This review describes the development of arthroscopy of the hip over the past 15 years with reference to patient assessment and selection, the technique, the conditions for which it is likely to prove useful, the contraindications and complications related to the procedure and, finally, to discuss possible developments in the future.

Arthroscopic surgery of the hip has evolved considerably in recent years and offers the opportunity of treatment of many previously unrecognised intra-articular abnormalities. One of the early pioneers of the technique was Burman who, in 1931, undertook hip arthroscopy as part of a study on cadavers. However, the procedure did not gain popularity until the late 1970s. The reasons for this slow growth in interest were twofold. First, the femoral head is deeply recessed in the bony acetabulum with a thick fibrocapsular and muscular envelope surrounding it, which makes arthroscopic access more difficult compared with that to the knee or shoulder. Secondly, a lack of interest and knowledge of sports medicine, combined with limited imaging techniques, led to poor understanding of conditions involving the labrum and the chondral surfaces. However, in its present form, arthroscopy of the hip allows a clear view of the articular surfaces of the femoral head and the acetabulum, the acetabular labrum, the ligamentum teres and the surrounding synovium.

Patient assessment and preliminary investigations
A successful outcome after arthroscopy of the hip, like any other surgical intervention, requires careful patient selection involving a thorough assessment, including a detailed history, examination of gait and examination of the hip to reach an appropriate diagnosis. When taking the history, it is essential to differentiate whether the patient’s pain is arising from the lumbarosacral spine or from an extra-articular or intra-articular source. Pain located in the groin, anterior thigh and medial aspect of the knee usually indicates intra-articular pathology as does a history of mechanical symptoms such as catching, locking and giving way. Clinical examination of the patient with an intra-articular disorder may reveal limited movement and/or a positive impingement sign, or a positive McCarthy sign. The impingement sign is elicited by flexing, adducting and internally rotating the hip which, if positive, provokes pain. The McCarthy sign is elicited by fully flexing both hips and then extending the affected hip, first in external and then in internal rotation. A positive sign is indicated by pain being reproduced on extension.

Once a provisional diagnosis has been established, it should be confirmed by appropriate imaging. Unfortunately, plain radiography, isotope bone scanning and CT have a low specificity for diagnosing an intra-articular disorder, apart from identifying loose bodies and degenerative changes in the joint. MRI without contrast may also fail to identify chondral lesions less than 1 cm in diameter, labral tears and osteochondral loose bodies. However, the sensitivity can be increased to 92% by the addition of contrast. Despite this, MR arthrography has its shortcomings and, therefore, hip arthroscopy remains the most specific and sensitive tool for the diagnosis and management of intra-articular conditions.

Positioning and instrumentation
Arthroscopic access to the hip can be achieved with the patient in the supine or the lateral positions. The supine position was popularised by Byrd and allows the use of a standard fracture table and simplicity of positioning, thereby circumventing the need for specialised distraction devices, as well as allowing familiar
The lateral position has also gained acceptance and is the preferred position in our practice. It was originally described by Glick et al and has the advantage of providing reproducible bony landmarks for orientation, allowing peritrochanteric approaches to the hip and also facilitating access and instrumentation of most of the hip. Whichever position is used, it is important to be able to apply traction and, for access to the peripheral compartment, to enable flexion of up to 90˚ with internal rotation, to allow a thorough assessment of femoroacetabular impingement.

In their most basic form the instruments designed for arthroscopy of the hip are extra long to take account of the dense soft-tissue envelope which surrounds the joint. The availability of a shortened bridge for the arthroscope makes the system compatible with the standard-length knee arthroscope (Fig. 1). The cannulae used for hip arthroscopy are flexible and are also available in a slotted format to allow the use of curved instruments, thereby offering effective access to the joint. The burrs and the shaver blades are modified to provide extra length with both curved and straight options available. Specialised, rigid (with different angles) and flexible radiofrequency probes have been designed for resection of labral and chondral lesions. The flexible radiofrequency probes can be deflected up to 100˚ allowing access to areas inaccessible to conventional instruments. These probes have different configurations of the tip, e.g. the ligament chisel probe (Smith & Nephew Inc, Andover, Massachusetts) allows resection of dense soft tissue and the ablator probe (Smith & Nephew) gives rapid ablation of soft tissues with the possibility of debriding irregularities (Fig. 2).

Recent advances in acetabular labral repair and arthroscopic excision of the femoroacetabular impingement lesion have led to a further development in instrumentation. Bio-absorbable suture anchors with etchmark placing and transparent and partially-threaded arthroscopic cannulae...
læ allow the instruments to be viewed within the cannulae and give better visualisation to distinguish the depth of the field. Access systems which are similar to the tibial tunnel guide used in reconstruction of the anterior cruciate ligament have also been developed to facilitate rapid creation of portals and the passage and exchange of instruments (Fig. 3). These systems allow the simple establishment of a portal without fluoroscopic control in a short period of traction with a reduced risk of injury to the hip.

A fluid management system is of paramount importance for obtaining a good view of the hip. With the current systems, pressures as high as 100 mmHg are required to obtain a good view of the central compartment and approximately 60 to 80 mmHg to view the peripheral parts of the joint.

**Indications**

Although the indications for arthroscopy of the hip are expanding rapidly, there are many conditions for which it is already of proven benefit.

**Labral tears.** The acetabular labrum is a triangular fibrocartilaginous structure attached at its base to the rim of articular cartilage surrounding the periphery of the acetabulum. At the inferior margin of the acetabulum it is deficient and the transverse acetabular ligament completes the circumferential rim. Like the meniscus in the knee, the labrum has a good blood supply at its periphery and is relatively avascular at its free-edge. Its main physiological functions are to enhance stability, preserve congruity and prevent disruption of the sealing mechanism.

Labral tears are by far the most consistent abnormal finding at arthroscopy associated with a typical presentation of groin pain and catching, clicking or locking. They frequently occur in the avascular zone and in the anterosuperior quadrant of the acetabulum and fail to heal with conservative treatment. These tears can be traumatic in origin and are usually caused by a sudden pivoting or twisting action. They may also be associated with congenital or structural hip abnormalities such as Perthes’ disease, slipped capital femoral epiphysis and developmental dysplasia of the hip. As far as imaging is concerned, tears are often missed by conventional diagnostic radiological methods and even MR arthrography. However, arthroscopy provides an excellent means (Fig. 4) of assessing the labral anatomy and also an opportunity for either resecting the tears back to a stable rim or repairing them. Resection can be achieved by the use of arthroscopic shavers or radiofrequency probes. Chiron reported the results in 50 patients who underwent resection of labral tears. Half of those with some arthritic changes identified on radiographs pre-operatively continued to have residual pain. However, in patients without arthritic changes, 80% had symptomatic relief after resection.

Repair of labral tears has gained importance in recent years because of an increased understanding of the functional importance of the labrum. The goals of a labral repair are to relieve pain by eliminating the unstable torn flap, to restore the anatomy of the hip and to prevent the premature onset of arthritis. The importance of repairing the labrum was demonstrated in a recent study by Espinosa et al in which the results of open resection (group 1) of the labrum were compared with re-fixation of the labrum (group 2) for the treatment of femoroacetabular impingement. The Merle d’Aubigné clinical score and the Tonnis arthritis classification system were used to study the outcome. At one year after operation, both groups showed a significant improvement in their clinical scores compared with their pre-operative values. However, at two years post-operatively, only 28% of the hips in group 1 had an excellent result, 48% had a good result, 20% a moderate result and 4% a poor result. By contrast, in group 2, 80% had an excellent result, 14% a good result and 6% a moderate result. Comparison of the clinical scores between the two groups revealed a significantly better outcome for group 2 at one and two years. Radiological signs of osteoarthritis were also significantly more frequent in group 1 than in group 2 at one and two years. This study clearly demonstrated that patients treated with labral re-fixation recovered earlier and had a superior clinical and radiological outcome when compared with those who had undergone resection. Along with treatment of the labral tear itself, it is also extremely important to address associated abnormalities such as paralabral cysts which are amenable to arthroscopic decompression and other factors responsible for the labral tears in order to avoid recurrence or progression of the disease process.

Technically, if the tear involves a peripheral detachment, a bio-absorbable suture anchor can be used to secure the torn area to the acetabulum. This process is demanding and
requires correct placement of the anchor under fluoroscopic guidance and subsequent passage of a knot through a cannula and over the labrum, using a standard arthroscopic knot-tying technique.\textsuperscript{25}

Although the long-term results of arthroscopic labral repairs are unknown, the short-term results seem to be promising. Early follow-up studies in athletes with labral repair showed outcomes similar to those after labral
More recently, Philippon described a study of 900 labral repairs carried out between 2002 and 2006 in which 78% of the patients had excellent results.

The main complication of labral repair was the formation of adhesions between the capsule and the labrum.
**Chondral lesions.** Lesions of the articular cartilage of either the femoral head or the acetabulum are often elusive sources of pain in the hip. They are frequently associated with labral tears, dislocation of the hip, osteonecrosis, slipped capital femoral epiphysis, dysplasia and degenerative arthritis. Another recognised mechanism for the development of a chondral lesion is the so-called ‘lateral impact injury’. This involves a blow to the greater trochanter and usually occurs in young adult males. The sudden impact loading leads to transfer of this large force directly to the joint surface rather than to the bone, resulting in chondral damage.

The most common initiating site for labral and chondral lesions has been termed the ‘watershed zone’ by McCarthy et al. A lesion starting at the labrochondral junction has the potential to destabilise the adjacent articular cartilage, by allowing synovial fluid to be pumped underneath the cartilage, leading to delamination and eventual exposure of the underlying subchondral bone. Arthroscopy, in this case, gives an excellent visual field (Fig. 5), an opportunity for debriding, and in certain cases the use of a microfracture technique, to treat chondral defects. It should, however, be noted that the success of arthroscopic treatment depends largely on the severity and extent of any chondral damage. An outline of the natural history of these chondral lesions is provided by O’Donnell’s study involving second-look arthroscopy performed for recurrent symptoms after primary debridement for labrochondral pathology. Six of the eight patients had some progression of the chondral lesion. However, a similar debridement of the osteochondral lesion in these non-arthritic hips led to resolution of symptoms.

An exciting area of arthroscopic surgery which is slowly developing is autologous chondrocyte implantation (ACI) in the hip. Results from a recently conducted, small prospective randomised controlled trial of 30 patients in Italy, indicated that ACI in the hip was better than simple debridement alone in patients with arthroscopically-proven traumatic chondral lesions. A collagen-based matrix was used to implant the chondrocytes and the results in the short term appeared to be encouraging.

**Synovial conditions and loose bodies.** Arthroscopy allows both the diagnosis and treatment of conditions affecting the synovium such as pigmented villonodular synovitis, synovial chondromatosis, rheumatoid arthritis and crystalline arthropathies (Fig. 6). In its most simple form, arthroscopy enables an accurate synovial biopsy to be taken from the most inflamed tissue visible within the hip. At a more advanced surgical level, it is possible to undertake a synovectomy by arthroscopic means.

Loose bodies can present a major problem in the hip and the patient may present with symptoms of painful locking or catching of the joint. The usual conditions which lead to the production of loose bodies include synovial chondromatosis, Perthes’ disease, osteochondritis dissecans and, occasionally, trauma. Non-ossified loose bodies are not always visible on plain radiography, but when suspected can be managed arthroscopically. Arthroscopy is by far the least invasive method available for the removal of loose or foreign bodies which can be accomplished without formal dislocation of the joint. Boyer and Dorfmann recommend that the peripheral compartment is explored first, since most of the loose bodies are found in this area. Loose bodies can be removed individually with the grasper by suction or, if they are too large, by mechanical morcellisation in situ and subsequent lavage and suction.

However, arthroscopic removal of loose bodies is not always completely successful. Sometimes it is necessary to leave some residual loose bodies rather than to cause damage to the joint and occasionally, it is necessary to undertake an arthrotomy to remove them.

The results of a study of 111 patients who underwent arthroscopy of the hip for removal of loose bodies showed that approximately 57% had an excellent result after treatment. However, approximately 37% needed a re-arthroscopy for the recurrent symptoms and 17% an arthroplasty at a later date. Apart from providing a blood supply to the developing hip, the ligamentum teres also contributes considerably to the stability of the joint. The ruptured ligamentum can be a source of pain and, occasionally, of locking. Lesions of the ligamentum were classified by Gray and Villar as traumatic or degenerative. The former usually accompany a dislocation while a degenerative rupture is generally secondary to an ongoing disease process. Arthroscopy allows visualisation of ligamentum teres and debridement to abolish pain and prevent impingement (Fig. 7).

It has also been noted that patients with a rupture of ligamentum teres have recurrent episodes of subluxation which may result in a higher incidence of degenerative change. Reconstruction of the ligamentum has been described by Philippon, and the procedure has been carried out in three patients for recurrent instability with good short-term results. Although reconstruction is still in its infancy it is possible that the ligamentum teres has a role similar to that of the anterior cruciate ligament in the knee but further study is required to elucidate its function and thereby to guide future management when it is disrupted.

**Osteonecrosis.** The role of hip arthroscopy in the diagnosis and management of osteonecrosis is controversial. Some even consider that it is a contraindication. However, the procedure allows staging of the disease and management of associated chondral flap lesions. It also enables treatment of patients with mechanical symptoms such as locking, giving way or clicking secondary to an aspherical femoral head, a chondral lesion or a loose body. It is this group of patients who seem to benefit most from arthroscopy. The surgeon can identify early subtle changes in the articular cartilage of the femoral head which sometimes herald its collapse. Retrograde drilling of avascular lesions
is also possible arthroscopically with accurate placement of the tip of the drill.

**Hip instability.** Thermal capsular shrinkage, as performed at the shoulder, can also be achieved by hip arthroscopy, although in the presence of considerable hyperlaxity (e.g. Ehlers-Danlos syndrome) a capsular shrinkage may be insufficient to stabilise the joint fully.\(^{50}\)

Capsular plication along with thermal capsular shrinkage has also been described by Philippon\(^{51}\) with good short-term results in patients with recurrent instability in the presence of an intact ligamentum teres.

**Septic arthritis.** As in the knee, arthroscopy of the hip offers the advantage of a thorough debridement, lavage and culture in septic arthritis without the potential morbidity associated with an arthrootomy.\(^{52}\) The procedure allows an opportunity to obtain a synovial biopsy in cases in which the culture is indeterminate.\(^{53}\) Chung, Slater and Bates\(^{54}\) in a study of nine children with septic arthritis, reported complete resolution of infection without recurrence after an arthroscopic washout, lavage and administration of postoperative intravenous antibiotics.

**Problems after total hip and resurfacing arthroplasty.** Arthroscopy of the hip has also been useful in evaluating and treating problems after total hip replacement such as the removal of loose fragments of cement or debris which prevent concentric reduction of the artificial joint.\(^{55,56}\) It also offers the advantage of obtaining synovial fluid and synovium easily for analysis. In our experience, arthroscopy in a patient with a painful resurfacing arthroplasty and otherwise normal investigations revealed failure of fixation of the acetabular component on rotation of the leg. Thus, the dynamic nature of hip arthroscopy may be useful in diagnosing early aseptic loosening in resurfacing arthroplasty.

**Osteoarthritis.** It is well known that the radiological appearance of the hip may not reflect the state of the articular cartilage.\(^{57}\) Focal loss of articular cartilage and degenerative changes on the femoral head or acetabulum may not be visible on standard radiographs.\(^{58}\) In these situations, arthroscopy is a valuable aid in diagnosing osteoarthritis. However, the response of the osteoarthritic hip to arthroscopic debridement is variable,\(^{59}\) with less success after debridement of larger lesions (Fig. 8). However, for the younger patient, arthroscopic debridement is of value, not only to ameliorate symptoms for a variable period, but also in the assessment of possible future alternative treatment. Sampson\(^{60}\) in a study of 97 hips with grade-III or grade-IV osteoarthritis found that 90 had good to excellent results at 30 months after arthroscopic intervention. Only seven subsequently required an arthroplasty. The arthroscopic procedure consisted of an osteophytectomy, microfracture, removal of loose bodies and debridement of the head-neck junction and the rim. However, he cautioned that in these patients it is essential that both the patient and the surgeon have set realistic goals before the arthroscopy.

**Femoroacetabular impingement.** In its simplest form this is defined as the abutment of the proximal femur on the acetabular rim, normally anteriorly.\(^{61}\) It is a distinct pathological entity and a likely precursor to osteoarthritis.\(^{62}\) Three main types have been described depending upon the
cause. The first is known as cam-type impingement in which the head of the femur has an abnormal shape which leads to labral damage on full flexion and internal rotation. The second is the pincer type in which the acetabulum is retroverted leading to compression of the labrum in full flexion. The third is mixed, in which both factors play a role.61 Impingement usually affects young active adults and presents with groin pain, typically when the hip is being fully flexed. Clinical examination reveals a positive impingement sign. Although not pathognomonic, it suggests the possibility of a disorder at the chondrolabral junction anteriorly. Non-operative treatment is usually unsuccessful and the aim of surgical intervention is to improve the clearance for hip movement by alleviating the abutment of the proximal femur against the acetabular rim.61 Both open and arthroscopic techniques have been described.63,64 However, arthroscopy remains the least invasive method of visualising the impinging area, and of resecting it (Fig. 9). The technique allows the surgeon to gain access to both the central and peripheral compartments of the hip and requires considerable arthroscopic experience. The cam type of impingement is tackled by excision of the prominent area on the anterior aspect of the junction of the head and neck of the femur with the help of radiofrequency probes and burrs in the peripheral compartment. It is essential that the traction is released and the hip flexed to relax the anterior capsule and thereby allow access to the peripheral compartment. Once the prominence has been excised, a dynamic assessment is made and the impingement test reproduced with arthroscopic assessment to be sure that there is no residual impingement. When this has been achieved any associated labral damage must also be addressed. If the lesion is a pincer type, acetabular recession is necessary.63 This is achieved by detaching the labrum, recessing the acetabulum and then re-attaching the labrum. In the mixed form of impingement, both acetabular recession and excision of the ‘bump’ may be necessary. Again, long-term results are awaited, but a prospective trial comparing open and arthroscopic treatment showed almost universally good results, suggesting that arthroscopic treatment may be advantageous since it avoids the complications associated with open surgical dislocation.65

**Arthroscopically-assisted partial resurfacing.** The Arthrosurface HemiCAP (Contoured Articular Prosthetic) resurfacing system (Arthrosurface, Franklin, Massachusetts) has been developed to treat isolated and localised chondral lesions and defects. The procedure is intended as a temporising measure before total joint replacement, especially in the younger patient. The surface of the implant aligns precisely with the contours of the patient’s articular cartilage surface, thus filling the defect and restoring a smooth and continuous surface. The implant is a cap-like structure made from a cobalt-chrome alloy with a central post on the deep side. Philippon66 has implanted this prosthesis using an arthroscopically-assisted technique. The surfaces are prepared and the central post is inserted through the standard portals. A small incision (depending upon the size of the implant) is finally made in order to insert the prosthesis. In his series of 32 patients with chondral defects greater than 2 cm in diameter, 23 had good results and the rest progressed to total joint replacement.66
**Extra-articular lesions.** Modern instrumentation allows the treatment by arthroscopy of extra-articular lesions such as a snapping iliopsoas or tensor fascia lata and trochanteric bursitis.\(^6\)\(^6\)\(^6\) It is now possible to perform a psoas tenotomy, release of the tensor fascia lata and a trochanteric bursectomy using the arthroscope, thereby shortening the period of hospitalisation and reducing the morbidity associated with these operations if they are performed as open procedures.

Arthroscopic bursectomy is performed under local anaesthesia with the patient in the lateral position and without traction. Two paratrochanteric portals are made and a standard 30° arthroscope is used to view the bursa which is infiltrated with normal saline to allow adequate visualisation and then excised in total using an arthroscopic shaver.\(^4\) In a study of 27 patients with recalcitrant trochanteric bursitis, Fox\(^67\) demonstrated good or excellent results at 5-year follow-up in 23 of 27 patients after arthroscopic bursectomy.

In another study of six patients (seven hips), Ilizaliturri et al\(^5\) showed good results at 21 months with minimal complications after arthroscopic release of the iliopsoas tendon for the snapping hip syndrome. To access the iliopsoas tendon using the arthroscope, the hip is externally rotated to bring the lesser trochanter into full view of the image intensifier while the hip is flexed to about 30° to relax the anterior capsule. After this, an inferior portal is established under fluoroscopic control and the psoas bursa and tendon visualised. Once this has been accomplished, a second portal can be made under direct visualisation for release of the tendon by a radiofrequency probe.

As far as the release of the tensor fascia lata for recalcitrant cases is concerned, arthroscopy has also proved to be beneficial. Byrd\(^6\) has recommended that snapping of the tensor fascia lata should be substantiated with the patient under anaesthesia. Once this has been accomplished the fascia can be incised longitudinally and a cruciate pattern fashioned. The aim is to create a diamond-shaped resection which will relax the fascia and eliminate snapping. In his series of 11 patients treated by this method, complete resolution of snapping was accomplished in ten while one continued to have snapping, but without pain.

**Intractable hip pain.** Arthroscopy of the hip is of value in the investigation of intractable hip pain, even when all the traditional investigations are normal.\(^68\) It is not possible to declare a hip normal without undertaking an arthroscopy.

**Contraindications**

Any condition which does not allow safe access to the hip is a contraindication to the procedure. Consequently, heterotopic ossification, advanced osteoarthritis, protrusio and ankylosis are absolute contraindications.\(^69\) Also, skin ulceration, acute inflammation in the vicinity of the proposed arthroscopy portals and acute osteomyelitis of the femur or acetabulum remain absolute contraindications.\(^69\) For some, osteonecrosis is considered to be a contraindication.\(^48\) This was the opinion of the senior author (RNV) in his early years of arthroscopy of the hip, but not any longer since it does have a role in the management of this condition. Morbid obesity is a relative contraindication since it makes safe access to the joint difficult because of the limited distraction and the need for longer instruments.

**Complications**

Complications in hip arthroscopy are generally related either to distraction of the hip or to the creation of the portals. The incidence ranges from 0.5% to 5%.\(^70\) The most common problems are transient or permanent nerve palsies (sciatic, femoral, pudendal or lateral cutaneous, labral or chondral damage, and fluid extravasation.\(^71\) Infection and osteonecrosis are, fortunately, rare. Pressure necrosis around the area of the perineal post can occur and anal and vaginal tears have also been reported because of overzealous traction. It is the senior author’s practice to warn all patients before hip arthroscopy that there is a risk of 5% of symptoms being made worse, rather than better, by the procedure.

Failure to gain access to the hip may also be regarded as a complication since it is not always possible to enter the hip arthroscopically. The stiffer the hip is on clinical examination, the harder it is to pass an arthroscope into the hip.

**The future**

As the expertise of the surgeon improves in arthroscopic surgery of the hip, the conditions treated by it also increase in number. Possibilities include reconstruction of ligamentum teres, biological resurfacings in the form of either stemcell implantation, matrix associated autologous chondrocyte implantation or mosaicplasties to fill defects in the articular cartilage and, perhaps, even computer-aided resection of impingement lesions.

Once thought to be an impossible procedure, arthroscopy of the hip is now an established orthopaedic technique. However, it remains a highly specialised method, with only a small number of surgeons worldwide undertaking a considerable number of procedures. The acquisition of dexterity is a slow process and is not without complications and should not be undertaken by the occasional operator.

**References**
