Treatment of Congenital Dysplastic and Dislocated Hips

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Treatment of dysplastic hip depends on the severity of the disease, the stage of the secondary arthritic changes, age of the patient, available bone stock and the functional goals of the patient. We have categorized the dysplasia into four types: 1) High riding dislocation with no femoral head pelvic contact in which the patient may be entirely asymptomatic until middle or older age when in general, back pain is the predominant complaint. 2) High riding dislocation, but where femoral head contacts a false acetabulum and secondary arthritis develops at a variable age usually middle age. 3) A definite dysplastic hip less than 50° covered but where the head has not dislocated and the dysplastic hip is in the region of the normal acetabulum and which causes secondary early osteoarthritis in young adult life. There may also be symptoms as early as adolescence prior to the formation of arthritis. 4) Type four has less definite dysplasia but where the head is uncovered 1/3 to 1/2. These patients develop osteoarthritis generally in middle age.

For the dysplastic hip type 3 or 4 that is not dislocated treatment should be instituted when symptoms appear before arthritis is advanced. A pelvic osteotomy is generally the procedure of choice. We have had most experience with the Chiari type and have utilized this procedure for subluxation in a patient over four years of age. Occasionally for coxa magna of Perthes, where there are minimal osteoarthritic changes and at least 90 degrees of flexion. The technique includes: an oblique osteotomy ascending proximally from lateral to medial, identifying its location just above the head with an image intensifier. Pelvic cut is made with a Gigli saw after passing it through the obturator foramen. The hip is adducted and the medial displacement occurs. We generally fix the osteotomy with two Steinman pins placed in the subcutaneous tissue for easy removal. The patient is kept non weight-bearing until the osteotomy is healed. The advantages of this technique are its simplicity and low morbidity. Its disadvantages are that it does not provide a cartilaginous cover to the head.

There are other pelvic osteotomies that can be performed. Salter has been recommending his osteotomy for young adults as well as children. The principle is to redirect the entire acetabulum as a unit in order to increase the total contact area and improve the distribution of pressure. His indications are essentially the same as for a varus (adduction) osteotomy. There may be early degenerative arthritis secondary to persistent subluxation. He lists the following pre-requisites: 1) Subluxation of the femoral head from the
free acetabulum. 2) Reasonable congruity of the joint surface as obtained by AP and "frog" projections. 3) Articular cartilage 50% of the normal thickness. 4) At least 60% of the normal R.O.M. with particular reference to flexion and abduction.

Wagner has a type of "dial" osteotomy, utilizing sharpened curved gouges to rotate the acetabular cartilage and its subchondral bone to cover the head. This has a distinct advantage over fibrous or bony coverage of the Chiari but is technically more difficult. Depending on the degree of dysplasia, Wagner often supplements this procedure with a pelvic bone graft or a Chiari osteotomy.

Results of Resurfacing and Joint Replacement

Once secondary arthritis is established, osteotomy is unlikely to be successful. One hundred and seventeen hips in 92 patients treated for congenital dysplastic or dislocated hips at UCLA with joint replacement have an elapsed followup of 2 to 10 years average 4. Eighty-six hips in 63 patients average age 49 years have had Conventional Trapezoidal-28 replacement and 30 hips in 29 patients average age 35 years received Tharies resurfacing. (Table 1) Thirty percent were dislocated in each group but the majority of the dislocated hips were treated with conventional replacements.

<table>
<thead>
<tr>
<th>Patients</th>
<th>Hips</th>
<th>Ave. Age (yrs.)</th>
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<tbody>
<tr>
<td>All Types</td>
<td>92</td>
<td>116</td>
</tr>
<tr>
<td>T28, TR28</td>
<td>63</td>
<td>86</td>
</tr>
<tr>
<td>THARIES</td>
<td>29</td>
<td>30</td>
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</table>

The average followup of the conventional replacements was three years, those resurfaced two years. Fifty-six of the conventional replacements followed over 2 years had an average 4 year followup. (Table 2) Overall results showed excellent pain relief and improved walking and function with the comparable percent improvement in both groups comparable. Sixty-eight percent of hips had positive preoperative whereas 85% had negative or level Trendelenberg sign at followup. The use of longer neck straight stem components has improved the later results. (Table 3)
Table 3. Overall Follow-up Results

<table>
<thead>
<tr>
<th></th>
<th>Preop</th>
<th>Postop</th>
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<tbody>
<tr>
<td>Pain</td>
<td>4.4</td>
<td>8.5</td>
</tr>
<tr>
<td>Walking</td>
<td>5.4</td>
<td>8.1</td>
</tr>
<tr>
<td>Function</td>
<td>5.3</td>
<td>8.2</td>
</tr>
<tr>
<td>Flexion Arc</td>
<td>71°</td>
<td>102°</td>
</tr>
<tr>
<td>Abduction</td>
<td>21°</td>
<td>28°</td>
</tr>
<tr>
<td>Rotation Arc</td>
<td>30°</td>
<td>57°</td>
</tr>
</tbody>
</table>

There were four nerve palsys in conventional group, two femoral, and two combined femoral and peroneal palsy. All but one had significant recovery. Restoration of limb length up to 7 centimeters was greatest in the conventional group and averaged 2 centimeters.

There were 7 major complications (8.1%) in the conventional hip replacement group including 3 socket and 1 femoral loosening, and 1 fractured femur all requiring revision. Two deep sepsis resulted in one girdlestone and one which will require a similar procedure for E. Coli hematogenous sepsis four years postoperatively. (Table 4) The major complication rate for Tharies group was 16.7% with 5 failures all loosening. This included 3 loose sockets all revised and 2 with both components loose which required conversion to total hip replacement. (Table 5) Those patients who loosened were young with average age of 32 years and four were among our first 50 Tharies cases. The sockets were uncovered by bone laterally and two were dislodged from an intact acrylic bed by neck component impingement. The sockets were subsequently designed with less depth by 4 mm and bone grafts employed to provide full bony containment. In addition, new techniques were employed to optimize fixation. Better selection of patients, improved design and technique has, in fact, eliminated major complications in a further group of 6 resurfacing follow 6 months to 2 years. Two who loosened in the earlier series would have been amenable for some type of pelvic shelving procedure.

Indications For Type of Replacement and Technique

Type 1 and 2 dislocated hips which are not amenable to osteotomy and require joint replacements are generally best reconstructed at the anatomical site of the true acetabulum. Most dysplastic hips have considerable femoral as well as acetabular dysplasia so that the indications for conventional surface replacement are often dependent on the anatomical and functional tradeoffs. One important factor is the amount of migration proximally. If one resurfaces, then the hip will have to be brought down to the anatomical acetabular site by extensive muscle releases alone. If the patient is short, by more than 4 cm and has a short femur (less than 40 cm), it may be undesirable to attempt to lengthen the extremity to this degree. Shortening of the femur can be more readily accomplished when using a conventional type of stem replacements.
Careful templating or preoperative CAT scanning must be performed so that the prosthesis is not too large to fit the intramedullary canal after shortening. The straight stem TR-28 series has been very satisfactory. The other major decision relates to femoral head bone stock. A dislocated femoral head becomes very osteoporotic and occasionally entirely cystic and does not provide enough quality bone stock for resurfacing.

On the acetabular side the most cavernous acetabuli although small are often those associated with complete femoral head dislocation since birth. Those that are subluxed tend to erode away the superiolateral acetabular margin. However, the greatest deficiency often lies in the sagittal plane anterior posteriorly and can only be assessed by a CAT scan which is most useful in assessing not only pelvic bone stock but also in evaluating the dimensions of the femur for stem type replacement. It can also provide accurate information regarding anteverision. Those hips which have deficient bone stock either laterally or anteroposteriorly, require bone grafting. If the decision is for conventional replacement, then the femoral head often provides an excellent bone graft. Our technique is to remove the cartilage and subchondral bone with a high speed burr from both the graft and the ilium. The bone graft may then be shaped and positioned against the ilium and fixed temporarily with small Kirschner wires. It is then desirable to attach the graft more rigidly using ASIF cancellous or cortical screws using a lagging technique to the ilium with washers. The graft, once in place, can be excavated without endangering fixation using a high speed burr until the approximate socket size has been reached. It should then be completed with a reamer, taking care not to dislodge the graft. We have not found it necessary to bolt the graft to the pelvis as suggested by Harris. If resurfacing is to be performed, the donsite for the graft can be taken from the medial osteophyte or iliac crest. Harris has used homologous grafts successfully in a variety of hips needing bone grafting.

One of the deciding factors regarding the decision for resurfacing relates to the size of the acetabulum and the maximum size of the femoral neck. Often only the small size components can be accommodated. With conventional acetabular replacement components of 32mm to 36mm can be inserted with a 22mm or 28mm femoral ball size. The smallest THARIES resurfacing component acetabular stock requires 41mm in diameter. (Table 6)

Table 6. ACETABULAR DEFICIENCY SMALL SOCKET SIZE

<table>
<thead>
<tr>
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<th>Surface-41mm needed</th>
<th>Conventional-32mm</th>
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<tbody>
<tr>
<td>FEMORAL</td>
<td>Small Straight Stem Unit</td>
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In general, a thorough muscular tendinous release is necessary including iliopectoas, adductors, (released subcutaneously with further proximal stripping internally) rectus femoris (care should be taken to locate the femoral vessels which are anatomically anterior and medially), and the gluteus maximus tendon. A trial reduction should be performed. However, if the acetabulum bone support is weak or has been supplemented by a graft, the reduction maneuver could dislodge or damage the graft fixation. A general assessment can be made without full
reduction and assessment made so that
socket cementation can be carried out.
A formal trial reduction could then be
completed before the femoral component
is cemented into the femur.

When considering the trade-offs of con-
ventional versus surface replacement, it
is important to evaluate the degree of
anteversion. More than 50-60° is likely to
require a derotation osteotomy if resur-
facing is performed increasing the magni-
tude of the procedure or requiring a second
stage. We have performed this in the
supracondylar area although it may be
feasible in the subtrochanteric region.

We have found that a “safe” level of
lengthening is ten percent of the length
of the femur. Traction of the nerves may
produce some clinical weakness of the
femoral and especially the peroneal nerve
even at that length. The individuals
tolerance is more of a factor between ten
and 15% lengthening and more extensive
muscle weakness is likely. We recommend
that the sciatic nerve be isolated and
palpated as trial reduction is being perfor-
mved to evaluate the degree of stretch
applied. When performing a trial reduc-
tion, it may be necessary to try several
modes of reduction to determine which is
the least traumatic. For example, our
standard mode of reduction consists of
abduction and extension bringing the limb
back onto the operating table with the
patient in the lateral decubitus position
while applying traction. If an extensive
muscle release is necessary and already
performed, it is often less traumatic to
bring the limb to the table and insert the
hip by applying straight traction and
manually applying medial pressure for
reduction.

Trochanteric reattachment can be diffi-
cult when the limb is lengthened. Preop-
erative planning will determine the magni-
tude of the potential problem and its
solution. If the limb is to be lengthened,
 it is wise to osteotomize the trochanter
from the base with the longest possible
obliquity based distally. The trochanteric
fascia and capsular attachments are relea-
sed by incising proximal to the trochanter
to the underlying fat and muscle so that
it can be maximally mobilized. It is
advisable to see if the trochanter can be
reattached at the time of trial reduction
prior to cementation of components. Plac-
ing the limb in thirty to forty-five degrees
of abduction has been feasible and has
not left the patient with a permanent
abduction contracture. If the trochanter
can be reattached in the subluxed case to
a cancellous bone bed, then the two wire
interlocking technique is satisfactory. If
femoral shortening has been necessary it
is wise to add a third wire placed parallel
to the vertical wire for additional stability
and strength. If the trochanter is not
rigid, or if there is a marked abduction
contracture after reduction, it is wise to
leave the patient in bed in balanced
suspension for one to two weeks until
soft tissue healing has progressed and
the limb can be gradually adducted close
to the neutral position. The trochanter is
generally anatomically posteriorly posi-
tioned into a gable degree in the dysplas-
astic hip in association with anteversion
of the femoral neck. In resurfacing, we
generally reattach the trochanter anatomi-
cally. However, in a high riding disloca-
tion where the femur has, of necessity,
been shortened below the trochanter with
conventional replacement we generally
reattach the trochanter laterally and correct as much of the excessive anteversion as possible.

Rehabilitation is likely to be slow and graduated exercise is often necessary. Bone grafts which cover more than 1/3 of the socket should be protected by non-weight bearing for four to six months and examined by x-ray to determine bone union which is not easy to assess.

**Conclusion**

We have demonstrated that hip resurfacing can achieve results comparable to conventional total hip replacement in terms of pain relief, walking, function, and range of motion. Complication rates of both conventional and resurfacing are higher than those from groups of patients with primary osteoarthritis or rheumatoid arthritis. The enhanced stability and apparent lower risk of sepsis weigh in favor of its use when bone stock is sufficient to provide containment of the socket with minimal grafting.

We have included in our series the most difficult group of patients, the young and very active. However, it is doubtful that lifetime durability can be achieved for the very young and very active patient at this time. The changes in component design, improvement in instrumentation, and, most importantly, in fixation technique, coupled with more discretion in recommending the procedure for patients in whom other surgical procedures (such as pelvic shelving, rotational osteotomy or arthrodeses) would be preferable, should result in improved long-term results. (Table 7)

Each surgical team which engages in surface replacement of any kind must focus on each complication and strive for prevention. We believe that neck fractures are largely preventable. The THARIES range of components enables the surgeon to customize the prosthesis to the hip, rather than the hip to the prosthesis. The instrumentation provides a useful guide to protect the neck, but the surgical team must be thoroughly versed in its advantages and its shortcomings.

While we understand the surgeon's preference for using a different surgical approach to the hip joint, we feel that at the outset surgeons learning the technique should use a lateral, transtrochanteric approach because of the wide exposure provided with a relatively low incidence of significant heterotopic bone formation. Surgeons should not compromise on bone preparation, cleansing and drying, and exposure is most helpful in utilizing the new techniques of compression and containment for acetabular fixation. If the surgeon wishes to explore another approach, he should do so only after he can demonstrate to himself a consistent optimal interface with no radiolucencies on a high-contrast postoperative x-ray. The fear of trochanteric migration can be minimized by concentrating on a technique which is proven to produce reliable results.

The advantages of surface replacement are considerable with excellent stability, low sepsis, minimal systemic complications, and less blood loss, but especially attractive is the ease of revision and the quality of options available. These advan-
tages indicate it is well worth the effort to learn the necessary special techniques to perform quality and lasting surgery. We further believe that the surgeon must accept the considerable responsibility to obtain the best possible fixation using the known adjuncts for achieving this goal. These will be improved in the future, just as they have markedly improved in our own institution during the past six years. We do agree that there is concern regarding excessive sacrifice of acetabular bone stock, and believe that this can be minimized utilizing our current technique. When bone stock is severely deficient, conventional replacement is preferable.

There is no doubt that the best time for optimizing fixation is at the initial surgery when maximal trabecular bone can be exposed by reaming. We do, however, recommend that the hip should be protected from excess stress in the postoperative period. The length of protection or degree to which the surgeon and patient should strive to achieve this goal has not yet been carefully defined. We advise a minimum of two months non-weight bearing, partial-weight bearing with crutches for an additional month, and progressing to a cane in the fourth month. If the socket is supported by more than 30% bone graft, prolonged non weight-bearing until healing is recommended.

Our own confidence in the procedure at this time has increased so that we are applying it to older patients due to nearly very low dislocation and sepsis rates and easier revision. We consider resurfacing will become a permanent part of our orthopedic armamentarium. While it is unlikely that all orthopedic surgeons should or would decide to spend the time necessary to perfect the technique, we feel it is well worth the time and effort for those who have large numbers of hip patients and we do not believe that conventional replacement should not be used in youthful patients with sufficient bone stock to be resurfaced. (Table 8)

Table 8. HIP SURFACING NOT RECOMMENDED
For patients who do not understand potential benefits and risks For the 60 minute surgeon
The technique must be learned and improved

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