Peri-acetabular rotational osteotomy with concomitant hip arthroscopy for treatment of hip dysplasia

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Reconstructive acetabular osteotomy is a well established and effective procedure in the treatment of acetabular dysplasia. However, the dysplasia is frequently accompanied by intra-articular pathology such as labral tears. We intended to determine whether a concomitant hip arthroscopy with peri-acetabular rotational osteotomy could identify and treat intra-articular pathology associated with dysplasia and thereby produce a favourable outcome. We prospectively evaluated 43 consecutive hips treated by combined arthroscopy and acetabular osteotomy. Intra-operative arthroscopic examination revealed labral lesions in 38 hips. At a mean follow-up of 74 months (60 to 97) the mean Harris hip score improved from 72.4 to 94.0 (p < 0.001), as did all the radiological parameters (p < 0.001). Complications included penetration of the joint by the osteotome in one patient, a fracture of the posterior column in another and deep-vein thrombosis in one further patient. This combined surgical treatment gave good results in the medium term.

We suggest that arthroscopy of the hip can be performed in conjunction with peri-acetabular osteotomy to provide good results in patients with symptomatic dysplasia of the hip, and the arthroscopic treatment of intra-articular pathology may alter the progression of osteoarthritis.
One patient had undergone a contralateral Chiari osteotomy and another patient had a varus femoral osteotomy in the same hip. One patient underwent a simultaneous varus femoral osteotomy and another a valgus femoral osteotomy.

All patients were operated in the lateral decubitus position on a standard operating table through a transtrochanteric approach. A curvilinear incision was used beginning 2 cm below the anterior superior iliac spine, curving distally to about 2 cm below the greater trochanter and ending 5 cm from the posterior superior iliac spine. Dissection continued anteriorly between gluteus medius and tensor fascia lata, and posteriorly by splitting the muscle fibres of the gluteus maximus at the level of the posterior border of gluteus medius to expose the short external rotator muscles. An osteotomy of the greater trochanter was then performed using an osteotome, taking care to avoid damage to the femoral neck. The greater trochanter was reflected proximally along with gluteus medius and minimus after gently separating the capsule from the fibres of gluteus minimus. Tensor fascia lata was protected rather than divided. This dissection was continued circumferentially to expose 3 cm of the innominate bone.

After the joint capsule was exposed, a standard 4 mm arthroscope with a 30° or 70° lens was inserted while applying manual traction which was maintained throughout the arthroscopic procedure. The articular cartilage and the acetabular labrum were examined to identify any pathology and arthroscopic shaving of labral tears and debridement of degenerative tissue was performed.

The osteotomy line was marked circumferentially with diathermy 2 cm proximal to the acetabular margin. Posteriorly, the space between the greater sciatic notch and the joint space was bisected so that the osteotomy line was approximately equidistant from the greater sciatic notch and the acetabular margin. The osteotomy was performed with specially designed curved osteotomes (Mizhu, Tokyo, Japan) under image-intensifier control. Anteriorly the osteotomy line connected the anteroinferior aspect of the proximal osteotomy to the pubic tubercle. A thick acetabular fragment was created to reduce the risk of osteonecrosis. The osteotomy penetrated the inner wall of the pelvis to reduce the risk of breaching the articular surface and to maintain the blood supply to the acetabular fragment from the inner wall.

The acetabular fragment was then displaced anteriorly and laterally under direct vision and image-intensifier control to produce adequate cover of the femoral head with the rotated fragment in contact with the pelvic wall. Usually the acetabular fragment was rotated anteriorly by one finger breadth. The hip joint was flexed and abducted to check if there was excessive anterior or lateral correction leading to femoroacetabular impingement. The rotated acetabulum was stabilised with three cortical screws (3.5 mm in diameter) which were inserted from the superior part of the acetabulum in a proximal direction towards the ilium. Due to the spherical shape of the fragment there was a wide area of contact and no bone graft was needed. The greater trochanter was then reattached to the original site with either wires or two 5 mm cannulated screws.

Quadriiceps, hip strengthening and range of movement (ROM) exercises were started as soon as pain permitted. Wheelchair ambulation was allowed on the fifth day. Crutch-walking with partial weight-bearing was started one week post-operatively and full-weight-bearing was allowed 12 to 16 weeks after operation.

The labral lesions were classified by their appearance as longitudinal tear, flap tear, radial tear, complex tear, degenerative tear and fibrillation, and by their position as anterior, anterosuperior, superior, posterosuperior or posterior.22 The radiological degree of osteoarthritis was evaluated pre-operatively and at the latest follow-up using the Tönnis classification.23 Group A included 30 hips (including two bilateral patients) with pre-arthritis or early arthritis (Tönnis grade 0 and I) and group B 13 hips (including one bilateral patient) with advanced arthritis (Tönnis grade II and III).23 Radiological evaluation included measurement of the centre-edge angle,24 Sharp angle,23 acetabular-head index26 and head lateralisation index;27 and was undertaken pre-operatively and during post-operative follow-up. The clinical outcome was evaluated using the Harris hip score28 (HHS) which was recorded pre-operatively and at each post-operative visit.

Statistical analysis. Student's t-test was used to compare the pre-operative and the most recent follow-up post-operative clinical and radiological findings. A p-value < 0.05 was considered significant for normally distributed data. All statistical analyses were performed using SPSS version 12.0 (SPSS Inc., Chicago, Illinois).

Results

Labral lesions were detected at arthroscopy in 38 hips (88.4%). The most frequent location was anterosuperior (Table I). They were found in 25 (83.3%) of the hips in radiological group A (Fig. 1), with 16 hips with labral tears and nine with fibrillation. In group B, all 13 hips showed...
labral damage (Fig. 2) with nine labral tears and four hips with fibrillation (Table II). Arthroscopic debridement was performed in all 38 hips. Limited labral excision was performed for 16 hips (53.3%) in group A and nine hips (69.2%) in group B with a focus on preserving healthy tissue. Fraying from labral tears and fibrillations was debrided to a stable rim by using a motorised shaver.

The mean follow-up was 74 months (60 to 97). Pre-operative arthritis according to the Tönnis classification was grade 0 in seven hips (16.3%), grade I in 23 hips (53.5%), grade II in 11 hips (25.6%) and grade III in two hips (4.7%). At the most recent follow-up, the Tönnis grade had improved in eight (18.6%), was unchanged in 31 (72.1%) and had deteriorated in four hips (9.3%). At this time, ten hips (23.3%) were in grade 0, 25 hips (58.1%) in grade I, six hips (14.0%) in grade II and two hips (4.7%) were in grade III. In comparison with the pre-operative values, there was a significant increase in the centre-edge angle, the Sharp angle and the acetabular head index. Moreover, there was medialisation of the femoral head as measured by the head laterolisation index (Table III).

There was no significant change in the ROM (Table IV). The mean HHS improved from 72.4 (60 to 83) pre-operatively to 94 (76 to 100) at the most recent follow-up (p < 0.0001).
Complications. There was one case of fracture of the posterior column and another case of penetration of the joint by the osteotome. There was no post-operative infection, one case of deep-vein thrombosis and two cases of heterotopic ossification. There was no nonunion of the acetabulum or stress fracture of the pubic bone. No patients underwent a conversion to total hip replacement.

Discussion
Rotational acetabular osteotomy is a well established form of treatment for young adults with symptomatic dysplasia of the hip. It may also be used under some circumstances in adults with advanced osteoarthritis of the hip secondary to dysplasia. The original Bernese peri-acetabular osteotomy is performed using a series of straight cuts and the osteotomy is completed by a controlled fracture to separate the acetabulum from the surrounding pelvis. Although this is a stable osteotomy with a large acetabular fragment without damage to the gluteal muscles and minimum risk of avascular necrosis and nonunion, it is aspherical, and not all of the osseous cuts can be performed under direct vision due to limited exposure. It may also be difficult to assess and control anterior correction. The rotational acetabular osteotomy is spherical with excellent congruity, rapid healing and intrinsic stability precluding the need for internal fixation; however, it is an intra-articular osteotomy at the distal-medial extent, since it leaves the tear drop in its original position with the possible development of avascular necrosis of the acetabular fragment and the need for bone grafting. We aimed with our technique to combine the advantages of the Bernese osteotomy with those of the rotational osteotomy. Through a transtrochanteric approach, preserving the blood supply of gluteus medius, we created a spherical osteotomy under direct vision. This enabled us to rotate the acetabular fragment to any desired position where it was inherently stable with a well-preserved blood supply from the inner wall of the pelvis, undisturbed by a capsulotomy that was no longer necessary. Despite an inherently stable position, we used additional fixation with 3.5 mm screws in order to prevent the possibility of movement of the rotated acetabulum and loss of correction, and also in order to facilitate early mobilisation.

Labral lesions are frequently present in patients with dysplasia of the hip and are associated with worse outcomes if left untreated. Re-orientation of the acetabulum without addressing an accompanying labral lesion

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<th>Table II. Classification of the labral tear in each group</th>
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<td>(Tönnis 0 and I)</td>
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<td>Flap</td>
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<th>Table III. Mean (range) pre-operative and post-operative radiological parameters</th>
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<td>CE angle (°)</td>
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<td>AHI</td>
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* CE, centre-edge; AHI, acetabular-head index; HLI, head lateralisation index

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<th>Table IV. Mean (range) clinical results</th>
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<td>Parameter</td>
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<td>Abduction (°)</td>
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<td>HHS*</td>
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* HHS, Harris hip score

Table IV. Mean (range) clinical results

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increases the high cartilage-loading, but the labral lesion remains. Although the osteotomy itself rotates the labrum away from the weight-bearing area, if it is torn it will give symptoms post-operatively. We believe therefore that labral lesions should be treated in conjunction with any reconstructive procedure, as leaving labral pathology within the joint can be a cause of residual symptoms.5,7,31,32 Routine arthrotomy in conjunction with peri-acetabular osteotomy is recommended for assessment of femoroacetabular impingement, labral pathology and if necessary, for limb-erative labrum or joint debridement.34 In this study, no complications were noted during the periacetabular osteotomy.

In a series of 16 hips in 13 patients at a average 4.2 year follow-up, the hip centre was moved medially by a mean of 10 mm and the mean HHS improved from 73.4 pre-operatively to 91.3.1 However, not all of these hips underwent arthrotomy. Similarly the mean head laterisation index decreased from 82.6 to 72.3 in a series of rotational acetabular osteotomy without arthrotomy.27 In another series of 46 hips undergoing T-shaped capsulotomy at a mean follow-up of 4.2 years, the mean centre-edge angle improved from 3° to 35°, the mean Sharp angle from 57° to 40° and the mean medialisation of the femoral head was 6 mm.35 In our series, at the most recent follow-up, the severity of osteoarthrosis had improved in eight (18.6%) and remained unchanged in 31 (72.1%) and other radiological parameters had improved significantly. There was also improvement in the functional outcome after combining the procedure, as is evident by the improvement in HHS.

In spite of the favourable outcomes, there are some limitations to this prospective study. There is no control group. Two control groups of patients, one with peri-acetabular rotational osteotomy with routine arthrotomy and the other without any treatment for the intra-articular pathology would be the ideal assessment of outcome. There are no studies in the literature that report the outcome of treatment of intra-articular pathology in association with peri-acetabular rotational osteotomy. This study is thus the only one in which intra-articular pathology was routinely treated arthroscopically during peri-acetabular osteotomy, and we recommend this combined surgical treatment for patients with symptomatic dysplasia of the hip. As well as relieving symptoms, it may prevent the progression of osteoarthrosis.

References

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