HOW TO DO RESURFACING IN HIP DYSPLASIA

KOEN DE SMET

Recently, the new generation of metal-on-metal total hip resurfacing arthroplasty is well known for preserving the proximal femoral bone stock, minimizing the risk of postoperative dislocation using large femoral heads, and expecting low wear of metal-on-metal articulation for longer prosthesis survival. It also has the advantage in biomechanical loading in the proximal femur. Secondary osteoarthritis to developmental dysplasia of the hip (DDH) is a reason for total hip arthroplasty. Total hip replacement in patients with DDH presents a challenge to the surgeon. Taking in account that resurfacing is even more technically demanding, resurfacing in dysplasia needs to be addressed carefully. Most of the patients are young and active, who require improved range of motion of the hip besides relief of the pain, even expect to resume the ability to run and jump after the joint arthroplasty, thus to be allowed an active lifestyle. The outcomes of metal-on-metal hip resurfacing in dysplasia are encouraging, although some papers and surgeons report significantly worse medium-term results in dysplasia if matched with patients with primary osteoarthritis. (several papers) This difference in outcome can be explained by the higher technical difficulty, the anatomical abnormalities and the higher percentage of female gender.

High anteversion of the femur, narrow and smaller size femur, valgus femur, undeep acetabulum or deformed acetabulum, out of centre acetabulum are the anatomical challenges in dysplasia. The degree or grade of dysplasia will be affecting the difficulty of surgery or make the case as a contra-indication. Special dysplasia resurfacing cups can help in getting enough fixation in the

pelvis. In this chapter we will give advice “how to do resurfacing in dysplasia”. The different difficulties in this indication will be discussed in detail.
Reasons for failure in dysplasia will be fractures of neck of femur, loosening of the cup, aseptic loosening of the femoral component and more risk in high wear of the metal-on-metal friction couple because of smaller sized components and the higher risk in steep angle cup positioning. The coverage angle of the resurfacing cup, which is design related has an increased importance in dysplasia cases.(our paper)

Approach

Only the posterolateral approach is advised for treatment of severe dysplasia where also leg lengthening is needed. The better exposure of the acetabulum and the possibility of lengthening of the leg without touching the greater trochanter or destroying the abductor mechanism is far superior in this approach. The flexion contracture that often is seen after reduction of the hip, is a condition that disappears without forcing and too much physiotherapy in a couple of weeks. The possibility to leave the cup in somewhat less anteversion with already a high anteversion in the femur in the anterolateral approach does not in far beats the advantages of the posterolateral approach.

Anteversion

The femoral head component of resurfacing is normally put in neutral position in comparison to the femoral neck. In normal osteoarthritic cases there is no problem to correct the normal anteversion in the femoral neck to neutral angle. With this position the natural anteversion angle of the femoral neck is not changed, it is a cap placed in neutral position on an anteverted neck. (picture 1a) The highest correction of the anteversion possible is 20 to 25

degrees. The higher the correction the higher the risk in protrusio of the stem going out anteriorly of the femoral neck, or the higher the risk of notching and impingement.(picture 1b) With some resurfacing designs where the stem is smaller and thinner the risk of protrusio is less. If the stem is going out of the bone it does not indicate a higher risk of failure. Only with the designs that have a large stem, concerns are made about stress shielding and a higher risk of necknarrowing and fracture. In my practice I did not see any problems with protrusio of the stem at this moment. (picture with protrusio) Once the femoral neck anteversion is bigger then the possible 20 to 25 degrees correction, a higher anteversion position of the implant should be accepted in correlation to the cup anteversion or a different technique should be chosen. If the anteversion can not be accepted in correlation with the cup, and resurfacing is still preferred, a derotation osteotomy should be done. In these cases first the femoral prosthesis is implanted in line or parallel with the existing anteversion of the neck. Because the prosthesis will not be reduced before 8 minutes and there is no canulla inserted in the lesser trochanter (weakening the bone), setting of the cement and heat production in the bone will occur and therefore the prosthesis should be washed continuously with cooled water to prevent thermal damage. In a second stage a femoral osteotomy is done distally from the lesser trochanter at that level where an 8-hole AO plate can be applied. Four screws above the osteotomy and 4 screws below the osteotomy give the strongest and necessary fixation. With this construction 6 weeks plantar touch and 6 weeks partial weight bearing are prescribed for the patients rehabilitation. If needed like in Crowe IV cases with

very high dislocation and a too large leg lengthening, the derotation can be combined with a shorteningsosteotomy. (X-ray demirci)

The anteversion angle of the femur can only be measured with a CT-scan. If on x-ray the femur is seen as a profile view having taking an anteroposterior view or visa versa, the anteversion is very high (>45 degrees) what makes a derotation osteotomy obligatory. (x-ray)

If the anteversion is not enough corrected and there is also a corresponding high anteversion angle of the femur, the risk in subluxation with high wear or dislocation will increase.

Valgus

The high valgus often seen on x-rays is often estimated to high because of the combined anteversion. If the anteversion would be corrected with the rotation of the leg on the x-ray, a less high angle would be seen. Of course if the anteversion is not changed of the femur, it is this angle that is important to address the positioning of the femoral implant. Here the objective is again to put the prosthesis in as much normal anatomic position without making a to big risk for notching or a to big varus positioning. The normal anatomic position would be 140 degrees of varus/valgus angle, neutral position against the anteverted position of the femur.

Proximal femoral deformity

Some dysplasia patients have a previous performed femoral osteotomy with destruction or deformation of the proximal femur and the canal. This makes the placement of a total hip prosthesis difficult. These cases could be named specific indications for resurfacing avoiding the difficulties with a narrow and often curved proximal femoral canal. (foto canadees meisje?)

Femoral bone deficiency or cysts

(foto van je weet wel) Because of the dysplasia, difference in load transfer there can be big cysts or osteopenic area's in the femoral head. If a technique to avoid thermal necrosis of the bone and overpenetration of the bone is used, this should decrease the risk of failure if we apply the SARI-index from Paul Beaulé.

Acetabular deficiency and angle

The acetabular deficiency depends on the grade of dysplasia. Crowe classified dysplastic hips into 4 classes using the acetabular angle and the amount of proximal migration as the significant features. In dysplasia the acetabular angle ranges from 41 to 63 degrees, with an average of 52 degrees. The higher the abduction angle, the higher the risk of steep cup positioning with edge loading and early wear of the prosthesis. Implanting the cup in an ideal 40 degree abduction will imply that the superolateral edge of the cup will not be covered by bone. If the cup is implanted with a full coverage of bone at that area, the cup will be malpositioned leading to early failure and having also more risk of dislocatiion. This uncoverage can be accepted because it does not cause any clinical symptoms, unless the cup is not covered anteriorly causing groinpain, often wrongly called iliopsoitis, or if the cup is too flat, to low abduction, causing impingement laterally with the femoral neck. The deficiency in coverage by bone, decreases the fixationarea of the pressfit of the implant. It is the percentage of this area that will decide if a normal cup can be used, if the extend of dysplasia allows a resurfacing to be done, or if a special screw-dysplasia cup is needed. The pressfit can be

increased or obtained if there is not any with deepening out the floor of the acetabulum. If there is more bone removal in the pelvis to do resurfacing in comparison with a total hip procedure, where a smaller cup with screws can be used it should be seen as a relative contra-indication. Resurfacing always should stay a conservative procedure to the bone stock, if this is not achieved, the most important advantage of resurfacing is lost.

A decision at one moment will be needed to escape to a total hip, or stay with resurfacing and use a dysplasia cup. Any dysplasia cup will be one size bigger then a normal cup, will increase bone removal at the rim of the acetabulum, has more risk in uncoverage anteriorly, and also has a flenge or metal part at the edge of the cup that increases the risk of impingement with the femoral neck. The differences in the cups are discussed in the dysplasia cup design paragraph. Using a dysplasia cup can prevent to steep cup placement, to deep placement for pressfit, but has more risk of peripheral bone removal, uncoverage and impingement.

Acetabular deformity

Here we want to focus on anatomical deformities not the undeepeness and high abduction or defiency which was discussed in the previous paragraph. The rotation or anteversion of the acetabulum in a not previuously operated pelvis is more open, with a deficient anterior wall. To prevent impingement and groinpain problems 2 techniques can be used. The cup can be placed deeper what means more bone removal or the capsula and even the labrum should be kept to avoid conflict with the anterior muscles or tendons. Placement in to high anteversion should be avoided because of higher risk in wear of the metal-on-metal and dislocation risk, certainly because this is also

combined with a high anteversion of the femur. A Ct-scan can be used to assess the bonestock anteroposteriorly which is the most important parameter in the deformed acetabulum. The inferosuperior range will less dictate the possibility for use of a resurfacing. It will be the antero posterior width of the acetabulum that will allow the surgeon to restore the hip centre or not. Patients that have undergone previous surgery on the acetabulum can be a challenge. When the reorientation of the acetabulum is catching the normal anatomy the acetabular procedure should be easier then before. A problem arises when the pelvis (triple pelvic osteotomy) or acetabulum (Ganz-periacetabular osteotomy) have been to much tilted anteriorly with a result of a neutral or even a retroverted acetabulum. If this is the case, then posteriorly the cup will be sticking out, what can lead to pain with sitting on hard surfaces. Loss of pressfit posibility without screws is another problem. Deepening out the medial floor or enhanced fixation with a dysplasia cup can solve this problem. A removal of all excess of anterior bone is necessary to prevent impingement and to restore a good mobility, certainly the flexion of the hip. Sometimes the removal of the bone goes into the antero inferior iliac spine with the attachment of rectus and quadriceps. The same time costing procedure with bone removal is needed in cases where a Shelf plasty was performed and the roof prevents the hip to have a normal flexion mobility. The impingement in these cases should be checked at the end of the procedure with the finger on the femoral neck, and testing for subluxation posteriorly. If there is any concern the hip has to be dislocated again and more bone should be removed.

Impingement with greater trochanter

Evaluation of impingement anteriorly at the end of the resurfacing procedure after reduction, and in 90 degrees of flexion with looking to a conflict in endorotation as a routine assessment, an evaluation in dysplastic cases should be done with the leg in extension and exorotation. The higher anteversion of the femoral neck, the medialised cup to obtain pressfit and bonecoverage can result in a conflict of the greater trochanter with the ischial bone posteriorly. Because a higher offset can not be obtained by lengthening the femoral head as is done with a total hip prosthesis, the only solution is to reduce the bulk of the ischial bone or greater trochanter where the contact occurs. The removal and conflict should be tested until an acceptable situation is seen. Impingement will lead too discomfort in certain movements , subluxations and finally wear of the prosthesis and dislocation.

Dysplasia cup designs.

There are only 4 cups available on the market. Birmingham Hip Resurfacing (Smith&Nephew, Warsaw US) has a dysplasia cup, Adept resurfacing (Finsbury, Essex? UK), Cormet 2000 (Corin, UK) and Conserve plus (Wright Medical, Memphis US). The Adept and Conserve Plus design take in consideration that the screws should be angled to catch the bone. The Adept, BHR and Corin design only can be used in dysplasia, where the Conserve Plus design because of the offset of the flange with the screws from the rim of the cup implant can also be used in non-dysplasia needing enhanced fixation. The BHR dysplasia cup has 2 so-called “Mickey Mouse” ears (screw holes) that are threaded and are in line (in the same plane) with the cup, as well in the same plane, with no angle to the neutral plane for anteversion. (fig 15)

The Conserve Plus dysplasia cup design (QUADRAFIX) has a flange with 3 holes (1 cup for both sides) where there is a flange with a small distance away from the edge of the cup (Fig 16). As such it can also be used in non-dysplasia cases, such as in revision of resurfacing or non-dysplastic cases where enhanced fixation is needed. The direction of the screws is angled 20 degrees toward the bone of the acetabulum in abduction, and 20 degrees of retroversion to neutralize the anteversion of the cup. The second screw is neutral to the anteversion angle of the cup.

These improved screw angles direct the screws into the bone with a well-positioned cup. In the BHR dysplasia cup the screws tend to go out of the bone or do not reach the bone. To accomplish good fixation with these 2 screws, there is a risk of placing the socket too steep, and/or not anteverted, which leads to higher wear and impingement with the same edge loading wear mechanism described above.

bjective of the current study was to evaluate the early outcome of resurfacing arthroplasty for the mild DDH cases (Crowe type I and II). METHODS: Between September 2005 and May 2007, twenty-one consecutive patients (twenty-six hips) with the diagnosis of osteoarthritis secondary to DDH underwent metal-on-metal resurfacing arthroplasty. The average age at the time of surgery was 46.5 years (range, 37-59 years). Six patients (28.6%)

were male and fifteen (71.4%) were female. Clinical and radiographic results were observed. The follow-up was performed at 6 weeks, 3, 6, 9 months and then yearly. RESULTS: All patients were followed for a mean of 18 months (9-29 months). During the follow-up period no complications, such as dislocation of hip joints, infection or femoral neck fracture occurred. The clinical outcomes, as rated with the Harris hip score, improved significantly compared with the preoperative ratings. The mean postoperative Harris hip score was 90.7, compared to 35.5 preoperatively. The radiographic analysis showed that all prostheses were fixed with no radiolucencies. All of the patients who had equal limb lengths preoperatively had equal lengths postoperatively. Of the nine patients with preoperative limb-length discrepancy of 0.8 to 1.2 cm, all regained equal limb length postoperatively. In addition the pain was nearly completely relieved, the range of motion was remarkably improved and no restriction was needed after operation regarding early exercise. CONCLUSIONS: The new generation of metal-on-metal resurfacing arthroplasty may be a reasonable option for DDH of the Crowe types I and II.

Amstutz HC, Antoniades JT, Le Duff MJ.

Joint Replacement Institute, Orthopaedic Hospital, 2400 South Flower Street, Los Angeles, CA 90007, USA. hamstutz@laoh.ucla.edu

BACKGROUND: Modern hip resurfacing implants may increase stability and preserve more bone than conventional total hip arthroplasty. The purpose of this retrospective study was to analyze the mid-term results in a consecutive series of middle-aged patients with developmental dysplasia of the hip treated

with hybrid resurfacing joint arthroplasty. METHODS: Metal-on-metal hip resurfacing was performed in fifty-one patients (fifty-nine hips), forty-two of whom were female and nine of whom were male. The average age at the time of surgery was 43.7 years. Radiographic and clinical data were collected at six weeks, at three months, and at yearly follow-up visits. Seven hips had Crowe type-II developmental dysplasia of the hip and fifty-two had type-I. RESULTS: The follow-up period ranged from 4.2 to 9.5 years (average, 6.0 years). Initial stability was achieved in all but three hips. The clinical outcomes, as rated with the University of California at Los Angeles (UCLA) hip score, improved significantly compared with the preoperative ratings. On the average, the pain rating improved from 3.2 to 9.3 points; the score for walking, from 6.0 to 9.7 points; the score for function, from 5.7 to 9.6 points; and the score for activity, from 4.6 to 7.3 points (all $p = 0.0001$). The mean Short Form-12 (SF-12) mental score increased from 46.6 to 53.5 points, and the mean SF-12 physical score increased from 31.7 to 51.4 points (both $p < 0.0001$). The mean postoperative Harris hip score was 92.5 points. On the average, the range of flexion improved from 106 degrees to 129.6 degrees ; the abduction-adduction arc, from 41.9 degrees to 76.9 degrees ; and the rotation arc in extension, from 32.1 degrees to 84.8 degrees (all $p = 0.0001$). Four patients delivered a total of six healthy babies since the time of implantation of the prosthesis. Radiographic analysis showed a decrease in the mean body weight lever arm from 118.5 mm preoperatively to 103.9 mm postoperatively ($p = 0.007$). There were five femoral failures requiring conversion to a total hip arthroplasty. One hip showed a radiolucency around the metaphyseal femoral stem. There were no complete acetabular

radiolucencies, and all sockets remained well fixed. CONCLUSIONS: The mid-term results of metal-on-metal resurfacing in patients with Crowe type-I or II developmental dysplasia of the hip were disappointing with respect to the durability of the femoral component. However, the fixation of the porous-coated acetabular components without adjuvant fixation was excellent despite incomplete lateral acetabular coverage of the socket. More rigorous patient selection and especially meticulous bone preparation are essential to minimize femoral neck fractures and loosening after this procedure.

The dysplasia cup, which was devised as an adjunct to the Birmingham Hip Resurfacing system, has a hydroxyapatite-coated porous surface and two supplementary neutralisation screws to provide stable primary fixation, permit early weight-bearing, and allow incorporation of morcellised autograft without the need for structural bone grafting. A total of 110 consecutive dysplasia resurfacing arthroplasties in 103 patients (55 men and 48 women) performed between 1997 and 2000 was reviewed with a minimum follow-up of six years. The mean age at operation was 47.2 years (21 to 62) and 104 hips (94%) were Crowe grade II or III. During the mean follow-up of 7.8 years (6 to 9.6), three hips (2.7%) were converted to a total hip replacement at a mean of 3.9 years (2 months to 8.1 years), giving a cumulative survival of 95.2% at nine years (95% confidence interval 89 to 100). The revisions were due to a fracture of the femoral neck, a collapse of the femoral head and a deep infection. There was no aseptic loosening or osteolysis of the acetabular component associated with either of the revisions performed for failure of the femoral component. No patient is awaiting a revision. The median Oxford hip

score in 98 patients with surviving hips at the final review was 13 and the 10th and the 90th percentiles were 12 and 23, respectively.

x-ray woonink mar LINKS

The anatomic abnormalities associated with the dysplastic acetabulum make total hip arthroplasty a very complex and challenging procedure. The new generation of metal-on-metal total hip resurfacing arthroplasty providedes good stability and low risk of disclocation in young activities patients. Otherwise there are currently few studies about the use of a metal-on- metal hybrid resurfacing system in the treatment of severe osteoarthritis secondary to developmental dysplasia of the hip.

Knecht et al. reported on a small series of fifty-four patients managed with resurfacing who had good results with regard to function at one to four years of follow-up Nishii in his series show that 70% of the patients had developmental dysplasia of the hip, the survival rate, with the time to failure for any reason used as the end point, was 96% at five years.

Amstutz described a series of resurfacing with regular cup in casese of diysplasia : Crowe I (88%), Crowe II (12%). Seven of 59 hips need reo-operation at mean follow-up of six years.