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OSTEOARTHRITIS OF THE HIP TREATED WITH INTERTROCHANTERIC DISPLACEMENT OSTEOTOMY

A Follow-up Study

By

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In 1919 *Lorenz* described his bifurcation operation. It was primarily used for the treatment of congenital dislocation of the hip, but in a later publication (1925) he mentioned as one of the indications "the most serious cases of painful arthritis deformans". *McMurray*, in 1935, described an oblique osteotomy above the level of the lesser trochanter with medial displacement of the femoral shaft for the treatment of unilateral osteoarthritis of the hip. Independently, *Malkin* described displacement osteotomy one year later. In 1950 *Pauwels* introduced varus osteotomy without displacement. This method he had used particularly for young adults with painful dysplasia of the hip. Later, this angulation was combined with displacement. During the past 15 years several modifications have been devised.

That the relief of pain was of long duration was demonstrated by *Osborne & Fahrni* (1950), *Wardle* (1955), *McFarland* (1957), *Adam & Spence* (1958), and *Ottolenghi & Frigerio* (1962). Improvement of the radiographic appearances following osteotomy has been reported by int. al. *Osborne & Fahrni* and *Adam & Spence*. The majority of the patients in the above-mentioned studies have had the operation at an advanced stage of their disease, and a number of them have been treated postoperatively with prolonged external fixation.

In 1963 *Nissen* and in 1964 *Harris & Kirwan* published their reports on osteotomy in early cases of primary osteoarthritis of the hip. These authors found better results, in respect to pain, mobility, and X-ray findings in these patients compared with patients with longer-lasting and more severe osteoarthritis.

What the operation aims at according to *Duthie* (1964) is (1) to relieve pain, (2) to correct deformities, (3) to retain or improve stability, (4) to retain or improve mobility.

PRESENT MATERIAL

The present material comprises the patients treated, during the period 1957-1964 in the Orthopaedic Department of the Odensen County and City Hospital, for osteoarthritis of the hip by intertrochanteric displacement osteotomy.

The main indication for the operation was pain. No regard was paid to the severity of the osteoarthritis in deciding upon the operation.

A total of 61 patients had the operation. Six died more than 3 months after the operation. Among the remaining 55 two were operated on bilaterally, so that the series represents 57 operations. All 55 patients were examined postoperatively. 35 operations were performed on the right and 22 on the left hip.

Sex Ratio

34 operations were performed on women and 23 on men. This female preponderance is apparent also from most other publications on the surgical treatment of osteoarthritis of the hip (*Gade* 1947, *Nicoll & Holden* 1961, *Ottolenghi & Frigerio* 1962, and *Ferguson* 1964).

Age Distribution

The average age at operation for the entire series was 57 years (26-75 years). 88 per cent were in the range 41-70 years (Figure 1). The age distribution corresponds to that reported by others.

Primary and Secondary Osteoarthritis

The cause of primary osteoarthritis is unknown, while secondary osteoarthritis develops as a consequence of abnormality in the joint. Our series includes 5 cases of secondary osteoarthritis, viz. 1 old epiphysiolysis, 1 old fracture of the femoral neck, 1 case with a history of operation for congenital dislocation of the hip, and 2 cases of acetabular dysplasia. The others must be considered primary.

Bilateral Osteoarthritis of the Hip

In 29 cases (51 per cent) there was radiographic evidence of bilateral osteoarthritis, while in the remaining 28 cases the other hip was normal. *Shepherd* (1960) found 43 per cent bilateral cases among patients treated with osteotomy. *Nicoll & Holden* (1961) found 18 per cent and *King & Dooley* (1962) 17 per cent bilateral cases.

Previous Treatment

48 patients had previously had conservative treatment (short-wave therapy, massage, X-radiation, and injections) with no effect or an effect of only brief duration. Conservative treatment is stated to be of very doubtful value in osteoarthritis of the hip (*De Marneffe et al.* 1965).

Seven patients had previously been treated surgically by operation (fenestration

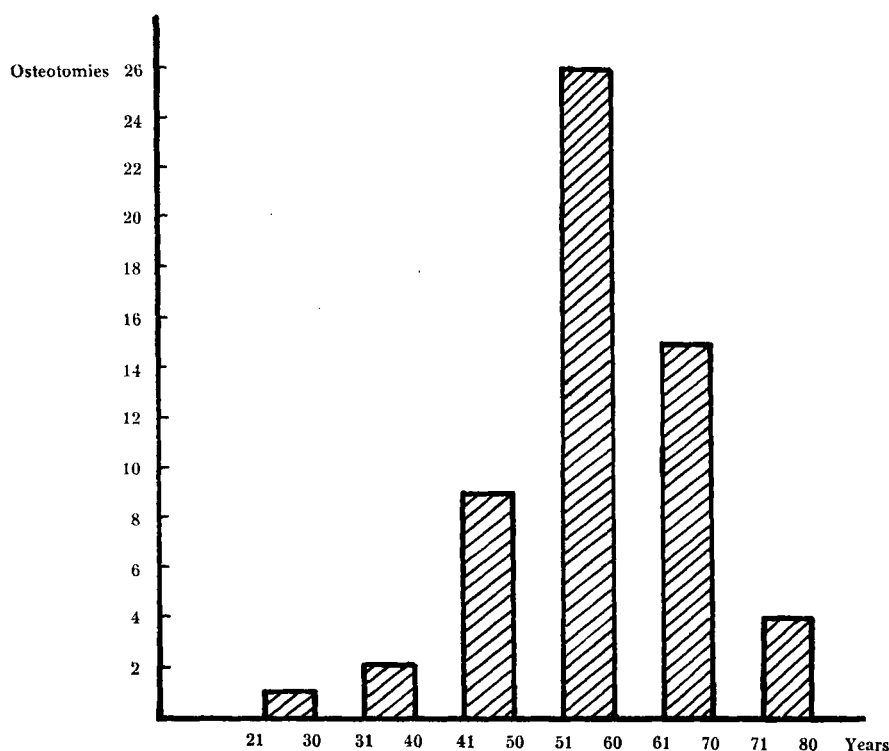


Figure 1. Distribution of osteotomies on the age groups.

3, Lance operation 2, Voss operation 1, and osteotomy 1). All had obtained some relief of pain by these operations, but the symptoms had recurred.

Follow-up Period

The follow-up was done at least 2 years after the operation. In 34 osteotomies the follow-up period ranged from 2 to 5 years and in 23 osteotomies from 5-8 years.

Operative Technique

All the osteotomies were carried out by the same technique. Only internal fixation was used with Bosworth's spline (Figure 2).

The method is as follows: The patient is placed on a traction table, and an incision is made from the tip of the greater trochanter and carried to about 15 cm distally. The iliotibial tract is divided, the vastus lateralis is incised and divided by blunt dissection for a length of 6-8 cm. The femur is stripped on the lateral aspect and the intertrochanteric region exposed. Thereafter, the bone is encircled by a Gigli saw, and after it has been ensured that the saw is proximal to the lesser trochanter, the bone is sawn obliquely—from the medial-proximal aspect in the lateral-distal direction. If a valgus or varus position is to be corrected, 2 Gigli saws are applied and a wedge is removed. Thereafter, the distal fragment of the femur is

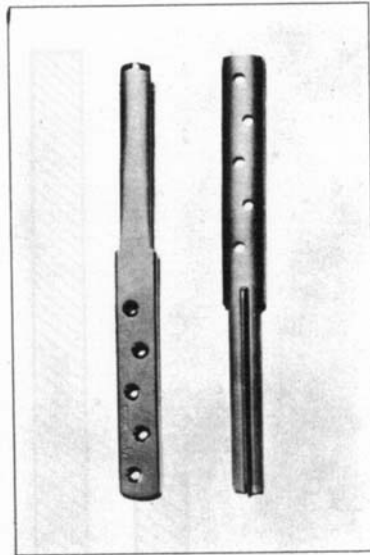


Figure 2. Bosworth's spline.

displaced medially, the aim being a displacement of about half the width of the bone, and the tip of a Bosworth spline is knocked up through the osteotomy surface and the trochanter. After correction of a rotation contracture, if any, the spline is fixed to the femur with 3-5 screws. Prior to the fixation a good contact between the osteotomy surfaces must be secured. The vastus lateralis and the iliotibial tract are sutured with catgut and the skin with nylon or steel wire.

The Bosworth spline is easy to apply. It fixes rotation, flexion, and abduction.

X-ray exposures were not made during the operation. The first check-up film was taken 7-14 days after the operation and then usually again 3 months after the operation.

Postoperative Regimen

A few days after the operation the patients were allowed to sit. At the end of 1-2 weeks they were started on walking exercise and they were permitted to put the operated leg, to the floor but not to subject it to weight-bearing. When the patients could manage confidently with 2 English canes they were discharged. If X-ray films 3 months after the operation showed union, they were given permission for full weight-bearing. Anticoagulant medication was not used in any one case in connection with the operation.

RESULTS

Pain

All the patients had pain on weight-bearing prior to the operation, and in 32 this pain had lasted for more than 5 years. Before the operation 45 had pain at rest (Table 1).

Table 1. Preoperative duration of pain.

	Pain on weight-bearing	Pain at rest
None	0	12
<1 year	5	13
1-5 years	20	24
>5 years	32	8
	57	57

In analysing the postoperative results 2 osteotomies have to be excluded, as these patients were later subjected to Girdlestone's operation.

At follow-up it was found that 34 osteotomies had resulted in the complete relief of pain, while 18 had reduced the pain and 3 had had no effect on the pain. No patient had increased pain. In other words, the pain had disappeared or been reduced after a total of 52 osteotomies or in 95 per cent (Table 2).

Table 2. Pain at follow-up in relation to preoperative duration of pain.

	None		Decreased		Unchanged	
	No.	%	No.	%	No.	%
Pain on weightbearing						
<1 year	4	80	1	20	0	0
1-5 years	12	63	4	21	3	16
>5 years	18	58	13	42	0	0
	34	62	18	33	3	5
Pain at rest	46	84	8	14	1	2

These figures correspond to the findings of others: *Adam & Spence* (1958): 57 osteotomies with improvement of pain in 81 per cent, *Robins & Piggot* (1960): 64 osteotomies with improvement of pain in 92 per cent, *Nicoll & Holden* (1961): 195 osteotomies with improvement of pain in 88 per cent, *Ottolenghi & Frigerio* (1962): 103 osteotomies with improvement of pain in 94 per cent, and *Howe et al.* (1963): 76 osteotomies with improvement of pain in 97 per cent.

The relief of pain is largely independent of the duration of the disease before the operation, as only a very few patients had had pain for less than 1 year (Table 2).

At follow-up the pain at rest had disappeared or decreased in 54 patients and was unchanged in 1 (Table 2).

If the pain is regarded in relation to the length of the follow-up period the best results are apparently found in the group with the shorter follow-up period, but there is not a significant difference between the 2 groups (Table 3).

Table 3. Pain at follow-up in relation to follow-up period (I), number of diseased hips (II), and degree of osteoarthritis (III).

	None		Pain		Unchanged	
	No.	%	No.	%	No.	%
I.						
Follow-up period 2-5 years	24	73	9	27	0	0
Follow-up period 5-8 years	10	45	9	41	3	14
II.						
Unilateral osteoarthritis	22	79	6	21	0	0
Bilateral osteoarthritis	12	44.5	12	44.5	3	11
III.						
Mild osteoarthritis	6	46	6	46	1	8
Severe osteoarthritis	28	67	12	28	2	5

Shepherd (1960) found practically no difference between a follow-up period of 5-7 years and 7-10 years. *Ottolenghi & Frigerio* (1962) found that in 60 cases followed for 1-3 years 85 per cent were relieved of pain and among 43 cases followed for 3-17 years 86 per cent were free of pain.

The results as far as the relief from pain is concerned is better in unilateral cases (79 per cent relieved of pain against 44.5 per cent in bilateral osteoarthritis). This difference is significant ($p < 0.01$) (Table 3). *Shepherd* (1960) reported that the relief from pain was greater in unilateral cases. *Müller* (1957) as well as *Nicoll & Holden* have stated, moreover, that in bilateral osteoarthritis the complaints about the unoperated hip often increase when the pain from the osteotomized side has been reduced. We have also observed this phenomenon, but not constantly.

There is no relationship between age at the time of operation and the result at follow-up in respect to pain. The same has been demonstrated by *Adam & Spence* (1958).

Harris & Kirwan (1964) reported a greater relief from pain after osteotomy in patients with early cases of primary osteoarthritis. When considering 13 of our mildest cases (with no radiographic deformity of the head before the operation and a preoperative flexion of at least 30°), we did not find better results than in the remainder of the series (Table 3).

Consumption of Analgesics

At follow-up 43 patients were not using any analgesics and 10 were using less than before the operation. In 2 the analgesic intake was unchanged. No patient had an increased analgesic intake, and no patient had any major consumption of these drugs.

Walking Distance

28 patients could walk farther than before the operation, while in 16 the walking distance was unchanged and in 11 reduced. Thus, in a total of 80 per cent the walking distance was unchanged or improved. In *Harris & Kirwan's* material of mild cases 65 patients out of 71, or 92 per cent, had the same or a better walking distance.

Use of Stick

Twenty patients were not using a stick at follow-up. The remaining 35 were using one or two sticks, several only 1 stick occasionally. One patient was using 2 crutches and 6 patients 2 English canes (Table 4). In all 7 the walking distance had been reduced.

A high percentage of *Hirsch's* (1961) patients were using a stick, but only a very few of *Ferguson's* (1964).

Table 4. *Use of a stick.*

	Preoperatively	1 year after op.	2 years after op.	At follow-up
1 ordinary stick	18	30	24	21
1 English cane	0	6	6	5
2 ordinary sticks	6	2	2	2
2 English canes	0	7	6	6
2 crutches	0	1	1	1
	24	46	39	35

Occupation

Before the operation 49 patients had had predominantly walking, one predominantly standing, and 5 predominantly sedentary jobs.

Fifteen patients had given up their jobs before the operation, 3 changed their occupation after the operation, and 2 gave up their jobs after the operation. One of the latter patients was relieved of pain after the operation, and in the other one the pain was reduced. It cannot be ruled out that their retirement from work was contributory.

A total of 8 patients had reached the age of 67, *i.e.* the pension age, during the follow-up period.

The working ability was practically unchanged from prior to the operation until the follow-up at which only 9 patients were incapacitated. 28 are partially and 18 fully capable of working (Table 5). Partially capable means that the patients can manage light work, *e.g.* the women can do domestic work except for the heaviest part of it.

25 patients obtained disablement pension, including 12 who has this pension before the operation.

Table 5. Working ability.

	Preoperatively	At follow-up
Full working ability	18	18
Partial working ability	26	28
Incapacitated	11	9
	55	55

Mobility

A collected assessment of the mobility in each hip, on the basis of the 6 differing movements, showed that in 16 cases (29 per cent) the mobility was improved, in 18 cases (33 per cent) unchanged, and in 21 cases (38 per cent) worse. The individual movements are shown in Table 6. It is apparent, as is also generally accepted, that the greatest loss of mobility concerns the external-internal rotation, and that flexion is best preserved.

By way of comparison the following previous findings may be mentioned: *Nicoll & Holden* (1961) found that among 28 patients with internal fixation 36 per cent had increased mobility, 39 per cent unchanged mobility, and 25 per cent decreased mobility, while the cor-

Table 6. Mobility.

	Flex.-Ext.		Abd.-Add.		Ext. rot.-Int. rot	
	Preop.	At follow-up	Preop.	At follow-up	Preop.	At follow-up
0	1	3	20	15	38	39
1-30°	13	15	20	19	13	14
31-60°	16	12	11	20	3	2
61-90°	18	15	4	1	1	0
>90°	7	10	0	0	0	0

responding values for 119 patients with external fixation were 21 per cent, 29 per cent, and 50 per cent. *Shepherd* (1960) also found better mobility after internal fixation. *King & Dooley* (1962) found the mobility to be essentially the same as prior to the operation, tending to decrease as the years went by. Among 75 intertrochanteric osteotomies *Ottolenghi & Frigerio* (1962) has 37 per cent with improved mobility, 39 per cent with unchanged and 24 per cent with decreased mobility. *Cauchoux* (1965) reported that nearly all patients treated by McMurray osteotomy lost some mobility. According to *Ottolenghi & Frigerio* the highest degree of mobility was found in patients with 60° flexion or more preoperatively, while a great limitation of motion was often found if the preoperative mobility had been less than 60°. This we cannot confirm, but when comparing preoperative flexion with the flexion at follow-up in patients with mild osteoarthritis (as already mentioned no preoperative deformity of the femoral head and at least 30° flexion) and in patients with more severe osteoarthritis (the remainder of the series) we found a better, but not significantly better mobility in patients with mild osteoarthritis (Table 7). This is in keeping with the observations of *Harris & Kirwan*.

Table 7. Flexion at follow-up in relation to degree of osteoarthritis.

	Mild osteoarthritis		Severe osteoarthritis	
	No.	%	No.	%
Flexion unchanged or better	9	69	23	55
Flexion poorer	4	31	19	45

It is difficult to explain the improvement in mobility, but part of the explanation is that mobility inhibited by pain before the operation

will be released. This is apparent from the often perceptibly increased mobility in an anaesthetized patient. Another factor may be the establishment of better mechanical conditions.

In respect to deformities, it may be seen that the number of flexion and adduction contractures was almost unchanged from before the operation. On the other hand, the number of external rotation contractures had increased by about 3 times (Table 8). This must be because it has not been possible to adjust the distal fragment to a sufficient extent into the correct position before fixing the spline.

Adam & Spence (1958) found little difference between the deformity before and after the operation.

Table 8. Contractures.

		Preoperatively	At follow-up
Ext. rotation contracture	>10°	5	14
Flexion contracture	>20°	3	2
Adduction contracture	>10°	6	6

There is no relationship between the freedom from pain and the degree of preoperative flexion. A comparison of the mobility at follow-up with the attainment of total relief of pain reveals that of those who had reduced mobility 48 per cent were totally free of pain, of those with unchanged mobility 56 per cent, and of those with improved mobility 86 per cent were totally free of pain. It is remarkable that half the patients in the group with reduced mobility were completely relieved of pain. However, this has also been demonstrated by others (*e.g. Ottolenghi & Frigerio* 1962). The explanation is not ankylosis, as in this material there were only 3 ankyloses at follow-up, 1 fibrous and 2 bony. *Shepherd* (1960) had 12 per cent ankyloses and *Nicoll & Holden* (1961) 34 per cent at follow-up. The last-mentioned authors found the incidence of ankylosis to be twice as high when the osteotomy had been followed by fixation in plaster cast as when internal fixation without plaster had been employed. Furthermore, the incidence was related to the movement of flexion prior to the operation. 74 per cent of the hips that ankylosed had had less than 45° flexion before the operation.

In our series we have one hip with pseudarthrosis between the femoral shaft and the pelvis. *Shepherd* had 12 out of 218.

Shortening

41 patients showed shortening of the leg on the operated side. This shortening was from $\frac{1}{2}$ –2 cm in 24 patients, from 2 to 4 cm in 15 patients, and more than 4 cm in 2 patients. It is due partially to the medial-superior displacement of the distal fragment.

Overweight

At follow-up 17 patients were overweight. Overweight is defined as 10 per cent in excess of the ideal weight, *i.e.* the average for the age group 25–30 years in relation to height (values derived from the tables of the insurance company Hafnia). We found no relation between overweight and pain at follow-up.

X-ray Findings

On the preoperative X-ray films 41 patients were found to have severe osteoarthritis, 12 moderately severe, and 2 mild. In 39 there was incongruence between the femoral head and the acetabulum. 51 patients had sclerosis of the head and acetabulum, 49 had cysts in the head and 44 in the acetabulum, 16 had exostoses on the head and 44 on the acetabulum, and in 37 the head was flattened.

At follow-up the X-ray appearances had improved in 26, while they were unchanged in 21 and aggravated in 8. The joint space was wider in 29, unchanged in 21, and narrower in 5. Out of the 39 patients with preoperative incongruence 8 showed improvement, while in 28 it was unchanged and in 3 accentuated. Among the 51 patients with preoperative sclerosis, the sclerosis was less marked in 27, unchanged in 22, and aggravated in 2 (Figure 3). *Adam & Spence* (1958) found improved X-ray appearances in 38 out of 55, unchanged in 16, and aggravated in 1 case. *Howe et al.* (1963) demonstrated an increased joint space in 47, unchanged in 23, and narrower in 9 cases. *Robbins & Piggot* (1959) felt that the increase of the joint space was due to the altered position of the femoral head and that it was due only occasionally to regeneration of the articular cartilage. It is obvious that in a number of cases the increase of the joint space is due to an altered position of the femoral head, as this is often apparent on films taken a short time after the operation.

A comparison of the degree of the osteoarthritis (the mild cases defined as before) and the X-ray findings at follow-up shows better (but

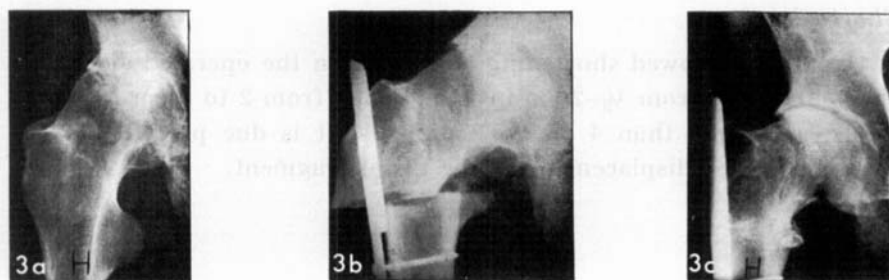


Figure 3. (A) Preoperative film showing severe right-sided osteoarthritis of the hip in a 43-year-old man. (B) The same hip two weeks after osteotomy. (C) The same hip 3 years after the operation. Regression of the osteoarthritic changes.

not significantly better) results in mild cases (Table 9). This is in accordance with the findings of *Harris & Kirwan*.

On comparison between absolute relief from pain and post-operative X-ray appearances, we found that of the patients with aggravated X-ray appearances 62 per cent were totally relieved of pain, while among those with improved appearances 73 per cent were totally free of pain. In other words, there is no relationship, and we found, strangely enough, that 62 per cent were rendered free of pain in spite of poorer X-ray appearances (Table 9).

Table 9. Postoperative X-ray findings in relation to pain at follow-up and degree of osteoarthritis.

	X-ray findings		
	Improved	Unchanged	Worse
No pain	19	10	5
Pain decreased	7	9	2
Pain unchanged	0	2	1
Mild osteoarthritis	12 (92%)		1 (8%)
Severe osteoarthritis	35 (83%)		7 (17%)

In two-thirds of the patients the head-neck angle had altered into varus as a consequence of the operation (Table 10). *Harris & Kirwan* (1964) reported an alteration of this angle into varus in 21 cases, while in 42 cases it was unchanged and in 9 it had altered into valgus. The varus position was not intended, but was found to occur more often when a straight V-spline was used.

Table 10. Alteration of the head-neck angle as a consequence of the operation.

	Varus	Valgus	Unchanged
$\leq 15^\circ$	26	3	13
$> 15^\circ$	11	2	
	37	5	13

The displacement at the site of osteotomy was in 23 cases less than half the width of the diaphysis and in 32 more than half the diaphyseal width. There is no relationship between the degree of medial displacement and the relief of pain.

The metal projects up through the trochanter in 30 patients. As already mentioned, the spline is intended to penetrate the cortex. In 7 the spline projects more than 2 cm. In 9 patients there was tenderness at the tip of the spline. 17 had pain on maximum passive movement in certain directions, but only 2 on abduction alone. In 3 cases the spline had been removed because of complications.

Complications

The operative mortality was 0. There were no infections and no cases showing any reaction around the spline. One patient had severe phlebitis, but without emboli. No patient developed limitation of movement in the knee.

Table 11. Healing time.

	Number of osteotomies
≤ 3 months	41
3-6 months	9
6-12 months	2
Pseudarthroses	5

50 osteotomies had united within 6 months, including 41 within 3 months. In 2 union was delayed, taking up to 1 year. There were 5 pseudarthroses (Table 11). The cause of the delayed union in the 2 cases was poor contact at the osteotomy site, while the causes of the pseudarthroses were as follows: In 2 patients marked displacement and poor contact at the osteotomy site, in 1 patient the osteotomy line was

below the level of the lesser trochanter, in 1 patient the spline was in an incorrect position as it projected into the head, and possibly into the joint. In the fifth case there had been primary union, but one year after the operation the patient sustained a fracture of the femoral neck which involved the osteotomy line and resulted in pseudarthrosis at the osteotomy site. Two of these 5 patients have later had Girdlestone's operation, 1 united after re-osteotomy, and the last 2 have not had further treatment as they are free of pain. In the literature the incidence of pseudarthrosis ranges from 0 (*Harris & Kirwan* 1964) to 18 per cent (*Crellin & Simurda* 1965). The causes stated are mainly lack of contact at the site of osteotomy and technical errors.

DISCUSSION

In the surgical treatment of osteoarthritis of the hip there is a choice of 3 main types of operation, each having its indication, viz. arthrodesis, arthroplasty, and osteotomy. Other operations for this disease should be considered merely palliative. Osteotomy is the simplest to perform, but the least understood (*Blount* 1964).

It is evident, however, that the X-ray changes are reversible and may regress following osteotomy. In respect to the way in which the osteotomy works most authors agree that a biochemical problem is involved. The mechanical factors comprise better centering of the femoral head in the acetabulum with increased contact area, better congruence of the joint surfaces, a more even distribution of pressure upon the joint surfaces, better distribution of weight-bearing upon the femoral head and neck, correction of deformities, and decreased muscular and capsular tension. *McMurray* (1939) and *Pauwels* (1951) assumed that these factors were primarily responsible and based their operations on them. *Pauwels* has later (1961) established that osteoarthritis is a bio-mechanical problem, consisting of 2 factors, viz. the mechanical stress exerted upon the joint and the biological state of the articular cartilage.

The biological process has not yet been elucidated, but vascularization factors appear to play an important role. *Harrison, Schajowics & Trueta* (1953) and *Rutishauser & Grasset* (1955) have demonstrated the presence of a hyperaemic process in osteoarthritis of the hip (the former active and the latter passive hyperaemia). It has been demonstrated also that the hyperaemia is localized in the marginal region of the osteoarthritic lesions. The collapsed articular cartilage, the sclerosed areas, and the subchondral lesions are ischaemic injuries.

According to *Nissen* (1963) the effect of osteotomy is due to interruption of the active hyperaemia. On the other hand, *Ottolenghi* (1965) believes that in osteoarthritis there is a question of passive hyperaemia and that osteotomy stimulates the production of an active revascularization and repair of the lesions.

A common result of all osteotomies is major or minor reduction of pain, major or minor correction of deformities, major or minor regression of the degenerative process. Simple transverse osteotomy in the trochanteric region, without displacement or angulation, will alleviate the pain like medullosotomy (*McKenzie* 1936), but it will not make the degenerative process regress (*Blount* 1964). Unless the deformity is corrected, the pain will return when activity is resumed (*Ferguson* 1964). Several authors find that medial displacement is not of decisive importance (*Malkin* 1936, *McFarland* 1954, *Campbel & Jackson* 1955, *Ferguson* 1964).

In performing the osteotomies we have considered medial displacement to be an important part of the operation which has been carried out in all cases. However, we did not find any relation between pain and degree of displacement. The head-neck angle had altered into varus in two-thirds of the cases, but this was not intended except in a few. In 39 patients with incongruence between the femoral head and the acetabulum, the congruence had improved in 8, was unchanged in 28, and worse in 3. There were relatively few contractures, but we did not succeed in correcting them. On the contrary, the number of external rotation contractures increased. The explanation of the less marked (but not significantly less marked) relief of pain in the group with a long follow-up period than in the group with a short follow-up period is possibly that the mechanical problems have not been satisfactorily solved.

CONCLUSION

Out of 55 patients 34 (62 per cent) were totally relieved of pain by intertrochanteric displacement osteotomy. In 52 patients (95 per cent) the pain disappeared or decreased. The total relief of pain is significantly higher in patients with unilateral osteoarthritis of the hip. There is no relationship between age and freedom from pain, between the degree of preoperative flexion and pain, or between the X-ray findings and relief of pain.

In respect to the correction of deformities, the number of flexion and

adduction contractures was unchanged, while the number of external rotation contractures was three times higher at follow-up than before the operation.

If the stability is expressed in terms of walking distance, this was improved or unchanged in 80 per cent and decreased in 20 per cent.

In a collected assessment of mobility, improved or unchanged mobility was found in 62 per cent and poorer in 38 per cent. Comparison of preoperative flexion and flexion at follow-up in patients with mild osteoarthritis (defined as mild or moderate X-ray signs without deformity of the head and preoperative flexion exceeding 30°) and in patients with severe osteoarthritis, showed better (but not significantly better) mobility in the group of mild osteoarthritis.

The total X-ray appearances were better or unchanged in 85 per cent and poorer in 15 per cent. The appearances were better (but not significantly better) in patients with mild cases (defined as above).

There were 5 cases of pseudarthroses—2 due to marked displacement and poor contact, 2 to inadequate technique, and 1 due to fracture after primary healing.

Summing up, it may be said that our results correspond largely to those reported by others. The most favourable results are obtained by operations on early, unilateral osteoarthritis, and it seems to be important to aim at a result as mechanically satisfactory as possible. But in more long-standing and more severe cases too the results are acceptable, decreasing with increasing limitation of movement and radiological destruction.

S U M M A R Y

During the period 1957-1964 57 intertrochanteric displacement osteotomies were performed on 55 patients with osteoarthritis of the hip, all of whom have been followed-up. The main indication for the procedure was pain. Fixation was exclusively internal, by Bosworth's spline. The technique is described. In 52 out of the 55 cases (95 per cent) the pain was relieved or reduced, while in 3 cases it was unchanged. Mobility was improved or unchanged in 62 per cent and poorer in 38 per cent. The X-ray findings were better or unchanged in 85 per cent and poorer in 15 per cent. Five pseudarthroses occurred. The most favourable results were observed in early and unilateral cases, but the method is also justified in the more severe cases of osteoarthritis.

RESUME

Pendant la période entre 1957 et 1964, 57 ostéotomies de déplacement intertrochantérien ont été pratiquées chez 55 malades souffrant d'ostéoarthrite de la hanche. Tous ces malades ont été suivis. La fixation a été exclusivement externe, par tige Bosworth. La technique est décrite.

Dans 52 des 55 cas (95 pour cent), il y a eu soulagement ou réduction des douleurs, tandis que l'état est resté inchangé chez 3. La mobilité s'est améliorée ou est restée inchangée dans 62 pour cent des cas et elle est moins bonne dans 38 pour cent des cas. Les trouvailles radiologiques sont meilleures ou inchangées dans 85 pour cent des cas et moins bonnes dans 15 pour cent des cas. Il s'est produit cinq pseudarthroses. Les résultats les plus favorables ont été observés dans les cas précoces et unilatéraux, mais l'application de la méthode est cependant aussi justifiée dans les cas plus graves d'ostéoarthrite.

ZUSAMMENFASSUNG

Während der Zeitspanne 1957-1964 wurden 57 intertrochanterische Verschiebungsosteotomien an 55 Patienten mit Osteoarthritis der Hüfte vorgenommen. Alle Patienten wurden nachuntersucht. Die Hauptanzeige für den Eingriff war Schmerzen. Die Fixierung geschah ausschliesslich intern mittels der Bosworth Schiene. In 52 von 55 Fällen (95 Prozent) waren die Schmerzen verschwunden oder erleichtert, während sie in 3 Fällen unverändert waren. Die Beweglichkeit war in 62 Prozent gebessert oder unverändert und herabgesetzt in 38 Prozent. Die Röntgenbefunde waren in 85 Prozent gebessert oder unverändert und in 15 Prozent verschlechtert. Pseudarthrosen entstanden in 5 Fällen. Die besten Ergebnisse wurden bei frühzeitigen und einseitigen Fällen beobachtet, aber die Methode ist auch bei schwereren Fällen von Osteoarthritis gerechtfertigt.

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