The Spitzy shelf operation for the dysplastic hip

Retrospective 10 (5–25) year study of 124 cases

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Since 1961 we have used the Spitzy shelf operation combined with a vertical flap osteotomy of the outer cortex of the ilium for early arthrosis secondary to acetabular dysplasia, subluxation, and dislocation. In 124 hips, followed for 10 (5–25) years, clinical improvement was maintained in 67/85 of patients who were operated on under the age of 30 and in 22/39 of patients treated after 30. However, less than half of the hips in the younger group and only one out of ten in the older group were symptom-free.

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Early arthrosis secondary to acetabular dysplasia has been successfully treated by enlarging the acetabular coverage by making a new bony acetabulum and many kinds of shelf operations have been described (König 1891, Albee 1915, Spitzy 1924, Lance 1925, Ghormley 1931, Schede 1933, Heyman 1963, Mizuno et al. 1975, Wainwright 1976).

We have used the Spitzy shelf operation since 1961 for early arthrosis secondary to acetabular dysplasia, subluxation and dislocation, and investigated the long-term results.

Patients

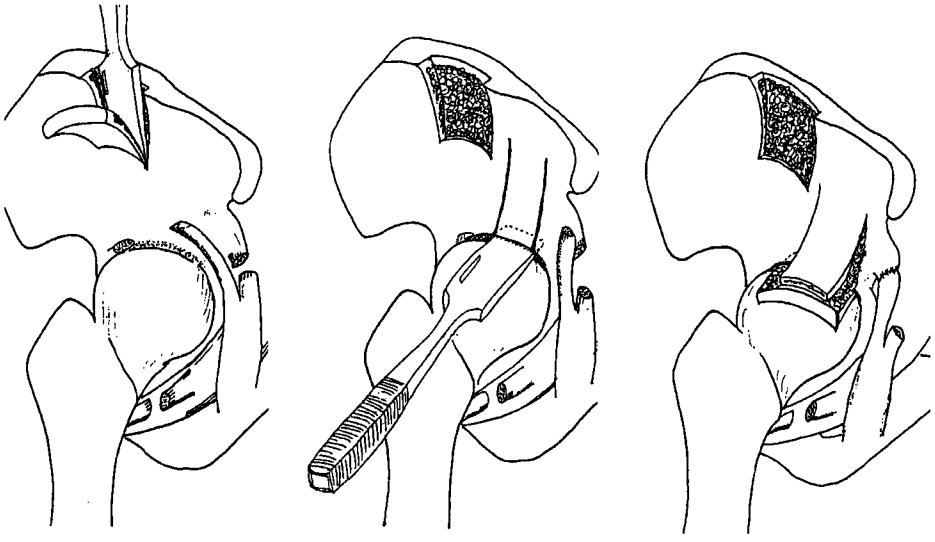
Included in this investigation are 124 hips in 113 patients who have been operated on at Kyoto University and followed for more than 5 years. 12 were men, 44 had bilateral arthrosis and 11 were operated on bilaterally. The mean age at the time of the operation was 24 (10–53) years (Table 1). 85 hips were operated on between the ages of 10 and 29 years (younger group) and 39 hips were operated on at over 30 years (older group). The follow-up period was 10 (5–25) years. The mean preoperative Center-Edge angle (Wiberg 1939) was –4.9° (–40° to 15°). 15 hips had CE angles of less than –20° and were severely subluxated or dislocated. Previous operations, such as Salter and Chiari innominate osteotomies, open reduction and advancement of the greater trochanter, had been carried out in 8 patients. The arthrotic hips on the other side were operated on by the shelf operation method in 11 patients, subtrochanteric osteotomies in 4, total hip replacement in 1, bipolar prosthetic replacement in 1 and Colonna operation in 1.

Operative procedure (Figure 1)

A Smith-Petersen incision was usually made. The outer cortex of the ilium was denuded subperiosteally down to the joint capsule. The insertion of the reflected head of the rectus femoris muscle was detached from the acetabular rim. The straight head of the rectus femoris muscle was also incised at the anterior inferior iliac spine. A broad osteotome was introduced along the joint capsule into the acetabular rim at the exact level where the reflected head is attached. A radiograph was taken with the osteotome in place to confirm the level and direction of the new shelf. Then a slot for the new shelf 2 cm in depth and an inlet of 0.3 × 3 cm was made using osteotomes and small curettes. A proximally-based vertical flap of the outer

Table 1. Age distribution at the time of operation

Age	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45 <	Total
Hips	21	19	35	8	19	9	7	5	124



The straight and reflected head were detached from their origin at the acetabular rim and anterior inferior iliac spine. A 3 × 4 cm cortex graft was obtained from the ilium. When necessary, the tendinous portion of the psoas muscle insertion was released from the lesser trochanter.

A broad osteotome was introduced into the acetabular rim to make a slot for the new shelf. A vertical cortical flap was made proximal to the slot.

The free cortex graft was inserted into the slot. The vertical flap was then raised onto the new shelf. Cancellous bony chips were packed. The stump of the reflected head was then sutured to the anterior inferior iliac spine to lengthen the rectus femoris muscle.

Figure 1. Modification of the Spitzy shelf operation.

iliac cortex of 2 × 5 cm was made proximal to the inlet. A free bone graft of 3 × 4 cm obtained from the ilium was then inserted into the slot so as to make the concave side of the cortex cover the joint capsule snugly. The vertical flap was then raised to cover the new shelf. Cancellous bone chips were packed into the triangular space made by the new shelf and the raised vertical flap. In recent cases the distal stump of the reflected head of the rectus femoris muscle was resutured to the proximal stump of the straight head at the anterior inferior iliac spine in order to lengthen the rectus femoris muscle. Iliopsoas and adductor tendons were released, if necessary.

Postoperatively, skin traction was applied for 2 weeks to prevent undue stress on the new shelf. Passive motion was then started. Partial weight-bearing started 2 months after operation, but full weight-bearing was not allowed until 6 months postoperatively, especially for the older patients.

Combined operation

In 31 hips operated on during 1969 and 1975, the detached rectus femoris tendon and iliopsoas tendon were reattached to the anterior aspect of the joint capsule in order to stabilize the femoral head (Muscle transfer group; Ito et al 1975). In 28 hips operated on recently, release and lengthening of the rectus femoris tendon in the way described above was combined (Muscle release group). In 33 hips the shelf operation was also combined with a varus (23) or valgus (10) intertrochanteric osteotomy (Osteotomy group). In 32 early cases, a simple shelf operation was carried out without muscle release or transfer.

The rating system of the Japanese Orthopedic Association (JOA)

A normal hip joint is given 100 points. These points are divided into 4 categories—40 points for pain-free condition, 20 points for normal gait, 20 points for abduction of over 30 degrees and flexion of over 90 degrees and 20 points for unrestricted daily living. The details of each category are indicated in Table 2 (Tanaka 1978).

For statistical calculations the Student's *t*-test was used.

Table 2 The hip-rating system of the Japanese Orthopedic Association

Rating scale for hip disabilities		
Pain		
None, only dull pain after long walk		40
Occasional pain,dull during walk		30
Moderate pain during walk		20
Severe pain on walking, occasional pain at rest		10
Severe spontaneous pain at rest		0
Walking ability		
Normal gait		20
Slight limp, no support, 2000 m, 30 min		15
Severe limp, one cane, 500 m, 15 min		10
Needs 2 crutches on walking outdoors		5
Unable to walk		0
Mobility		
Flexion	≥ 90°	12
	60°–89°	9
	30°–59°	6
	≤ 29°	3
	ankylosis	0
Abduction	≥ 30°	8
	20°–29°	6
	10°–19°	4
	≤ 9°	2
	ankylosis	0
Activities in daily living		
Possible		2
Difficult		1
Impossible		0
10 activities		
1	sitting on a chair	
2	sitting on a "tatami" floor	
3	bowing while sitting on a "tatami" floor	
4	putting on socks	
5	cutting toe nails	
6	squatting	
7	standing on floor	
8	standing on one leg	
9	going up stairs	
10	going down stairs	

Results

The preoperative mean JOA scores of several groups and those at the last follow-up are listed in Table 3. Distributions of the scores are indicated in Table 4. The mean preoperative score of all 124 hips was 73 and that at the last follow-up was 86 ($P < 0.001$). Both the preoperative and the postoperative scores of the older patients were lower ($P < 0.001$) than those of the younger patients. The postoperative clinical improvement was more apparent in the younger ($P < 0.001$) than in the older group ($P < 0.01$). 37 hips in the younger group and 4 hips in the older group were symptom-free and were given 100 points (Figure 2). The scores at the last follow-up were better by more than 5 points in 67/85 hips in the younger group and in 22/39 hips in the older group, and worse than the preoperative scores in 9 hips in the younger group and 10 hips in the older group. 9 hips in the younger group and 7 hips in the older group were almost unchanged. In 2 cases in the younger group, cup arthroplasties were carried out 2 and 10 years after the shelf operation. The mean postoperative score of the 69 hips followed for less than 9 years was 89 and that of the 55 hips followed for longer than 10 years was 81. In the younger group, there was a greater clinical improvement regarding muscle release than in the osteotomy group ($P < 0.05$). In the younger group, the unilaterally affected hips showed higher postoperative scores than did those bilaterally affected ($P < 0.05$). Marked improvement was achieved also in the severely subluxated and even dislocated hips with CE angles less than –20° (Figures 3 and 4).

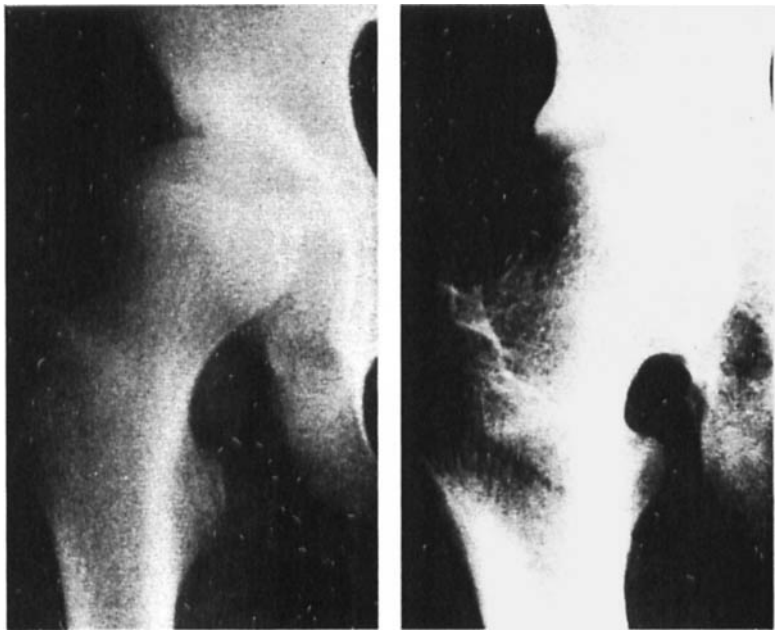
Table 3. Preoperative scores and scores at the last follow-up

				Young group (10–29), 85 hips					
	Overall	10–29	30<	Shelf	MT	MR	Ost	Unilat	Bilat
Preop	73	77	64	74	79	75	79	79	75
Last follow-up	86	91	73	89	92	93	90	94	89
Hips	124	85	39	20	25	20	20	40	45
P-value	< 0.001	< 0.001	< 0.01	< 0.001	< 0.001	< 0.001	< 0.01	< 0.001	< 0.001

MT Shelf operation combined with muscle transfer
MR Those with muscle release
Ost Those with intertrochanteric varus or valgus osteotomy

Table 4. Scores preoperatively and at the last follow-up

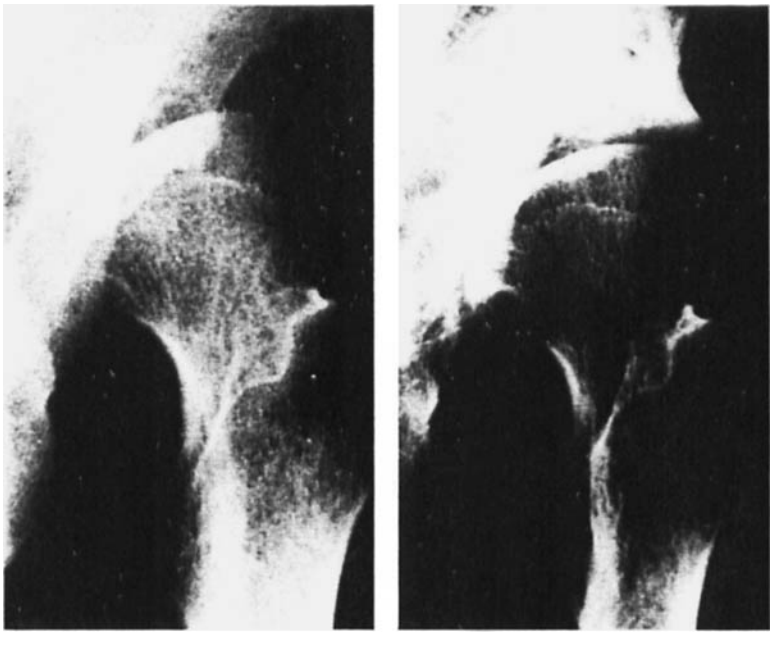
JOA Score	< 50	50–59	60–69	70–79	80–89	90–99	100
Preoperatively	4	14	28	39	24	15	
Last follow-up	2	10	12	12	18	29	41



Before the operation. The left hip was dysplastic (CE angle: –5°) and the score was 85 points.

10 years after the operation. The score is 100 points.

Figure 2. A 12-year-old girl treated with shelf operation and intertrochanteric varus osteotomy.



Before the operation. The left hip was subluxated (CE angle: –30°) and the score was 72 points.

7 years after the operation. She is almost symptom-free with 95 points.

Figure 3. A 19-year-old woman treated with shelf operation and muscle transfer.

Discussion

The Spitzy shelf operation combined with vertical flap iliac osteotomy and muscle release has several advantages, such as: 1) less radical surgical intervention than Chiari triple and periacetabular rotational innominate osteotomies, 2) technical simplicity, and 3) versatility of size, direction, and location of a new shelf. The new shelf is long enough if it covers the labrum and wide enough if it extends 30° both anteriorly and posteriorly from the top of the femoral head, i.e., half of the diameter of the femoral head (Tomihara et al. 1988). In the young group, the result of the combination of subtrochanteric osteotomy was worse than those without osteotomy. This is possibly because after a shelf operation the original cartilaginous contact between the labrum and femoral head is kept intact. It seems unnecessary to alter this contact by an osteotomy even if the femoral head is deformed and does not fit the bony acetabulum. On the contrary, an inverted or detached labrum "concentrates" the body weight, worsens arthrosis and, according to some authors, should be excised. Periacetabular rotatory osteotomy or triple osteotomy may be a choice if the labrum is unstable and is shown by an arthrogram to be detached. Saito et al. (1986) reported good results with the vertical flap osteotomy of the ilium (tectoplasty) for the dislocated and severely subluxated painful hip joints in young patients. In this survey, subluxated or even dislocated femoral heads were also covered successfully, possibly because the interposing thick fibrous capsule dispersed the body weight homogene-

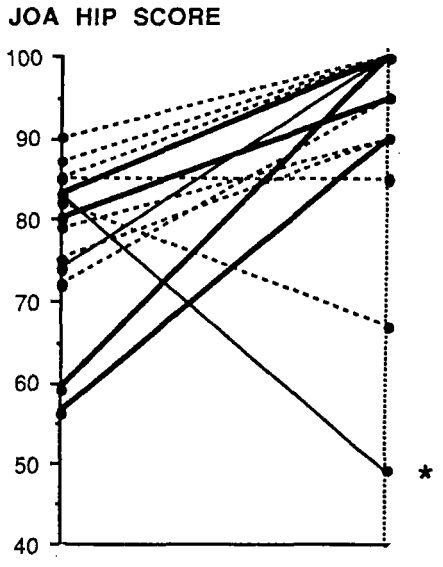


Figure 4. Shelf operation for subluxated and dislocated hips with CE angles less than –20°. Dotted lines indicate the shelf operations combined with muscle transfers and thick lines are those with intertrochanteric osteotomies.
*Cup arthroplasty was performed.

ously, creating a new fibrous cartilaginous contact between the femoral head and the grafted bony shelf. In order to obtain a more stable result, we currently prefer to restrict the shelf operation to those who are preferably younger than 30 years, have pre- or early arthrosis secondary to acetabular dysplasias and stable hip joints with an undetached or uninverted labrum. Severe subluxation and dislocation have not hitherto been included in the indications. However, in these conditions, the femoral head cannot be covered snugly by any innominate osteotomy but only by a grafted shelf.

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