British Hip Society and the British Orthopaedic Association to survey surgeons in England who are performing FAI surgery and to estimate their individual case loads. We will identify the major centres performing the majority of FAI surgery and establish the proportion of surgeons who are performing this surgery using hip arthroscopy or using open techniques.

A multidisciplinary sample of clinicians working in the centres performing hip arthroscopy will be interviewed to investigate their attitudes to randomisation of FAI patients. To stimulate discussion, clinicians will be provided with anonymised patient cases that cover the spectrum of patient presentations, including patient history (with duration of symptoms and previous treatments), examination findings and imaging. Clinicians will be invited to ‘think aloud’ as they evaluate the evidence and make a decision about whether or not they would randomise the particular patient in the proposed future trial. Interviews will be recorded and transcribed verbatim for analysis, and findings used to inform trial information packages for clinicians.

Establishing a consensus for operative indications, operative protocol, postoperative rehabilitation and conservative care

We plan to initially consult with national and international hip surgeons (many of whom have developed the current practices within this subspecialty). We will seek to obtain a consensus of opinion from this group on indications for surgery, operative technique, and rehabilitation.

Similarly, we will work with a group of national and international physiotherapists treating patients with FAI, in order to develop consensus on a best conservative care package.

These consensus activities will lead to the development of draft trial intervention protocols. We will then invite trial centres (operating surgeons and physiotherapists) engaging in our pilot study to a one-day workshop. This workshop will seek to formalise definitive protocols that are acceptable amongst all the collaborating centres.

Expert Patient Panel

In order to increase the numbers of patients randomised for the proposed future trial, we will investigate how best to inform patients of the benefits of trial participation, so that they can make good, informed decisions about this. We propose to establish an expert patient panel at UHCW: some have undergone FAI surgery; others have been managed conservatively. Interviews will be undertaken with a maximum variation sample of about 15 of these patients who would have been eligible for the RCT (selected to include a range of age, sex, disease severity, activity and socioeconomic status).

Interviews will explore patients' perspectives on their hip problems, previous experiences with treatments, views about arthroscopy surgery and conservative care, and the acceptability of randomisation between the interventions.

Patient information material

High quality patient information sheets and consent forms, which are clear, address the relevant patient concerns and which are presented in an easy to assimilate format will be vital for the success of the proposed future trial. Once an agreed protocol for both operative and conservative care has been established we will produce patient information material for the pilot study. The agreed documentation will be used in the pilot trial and honed in the light of feedback from both expert patients and patients in the pilot trial.

Prerequisites for commencing Pilot Trial – see flow diagram in section 7 below

Our pilot trial will be in a position to commence once some key aspects of the pre-pilot work have been completed and further ethical approval has been granted. These elements are:

- Feedback from Expert Patient Panel to finalise patient information material
- Consensus of opinion for treatment protocols
- Finalising treatment protocols and patient information material with collaborating centres

Other elements of the pre-pilot study will be not be required to be complete for progression to the pilot trial. These elements are:

- Expert patient interviews – which form part of the integrated qualitative research
- Quantity of FAI surgery survey

3.5 Pilot trial

Purpose

The purpose of the pilot trial is to estimate recruitment rate in order to assess the feasibility of a main trial.

Participants

Inclusion criteria

Patients will be eligible to participate in this study if:

- Aged 18-50;

- They have symptoms of hip pain - they may also have symptoms of clicking, catching or giving way;
- They show radiographic evidence of pincer- or cam-type FAI on plain radiographs and cross-sectional imaging;[49]
- The treating surgeon believes that they would benefit from arthroscopic FAI surgery.
- Able to give written informed consent
- Able to participate fully in the interventions

Exclusion criteria

Patients will be excluded from participation in the study if:

- They have previous significant hip pathology such as Perthes' disease, slipped upper femoral epiphysis or avascular necrosis;
- They have had a previous hip injury such as acetabular fracture, hip dislocation or femoral neck fracture;
- They already have osteoarthritis, defined as Tonnis grade >1[50], or more than 2mm loss of superior joint space width on AP pelvic radiograph;[11]
- There is evidence that the patient would be unable to participate fully in the interventions, adhere to trial procedures or to complete questionnaires, such as cognitive impairment or intravenous drug abuse.

Recruitment – see flow diagram in Section 7 below

Participants will be recruited from amongst the patients presenting to young adult hip clinics in each of the centres.

Screening of referrals

Possible FAI patients (younger adults with hip pain) will be identified by collaborating surgeons from referral letters. These patients will be invited to a diagnostic consultation with one of the collaborating surgeons. Prior to their appointment, these patients will be approached by post and telephone to seek consent for recording of their clinic consultations.

Diagnostic consultation

Surgeons will assess patients as usual, taking a history, examining the patient, and performing appropriate imaging investigations. Patients in whom a diagnosis of FAI is made, and who meet the eligibility criteria, will receive a description of the condition from their surgeon and an explanation that there are two possible treatments: an operation or a package of best conservative care. They will be given patient information about FAI and the trial. Patients will be invited to a trial information consultation to discuss what action they would like to take.

Trial information consultation

Patients will attend a Trial Information Consultation with a trained clinical researcher. Information will again be provided about FAI and its possible treatments, and about this pilot trial. Patients will be given an opportunity to ask questions. Patients will then be invited to give their consent to become participants in the trial. Patients who wish to take more time to consider will be given an opportunity to do so. Patients who agree to take part will complete baseline questionnaires at this consultation.

Treatment allocation

Participants will be randomly allocated to arthroscopic surgery and post-operative rehabilitation or best conservative care using 1:1 secure centralised telephone randomisation provided by Warwick CTU. Patients will usually be informed of their allocation at the Trial Information Consultation, and plans for delivery of the intervention will begin to be made there.

Post randomisation withdrawals

Participants may withdraw from the trial at any time without prejudice. If patients decide to have the treatment to which they were not randomised, participants will be followed-up wherever possible and

data collected as per the protocol until the end of the trial. The primary analysis will be on an intention-to-treat basis with a secondary per-protocol analysis.

Blinding

The patients cannot be blind to their treatment. The treating surgeons will, of course, not be blind to the treatment, but will take no part in outcome assessment for the trial. The functional outcome data will be collected and entered onto the trial central database via postal questionnaire by a research assistant who will be blind to the treatment allocation. The statistical analysis will also be performed blind.

Consent

Written informed consent will be obtained by a researcher delegated and trained by the research team. In general, from initial consultation to the day of surgery or start of best conservative care so there will be sufficient time for the patients to consider taking part in the trial. Any new information that arises during the trial that may affect patients' willingness to take part will be reviewed by the Trial Management Group; if necessary this will be communicated to all participants by the Trial Coordinator. A revised patient information sheet (PIS) will be provided and revised consent form will be completed if necessary.

Sample size

This pilot is not powered to estimate a treatment effect, rather to achieve a reasonable confidence interval around the estimate of the recruitment rate. Previous studies in orthopaedic surgery of operative vs. non-operative treatments have achieved recruitment rates of around 30%, so we have modelled around this rate.

Table 1 shows 95% confidence intervals around various recruitment rates for a range of scenarios. Sixty patients will allow a 95% CI of 18 to 41% if the true recruitment rate is 30% and we judge this to be a good balance between cost and duration of the pilot study and the required precision of the estimate.

Rate (%)	n=15	n=30	n=60	n=90	n=120
10	(0.0, 25.2)	(0.0, 20.7)	(2.4, 17.6)	(3.8, 16.2)	(4.6, 15.4)
20	(0.0,40.2)	(5.7, 34.3)	(9.9, 30.1)	(11.7, 28.3)	(12.8, 27.2)
30	(6.8, 53.2)	(13.6, 46.4)	**(18.4, 41.6)**	(20.5, 39.5)	(21.8, 38.2)
40	(15.2, 64.8)	(22.5, 57.5)	(27.6, 52.4)	(29.9, 50.1)	(31.2, 48.8)
50	(24.7, 75.3)	(32.1, 67.9)	(37.3, 62.7)	(39.7, 60.3)	(41.1, 58.9)

Table 1

We propose to approach 60 eligible patients across the four centres in order to estimate a recruitment rate with sufficient precision to plan a full RCT. Last year, the participating surgeons in four collaborating centres performed 221 arthroscopic FAI procedures in which at least 204 would have been eligible for this pilot. We therefore expect to complete an approach to 60 patients in 12 months.

Trial treatments

Arthroscopic hip surgery

As a relatively new procedure, there are a variety of surgical techniques for arthroscopic FAI surgery. We have chosen a group of surgeons who perform similar techniques which are typical of the majority of surgeons around the world, and representative of those used widely in the UK. The surgeons are all suitably trained and experienced. They will agree the final details of the following operative and post-operative rehabilitation protocol during a workshop in the pre-pilot phase of the trial.

The provisional operative protocol is:

- General anaesthetic with muscle relaxation.
- Supine or lateral patient positioning.
- Operating table with facility for traction and allows range of movement testing.
- Arthroscopy of central compartment.

- Arthroscopy of peripheral compartment working with one of the following; intact capsule, capsulotomy or capsulectomy.
- Ability to undertake bony surgery to correct abnormalities on both the femoral head neck junction and acetabular side of the hip joint.
- Ability to undertake soft tissue repair and or debridement to the labrum and or articular cartilage.
- Ability to record with either video or photos the intraoperative findings and solutions.

The provisional post-operative protocol is:

- Supervised by chartered physiotherapist.
- Patients receive adequate analgesia in the form of paracetamol, NSAIDs and opiates.
- Patient has an initial period of protected weight bearing stage. This may last 2–6 weeks dependant on the level of surgical intervention.
- Initial exercises are aimed at restoring range of movement, maintaining muscle function whilst allowing tissue healing and pain to settle.
- Patient progresses to intermediate exercises once fully weight bearing and experiencing minimal levels of discomfort. Ideally range of movement in the involved hip should be at least 85% of the uninvolved side.
- Patient progresses to further advanced exercises when range of movement is full, walking is normal and pain free and muscle strength is greater than 70% of the uninvolved side in all directions.

Best conservative care

A package of best conservative care will be agreed by the research team and by national and international physiotherapists involved in the management of patients with FAI. The protocol will permit individualisation by participating physiotherapists for each patient as is usual practice. It will comprise a range of conservative treatment options, including interventions that target patients' pain (anti-inflammatory medication, hip joint corticosteroid injection, postural adaptations, exercise, acupuncture, manual therapy techniques) and functional difficulties (lifestyle advice, gait modification, exercise and physical activity). The focus of this intervention will be an individualised, supervised and progressed exercise rehabilitation programme, informed by existing FAI literature[3,18,51-54] and relevant musculoskeletal pain literature more broadly[55-57] given the paucity of FAI or hip pain-specific trials and systematic reviews. The exercise rehabilitation programme is most likely to include patient education and advice, prescription of an exercise programme to be supervised in clinic and practised at home over a period of at least 12 weeks. The exercise approaches will focus on muscle control and balance exercise in the early phase, progressing to resistance exercise in available range, stretching exercise, and activity/sport-specific exercise in later phases of the programme. A template of exercises will be agreed from which therapists can individualise and progress the programme for each patient, in a similar way to previous exercise-based physiotherapy interventions in trials.[58] Patients will be asked to keep diaries of exercises performed unsupervised, based on the exercise diaries currently being used within a large trial of exercise for knee pain led by Professor Foster (the BEEP trial). Physiotherapists in each of the participating centres will provide the best conservative care intervention in conjunction with surgeons who will prescribe the anti-inflammatory medication and deliver the joint injections where required. In the pre-pilot study, we will identify a consensus of opinion amongst physiotherapists on how this care should be delivered but it is most likely to include up to 8 one-to-one (re)assessment and treatment sessions within the option of telephone follow-up contacts over a period of at least 12 weeks. Whilst the focus of the intervention will be on active rehabilitation and adherence to the advice over the long-term, a range of passive physiotherapeutic modalities will be permitted within the protocol to facilitate pain relief, including agreed manual therapy techniques and acupuncture. Protocol exclusions will include group or class based rehabilitation, hydrotherapy or care delivered by physiotherapy technical assistants or students.

The provisional non-operative care protocol is:

- Anti-inflammatory drugs for 2 to 4 weeks.
- Stretching exercises explained and initially supervised by a Chartered Physiotherapist for 2 to 3 weeks in the form of stretching exercises to improve hip external rotation and abduction in extension and flexion.
- Patients followed up every 2 weeks for 2 months by their physiotherapist

- Further assessment of the normal range of hip internal rotation and flexion after the acute pain has subsided. Physiotherapist determines the safe range of movement to avoid FAI.
- Patients are instructed to adapt to their safe range of movement and perform activities of daily living with minimal friction.
- Modification of activities of daily living predisposing to FAI (e.g. hip internal rotation associated with flexion and adduction. Patients are taught to avoid running on a treadmill or narrow straight trails to prevent internal rotation of the lower limbs. Such activities are to be replaced by running in a zigzag and wide courses (requiring some abduction and external rotation during turns). Cycling is to be avoided if possible, as this involves hip flexion and internal rotation at the same time. When cycling is unavoidable, the patients are advised to externally rotate the legs to give some rest to their hip and also elevate the bicycle seat to avoid deep hip flexion. Patients avoid sitting continuously for a long time with the spine fully straight and the hip in flexion; when sitting, lean back every 5 or 7 minutes (to decrease hip flexion) is encouraged.
- Patients followed up every 2 months for 4 months.
- Patient progresses to further advanced exercises when range of movement is full, walking is normal and pain free and muscle strength is greater than 70% of the uninvolved side in all directions. The goals of this stage are the restoration of muscular and cardiovascular endurance, and the improvement of balance reactions. Return to social sport should be possible at this stage.
- Some but not all patients will require sports specific training. Those who take part in competitive sport will certainly benefit from further strengthening and more sports specific exercise. Training regimes for this stage should be developed in conjunction with sports club physiotherapists or personal trainers.

Quality assurance of treatments

In a full trial, quality assurance of both interventions will be essential in order to ensure that any true effect is measured. One objective of this feasibility study will be to design and test methods for this quality assurance. This may be particularly challenging for the surgical intervention because is not clear that surgeons will accept the critical judgments of their peers, particularly when most of the surgeons performing these operations consider themselves to be innovators and experts.

For each operation, we will prepare a vignette comprising: an operative proforma describing the operation which has been performed; clips of intraoperative video; and post-operative 3-D shape imaging with a single sequence MR proton density volume acquisition. We have tested each of these elements and believe that they allow a comprehensive assessment of the quality of the surgery that has been performed. For each participant, this vignette will be analysed by an international expert group comprising John Timperley (secretary of the British Hip Society, with a usefully skeptical stance on FAI surgery), Mark Philippon (USA; chairman of the Research Committee of the International Society for Hip Arthroscopy), Martin Beck (Switzerland; one of the investigators credited with developing the early understanding of FAI), John O'Donnell (Australia; a highly respected high-volume arthroscopic hip surgeon), and Professor Charles Hutchinson (UK; an expert in musculoskeletal radiology).

For conservative care, participating physiotherapists will record full details of the advice and treatments, number of treatments, non-attendance, and any adverse events for each patient on specifically designed case report forms. process records of therapies including physiotherapy, prescribed analgesia, intra-articular injections and advice. These case report forms will be audited against the physiotherapists clinical notes to ensure accuracy and to determine protocol compliance by participating physiotherapists before collation by the research team in order to fully describe the interventions delivered. Where protocol deviations are noted, these will be discussed with the physiotherapists involved in order to enhance compliance with the agreed intervention protocol.

Outcome Measures

The primary outcome measure will be the Non-Arthritic Hip Score

(NAHS) Secondary outcome measures will be:

- IHOT-33, a possible alternate primary outcome instrument for a full trial;
- SF-36, to measure overall health-related quality of life; and
- EQ-5D, a preference-based measure of health-related quality of life.

Resource use will be monitored within the pilot study with the view to informing the design of economic measures within the subsequent definitive trial. Unit cost data will be obtained from national databases such as the BNF and PSSRU Unit Costs of Health and Social Care. Where these are not available, the unit costs will be estimated using primary research methods in consultation with the UHCW finance department. The cost consequences following discharge, including NHS costs and patients' out-of-pocket expenses will be recorded via a short questionnaire which will be administered at 3, 6 and 12 months post treatment. Patient self-reported information on service use has been shown to be accurate in terms of the intensity of use of different services.[59] An assessment will be made of the best possible way of identifying, measuring and valuing the economic costs and health consequences of hip arthroscopy for FAI for application within the subsequent definitive trial.

Follow-up

We will use techniques common in long-term cohort studies to ensure minimum loss to follow-up, such as collection of multiple contact addresses and telephone numbers, mobile telephone numbers and email addresses. Considerable efforts will be made by the trial team to keep in touch with patients throughout the trial by means of newsletters etc.

Follow-up questionnaires will be administered by post or email with 3 reminders and a final telephone call for minimum data collection.

Time	Data to be collected
Baseline	NAHS, IHOT-33, SF-36, EQ5D; preoperative imaging
6 weeks	Complication records, operation proforma, operative video, postoperative imaging
3 months	NAHS, IHOT-33, SF-36, EQ5D; complications; conservative care log; economics questionnaire
6 months	NAHS, IHOT-33, SF-36, EQ5D; complications; conservative care log; economics questionnaire
12 months	NAHS, IHOT-33, SF-36, EQ5D; complications; conservative care log; economics questionnaire

Table 2: Follow up measures

Good Clinical Practice

The trial will be conducted in accordance with the Medical Research Council's Good Clinical Practice (MRC GCP) principles and guidelines, the Declaration of Helsinki, Warwick Clinical Trials Unit SOPs, relevant UK legislation and the Protocol. GCP-trained personnel will conduct the trial.

Consort

The trial will be reported in line with the CONSORT statement.

3.6 Integrated qualitative study of recruitment (IQR)

Purpose

The aim of the IQR is to understand the recruitment process in the early stages, so that any difficulties related to design or conduct can be raised and changes put in place. The IQR will also be used to determine any staff training that needs to be developed. The IQR is intended to provide information about recruitment as it happens, and to provide the basis for the plan of action to improve it. The ethnographic nature of the IQR means that the research moulds itself around the needs of the trial and is completed when theoretical saturation is reached (that is, new data collection does not materially add to the findings).

Patient pathway through eligibility and recruitment

A comprehensive process of logging of potential RCT patients through screening and eligibility phases will be put in place in order to ensure compliance with the CONSORT checklist and to monitor recruitment. The trial team will develop a flow chart of the anticipated recruitment pathway that maps the patient's journey beginning from the point of diagnosis to making a decision about participation in the RCT.

These logs will give an indication of the numbers of eligible patients and particular points where they are 'lost' from the RCT. They will also indicate levels of equipoise – as evidenced by the numbers rejecting participation in the RCT and the selection of particular treatments.

In-depth interviews and investigator meetings

In-depth, semi-structured interviews will be conducted with two groups:

- Members of the TMG, including the CI and those most closely involved in the design, management, leadership and coordination of the trial;
- Clinical staff in each of the participating centres.

Interview topic guides will be used to ensure similar areas are covered in each interview, based on those used in previous studies, but also encouraging the informants to express their own views about the RCT and any recruitment challenges expected or experienced.

Clinicians who recruit to the trial will also be asked questions about their knowledge of the evidence and personal views about equipoise; the recruitment pathway, how they feel the protocol fits their clinical setting and any adjustments they think are needed. They will also be asked how they explain the RCT, the interventions and controls to patients, and the randomisation process.

The IQR team will observe meetings of the TMG and TSC. The IQR researchers will discuss the agenda with the CI, with the aim of fostering discussion, particularly about issues of eligibility and equipoise if these have emerged from the early findings. The meetings will also be a forum to discuss the findings of the IQR, and to deliver training or advice about recruitment.

Interviews and meetings will be audio-recorded and transcribed. Recordings may be transcribed verbatim whole or in selected parts, as necessary for comprehensive or targeted analysis. Transcripts and notes will be analysed thematically by the IQR researcher, using techniques of constant comparison and case-study approaches. This will involve detailed coding, and then comparing emerging themes and codes within transcripts and across the dataset looking for shared or disparate views among TMG members, specialist clinicians and recruiters, and within or between centres or specialties. The coding will be carried out using qualitative data analysis software such as ATLAS-ti or NVivo. The initial coding will be cross-checked by another researcher and discussed with the IQR PI, with inconsistencies resolved by discussion. Detailed descriptive accounts of the themes and cases will then be produced by the IQR researcher.

Interviews and meetings will provide data about: the evidence underlying the RCT, including the importance of the question and the commitment of staff to it, as well as individual clinical equipoise; the application of the protocol in clinical centres and any logistical issues; and suggestions about reasons for recruitment difficulties and potential solutions from those working closely within the RCT.

Audio-recording of consultation and recruitment appointments

Clinicians will scrutinise referral letters before clinics to identify potential FAI patients. In at least one centre (initially Coventry), patients will be contacted in advance of their first consultation to request their permission for their consultation to be recorded.

Those who have a diagnosis of FAI will then be given patient information about their condition, its possible treatments, and about the FASHIoN trial. They will be invited to attend a trial information consultation, which will be recorded.

Audio-recordings of appointments will be analysed as described above for interviews, with the addition of some of the techniques of focused CA – conversation analysis – pioneered in previous studies. CA techniques will be used to identify and document aspects of informed consent and information provision that is unclear, disrupted or hinders recruitment. Recordings will be listened to by the researcher and notes made about the content of the appointment, including the basic content covered,

the order of presentation of RCT arms and other treatment options, time spent on interventions and controls, and time spent describing both the RCT design and the randomisation process. An assessment will be made as to whether the appointment is recruiter- or participant-led, and also the degree to which there is evidence that the participant has understood the key issues of equipoise, randomisation, participation in the RCT, the option to choose their treatment, and the option to withdraw from the research at any time.

RIAS (the Roter Interaction Analysis System) coding will also be applied to the information consultation recordings. This is a well established system for analysing clinical consultation processes. It provides a detailed description of what happens during consultations, including: the nature and content of what is discussed; whether questions are asked in an open or closed manner; the relative contributions of clinicians and patients; the types of verbal utterances made e.g. clinicians showing approval, empathy, making partnership statements; the time spent in different consultation phases; and an affect rating for each consultation. RIAS coding will be imported into SPSS to provide a quantitative analysis of these different consultation mechanisms and characteristics, which will complement the other two analytic approaches.

The IQR researcher will document these details and provide an account for the IQR PI. When at least three recordings have been analysed, the IQR researcher and PI will decide what confidential feedback will be given to the recruiter. Issues to be fed back to the RCT CI/TMG, or to be used anonymously in training programmes will be discussed and defined.

These data will form the basis for feedback to individuals and for development of training programmes.

Study documentation

The CI/TMG will be working on the RCT protocol, ethical approval and governance documents during the early stages of the IQR. PIS and consent forms will be scrutinised by the IQR team to identify aspects that are unclear or potentially open to misinterpretation, the clarity of the lay presentation of the evidence, and the balance of information on the different arms in the RCT and its adverse events. The information from the study documents will be compared with the findings from the interviews and recorded appointments, to identify any disparities or improvements that could be made.

Feedback to CI/TMG

The IQR team will present summaries of anonymised findings emerging from their work to the CI and TMG, identifying any aspects of RCT design and conduct that could be hindering recruitment with the supporting evidence. There are likely to be several meetings regularly during the feasibility phase of the study to present these findings and discuss a plan of action to try to improve recruitment, if this proves necessary. The plan is likely to include some or all of: reconsideration of study information, advice about presenting the study, discussions about equipoise or evidence, issues with patient pathways, and logistical issues in particular centres. These may be addressed by new PIS, documents, changes to the protocol, or training for recruiters in the presentation of RCTs in general or the specific RCT.

Evaluation

Numbers of eligible patients, and the percentages of these that are approached about the RCT, consent to be randomised and immediately accept or reject the allocation will be assessed before the plan of action is implemented, and regularly afterwards to check whether rates are improving.

3.8 Adverse events

3.8.1 Adverse event management

Adverse events (AE) are defined as *any untoward medical occurrence in a clinical trial patient and which do not necessarily have a causal relationship with the treatment*. All AEs will be listed on the appropriate Case Report Form for routine return to the 'FASHIoN' central office.

Serious adverse events (SAE) are defined as any *untoward and unexpected medical occurrence that:*

1. *Results in death*,
2. *Is life-threatening*

3. *Requires hospitalisation or prolongation of existing inpatients´ hospitalisation*,
4. *Results in persistent or significant disability or incapacity*,
5. *Is a congenital anomaly or birth defect*
6. *Any other important medical condition which, although not included in the above, may require medical or surgical intervention to prevent one of the outcomes listed*.

All SAEs will be entered onto the reporting form and faxed to dedicated fax at WMSCTU within 24 hours of the investigator becoming aware of them. Once received, causality and expectedness will be confirmed by the CI. SAEs that are deemed to be unexpected and related to the trial will be notified to the Research Ethics Committee (REC) within 15 days. All such events will be reported to the Trial Steering Committee and Data Monitoring Committee at their next meetings. SAEs that may be expected as part of the surgical interventions, and that do not need to be reported to the main REC are: complications of anaesthesia or surgery (wound infection, bleeding or damage to adjacent structures such as nerves, tendons and blood vessels, delayed wound healing, and thromboembolic events, hip fracture, osteonecrosis and traction related neuropathies). SAEs that may be expected as part of the conservative care interventions and that do not need to be reported to the main REC are: transient increase in pain, delayed onset muscle soreness or mild bleeding at injection or acupuncture needle sites. All participants experiencing SAEs will be followed-up as per protocol until the end of the trial.

3.8.2 Risks and benefits

Both interventions are thought to provide benefit in patients with FAI. There is thought to be a longterm risk of osteoarthritis in patients with FAI. It is not known whether conservative care or arthroscopic surgery have an effect on this risk. The short-term risks of this study relate to the two interventions. These risks are described below:

Operative

Hip arthroscopy requires a general anaesthetic. The risk of complications from hip arthroscopy is about 1-2%[60]. These include:

- Infection – thought to be less than 1in 1000. If the infection occurred deep within the joint it may require more procedures to wash out the hip joint.
- Bleeding – possibly causing bruising or a local haematoma.
- Traction related – to allow the small arthroscopy instruments into the hip joint, traction is required to separate the hip joint surfaces. Sometimes after the procedure the pressure from the traction can cause some numbness in the groin, leg or foot. The numbness usually resolves within a few hours or days.
- Osteonecrosis – during surgery the blood supply to the hip joint could be damaged. However, there are no reported cases of osteonecrosis following arthroscopic hip impingement surgery so this is a very small risk.
- Femoral neck fractures - This is also a very rare complication. This complication would require a further procedure to fix the fracture.

Non-operative

There are some small risks with pain medications and joint injection. However, the main risk is muscle soreness and transient increases in pain from the exercises that will be undertaken.

3.9 End of trial

The pilot study will be complete when we have approached 60 patients to seek consent for randomisation or when it has become apparent that it is not feasible within 18 months. All patients who are randomised will be followed up for 1 year.

4. Data Management

4.1 Case Report Forms

The Case Report Forms will be designed by the trial coordinator in conjunction with the trial management team. All electronic patient-identifiable information will be held on a secure, password-protected database accessible only to essential personnel. Paper forms with patient-identifiable information will be held in secure, locked filing cabinets within a restricted area of Warwick Medical School. Patients will be identified by a code number only. Direct access to source data/documents will be required for trial-related monitoring. All paper and electronic data will be retained for at least five years after completion of the trial.

4.2 Statistical Analysis

The pilot study is not designed or powered to assess the size of any treatment effect, rather to estimate recruitment rate. The recruitment rate will be estimated based on data collected and a 95% confidence interval determined for this estimate. Treatment differences will be estimated for the primary outcome measure (NAHS) and all secondary outcome measures (IHOT-33, SF-36 and EQ-5D) at 3, 6 and 12 months. In addition to treatment differences the variability (standard deviation) of the outcome measures will be estimated in the target population. Together with the estimated treatment differences, the variability and recruitment rate will be used in power analysis to develop a range of potential trial designs, with recommendations as to which the most feasible option.

In addition to power analysis, summary data measures (e.g. means, medians and standard deviations) will be presented for all outcome measures at each occasion and inferences will be made on temporal changes and any potentially interesting effects within subgroups identified for future work. Analysis will be undertaken in SPSS® and R (http://www.r-project.org/) as appropriate.

It seems likely that some data may not be available due to voluntary withdrawal of patients, lack of completion of individual data items or general loss to follow-up. Where possible the reasons for data 'missingness' will be ascertained and reported. Although missing data is not expected to be a problem for this study, the nature and pattern of the missing data will be carefully considered — including in particular whether data can be treated as missing completely at random (MCAR). If judged appropriate, missing data will be imputed, using the multiple imputation facilities available in R (*http://www.r-project.org/)*. The resulting imputed datasets will be analyzed and reported, together with appropriate sensitivity analyses. Any imputation methods used for scores and other derived variables will be carefully considered and justified. Reasons for ineligibility, non-compliance, withdrawal or other protocol violations will be stated and any patterns summarized. More formal analysis, for example using logistic regression with 'protocol violation' as a response, may also be appropriate and aid interpretation.

5. Trial Oversight

The day-to-day management of the trial will be the responsibility of the Trial Coordinator, based at Warwick CTU and supported by the CTU administrative staff. This will be overseen by the Trial Management Group, who will meet monthly to assess progress. It will be the responsibility of the Trial coordinator and the clinical research fellow to undertake training of the research associates at each of the trial centres. The trial statistician and health economist will be closely involved in setting up data capture systems, design of databases and clinical reporting forms. A Trial Steering Committee (TSC) and a Data Monitoring Committee (DMC) will be set up.

5.1 Trial Supervision

Day-to-day management of the trial will be overseen by a Trial Management

Group. A TSC -with an independent Chairman - and DMC will be set up.

The remit of the TSC is to:

- monitor and supervise the progress of the trial towards its interim and overall objectives
- review at regular intervals relevant information from other sources
- consider the recommendations of the DMC
- inform the funding body on the progress of the trial.

A DMC charter will be compiled detailing the members of the committee, their individual responsibilities and the overall responsibility of the DMC. The main roles of the DMC will be to review/approve the Statistical Analysis Plan (SAP), and to review trial progress, interim data and safety aspects of the study.

5.2 Quality control

We will institute a rigorous programme of quality control. The senior trial manager in conjunction with the trial coordinator will be responsible for ensuring adherence to the trial protocols at the trial sites. Quality assurance checks will be undertaken by Warwick CTU to ensure integrity of randomisation, study entry procedures and data collection. The Warwick CTU has a quality assurance manager who will monitor this trial by conducting regular (yearly or more if deemed necessary) inspections of the Trial Master File. Furthermore the processes of consent taking, randomisation, registration, provision of information and provision of treatment will be monitored. Written reports will be produced for the TSC, informing them if any corrective action is required.

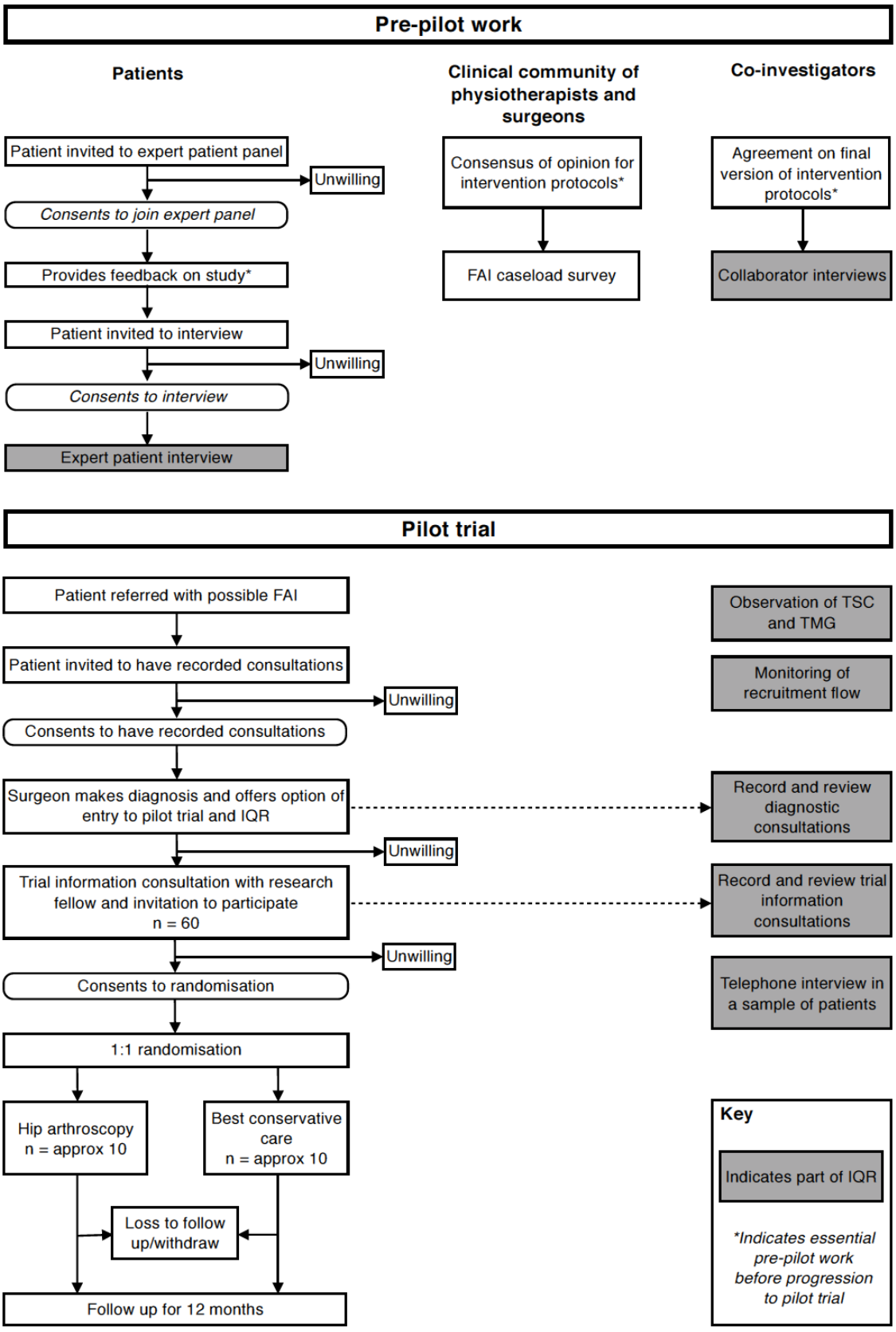
5.3 Insurance and Indemnity Arrangements

Standard NHS cover for negligent harm is in place. There will be no cover for non-negligent harm.

5.4 Dissemination

The results of this trial will substantially inform clinical practice on the clinical and cost effectiveness of the treatment of these injuries. The results of this project will be disseminated through peer-reviewed journals, conference presentations, the National Library for Health and through local mechanisms at all participating centres.

7. Trial flow diagram



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