

Rotational Acetabular Osteotomy (Tagawa's Method) for the Dysplastic Hip

**Hiromi HIJIKATA¹, Hiroyuki TAKEISHI², Shinei UMEHARA²,
Hiroshi IKEDA² and Yusaku MIYA²**

¹Department of Orthopedic Surgery, School of Nursing

²Department of Orthopedic Surgery, School of Medicine

Tokyo Women's Medical University

(Received Sept. 1, 1998)

Rotational acetabular osteotomy (RAO) is a procedure that corrects dysplastic acetabulum by circumacetabular osteotomy, obtaining a more anatomical relationship between the femoral head and acetabulum. RAO was performed on 531 patients (626 hips) between February 1980 and August 1997. One hundred and twelve patients (134 hips) were followed over 10 years to form the basis of this study. Postoperatively, the total Japan Orthopedic Association score (JOA score), center-edge, and oblique angle improved in all cases. RAO is a technique that can be indicated for pre, early, and even for some advanced stage coxarthrosis patients for long term excellent results and also for some advanced patients to temporize in anticipation of total hip arthroplasty.

Introduction

Rotational acetabular osteotomy (RAO) is a procedure in which it restores the position and acetabular coverage of the dysplastic hip to a nearly normal stage¹⁾. Through circumacetabular osteotomy of the acetabulum, the femoral head is adequately covered and the weight bearing area is enlarged, the shearing force is decreased by the reduction of roof obliquity, and the resultant force is decreased by the medial shift of the femoral head, to obtain satisfactory congruity²⁾ (Fig. 1).

We have been performing such an operation since 1980. We are reporting on the cases based on a 10 year follow-up study to analyze the effects and problems associated with RAO.

Subjects and Methods

Patients

Five hundred and thirty one patients (626 hips) were treated by this method from February 1980 to August 1997. One hundred and twelve patients (134 hips) were followed up for 10 years or more, from 120 months up to 193 months after surgery (average 142 months). A total of 108 patients (130 hips) were female and 4 patients (4 hips) were male. There were 7 pre-coxarthrosis patients, 32 early coxarthrosis, 66 advanced stage coxarthrosis patients, and 29 terminal stage patients. The ages of the patients at the time of operation ranged from 7 to 52 years old (average, 32 years). Pre/early coxarthrosis group patients ranged from 11 to 50 years old (average, 25 years), advanced/terminal stage group from 7 to 52 years old (average, 35 years).

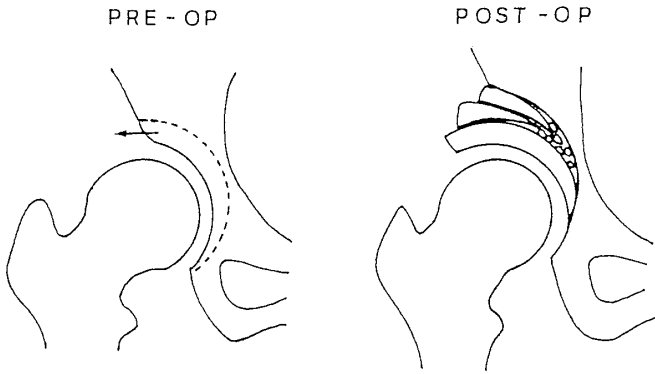


Fig. 1 Theory of rotational acetabular osteotomy (RAO)⁵⁾
adequate coverage) → enlargement of W. B. area ↑
good congruity)
decrease of roof abliquity → shearing force ↓
medial shift of femoral head → resultant force

Methods

All patients were classified as pre-coxarthrosis, early coxarthrosis and advanced stage coxarthrosis, and terminal stage coxarthrosis. Analysis was conducted by dividing these patients into three groups, A; all cases, B; pre/early group, C; advanced/terminal group. Study was based on scores obtained from (1) the Japan Orthopedic Association (JOA) score³⁾, (2) X-ray findings composing of pre-operative center-edge angle, acetabular oblique angle, lateral index, and joint congruity, and (3) survival rate, using the Kaplan-Meier method; considering a JOA score below 69 as death. The JOA score comprises of pain (40 points; pts), range of motion (20 pts), walking ability (20 pts), and activities of daily living (20 pts).

Based on the JOA score, the cases were classi-

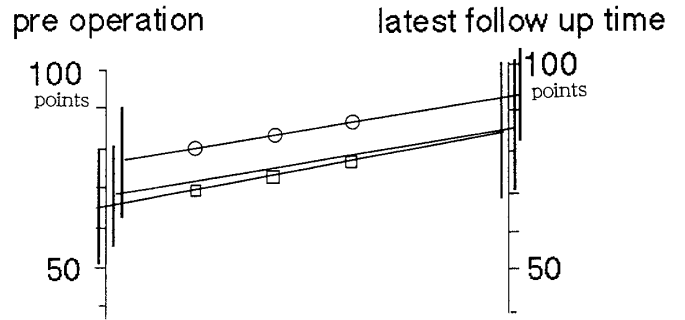


Fig. 2 JOA score (total)
— : all cases, ○ : pre/early group, □ : advanced/terminal group.

fied into good, fair, and poor congruity. The level of congruity between pre-operative and those at follow up time were used for evaluation.

Results

JOA scores in group A (all patients) ranged from an average of 69 points pre operatively and 87 points at final follow up time. Group B (pre/early coxarthrosis patients) improved from 78 points preoperatively to 93 points at final follow up time, Group C (advanced/terminal stage coxarthrosis patients) with average preoperative score of 65 points improving to average of 85 points at final follow up time. In all these groups, the JOA score improved by 20 points (Fig. 2).

JOA scores were classified as excellent (90~100 pts), good (80~89 pts), fair (65~79 pts), and poor (0~64 pts). Thirty six hips (92.3%) in the pre/early group, and 61 hips (64.2%) in the advanced, terminal group were classified as excellent/good (Table 1).

Most improvement was observed in pain, where Group A: improving 20 pts to 36 pts,

Table 1 JOA score

JOA score (points)	pre/early group cases (%)	advanced/terminal group cases (%)
90 ~ 100 (excellent)	28 (71.8%)	45 (47.3%)
80 ~ 89 (good)	8 (20.5%)	16 (16.8%)
65 ~ 79 (fair)	2 (5.1%)	25 (26.3%)
0 ~ 64 (poor)	1 (2.6%)	9 (9.5%)
excellent/good group	36 (92.3%)	61 (64.2%)

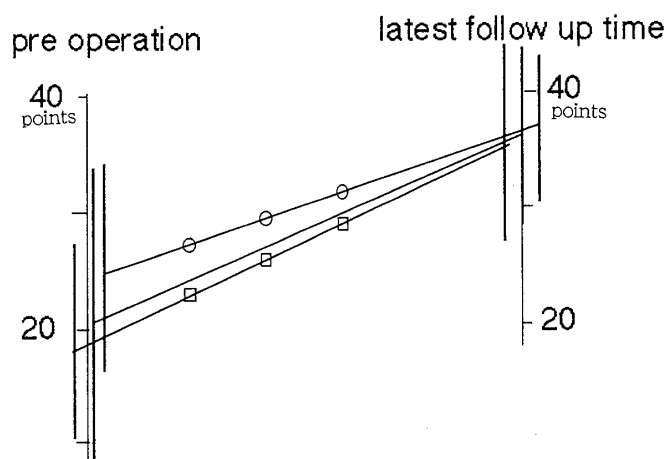


Fig. 3 Pain score

— : all cases, ○ : pre/early group, □ : advanced/terminal group.

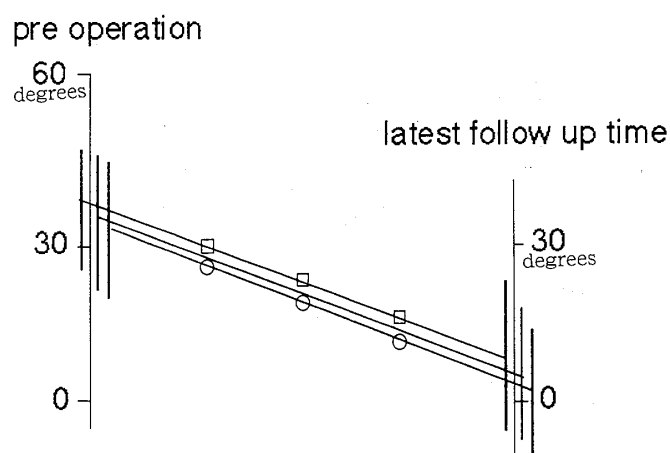


Fig. 5 Oblique angle

— : all cases, ○ : pre/early group, □ : advanced/terminal group.

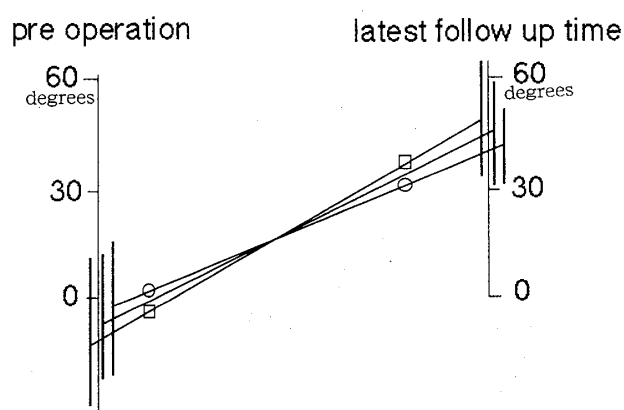


Fig. 4 Center-edge angle

— : all cases, ○ : pre/early group, □ : advanced/terminal group.

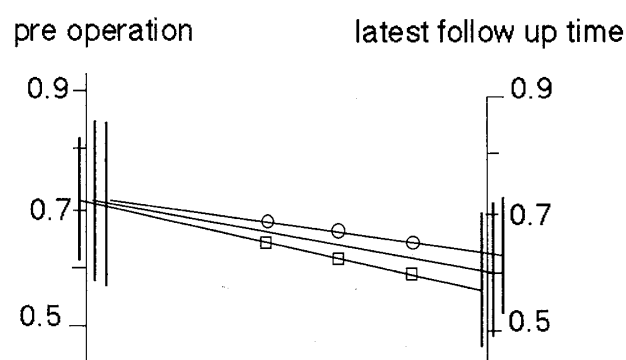


Fig. 6 Lateral index

— : all cases, ○ : pre/early group, □ : advanced/terminal group.

Group B from 25 to 36 pts, and Group C from 19 to 36 pts (Fig. 3). The center-edge angle in all cases improved from -3 degrees to 46 degrees, pre/early group from -1 to 43 degrees, advanced/terminal group from -4 to 48 degrees (Fig. 4). The oblique angle in all cases improved from 35 to 4 degrees, pre/early group from 32 to 2 degrees, advanced/terminal group from 37 to 5 degrees (Fig. 5). The lateral index in all cases improved from 0.69 to 0.60 pts, pre/early group from 0.70 to 0.6 pts and advanced/terminal group from 0.69 to 0.58 pts (Fig. 6).

Based on the pre-operative and final follow-up JOA score and radiographic findings, joint

congruity in pre/early group and advanced/terminal group were divided among good, fair, and poor conditions (Fig. 7). Of the 26 good congruity cases in pre/early group, 23 cases remained in good condition while 3 cases were in fair condition. The 12 cases which were in the fair condition preoperatively, 9 improved to good, 1 remained poor, and 2 fell to poor. One poor case at the preoperative stage had improved to good at follow up time. In the pre/early group, there were no cases which led to total hip arthroplasty (THA) (Table 2). Of the 3 good congruity cases in the advanced/terminal group, all remained in the same position at follow up time. Out of the 34 fair cases 25 improved to good, 6 remained fair,

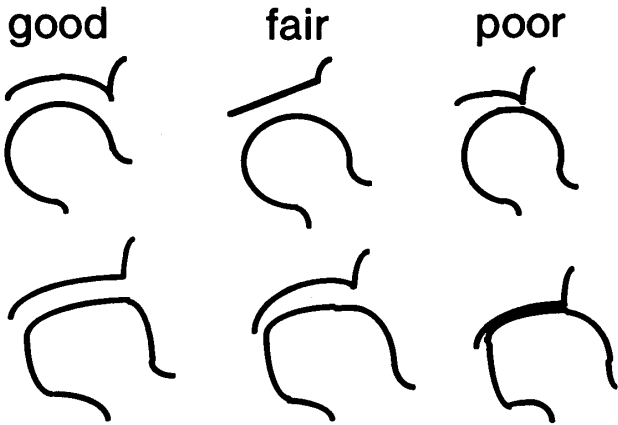


Fig. 7 Joint congruity

Table 2 Joint congruity pre/early group

good	26	→	good	23
		↘	fair	3
fair	12	→	good	9
		↘	fair	1
		↘	poor	2
poor	1	→	good	1

Table 3 Joint congruity: advanced/terminal group

good	3	→	good	3
		↘	good	25
fair	34	→	fair	6
		↘	poor	3 (THA : 1 hip, 39 mos)
poor	58	→	good	44
		↘	fair	12 (THA : 3 hips, 96, 113, 130 mos)
		↘	poor	2 (THA : 1 hip, 37 mos)

THA : total hip arthroplasty.

and 3 fell to poor of which one case had progressed to THA in 39 months postoperatively due to large cyst. Out of the 58 poor cases 44 improved to good, 12 remained fair, of which 3 hips had led to THA in 96, 113, 130 months postoperatively, and 2 fell to poor of which one hip had led to THA 37 months postoperatively (operation conducted at a difficult stage) (Table 3). One case which led to THA in the advanced stage was due to rotational acetabulum necrosis due to a thin osteotomy.

Survival rate in the pre/early group was 100% until the 88th month of follow up time. At final fol-

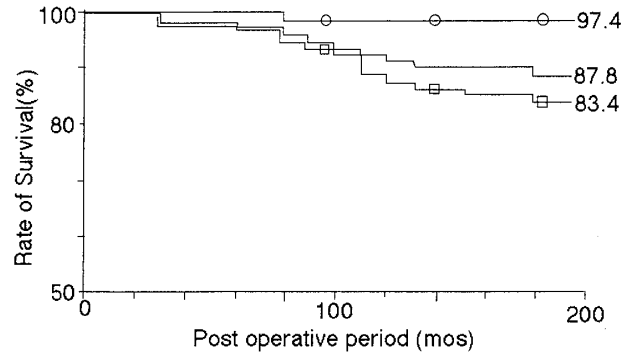


Fig. 8 Survival rate (Kaplan-Meier method)
— : all cases, ○ : pre/early group, □ : advanced/terminal group.

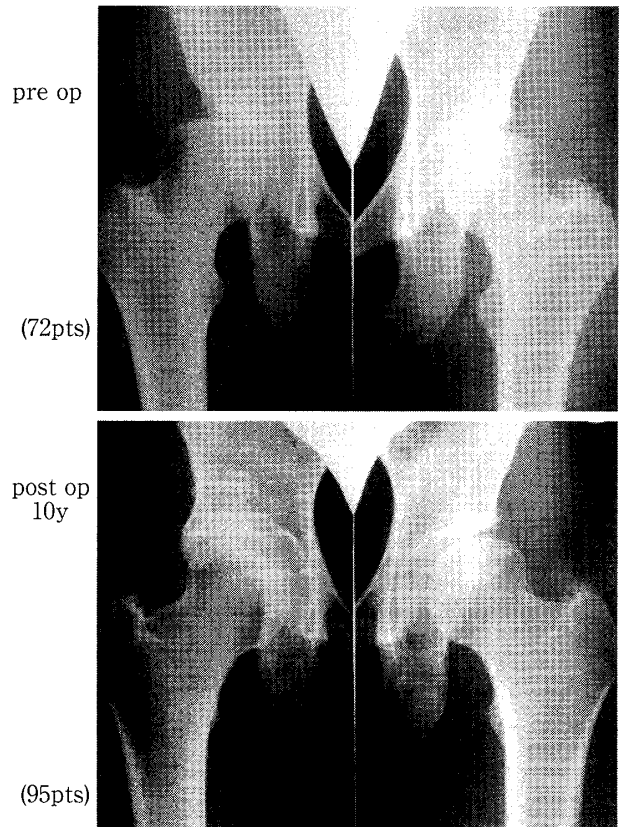


Fig. 9 Case 1 ; female 18 y

low up time, survival rate was 97%. In the advanced group, survival rate decreased after the postoperative period of 33 months, and at final follow up time the rate was 83% (Fig. 8).

Case reports

Case 1 : This female patient had early coxarthrosis at the age of 18 years old. After RAO, at

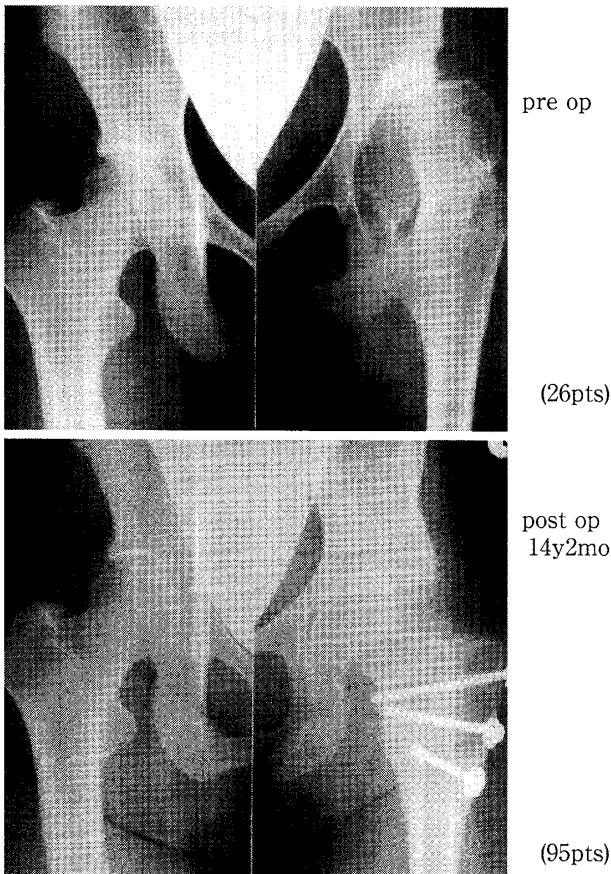


Fig. 10 Case 2 ; female 21 y

10 years follow up time, her JOA score improved from 72 to 95 pts. Good congruity and good results have been obtained throughout the period (Fig. 9).

Case 2 : This female patient had advanced stage coxarthrosis at the age of 21 years old, no joint cartilage in the weight bearing area. Good congruity was obtained 14.2 years after RAO and joint space was maintained and her JOA score was 95 pts. Good long-term congruity can be obtained even in advanced coxarthrosis patients if good congruity is obtained and horizontalization of oblique angle of acetabulum is obtained (Fig. 10).

Case 3 : This female patient with terminal coxarthrosis underwent RAO at the age of 46 years old. The joint space was narrow, however congruity was good, preoperatively. Through remodeling, the JOA score at 5 years follow up time was

95 pts. However, due to narrowing of joint space, THA was performed 11 years after RAO. RAO was conducted to temporize THA (Fig. 11).

Case 4 : This female patient with a large cyst underwent RAO at the age of 38 years old. The existence of the large cyst led to necrosis of rotational acetabulum. THA was performed 37 months after RAO (Fig. 12).

Discussion

RAO was initially done by Tagawa in 1968 with reference to Iino's procedure⁴⁾⁶⁾. From 1980 RAO was further conducted by Tagawa and Hijikata at the Tokyo Women's Medical College to form the basis of the 10 year follow up study⁷⁾⁸⁾. In RAO the acetabulum is rotated as a unit through circumacetabular osteotomy, using a specially designed curved osteotome, which aim to transfer the position of the acetabulum toward that of a normal hip joint as presented by Wagner's spherical acetabular osteotomy⁹⁾ or Eppright's dial osteotomy¹⁰⁾. In RAO, the new position of the acetabulum and femoral head is controlled by cutting the accessory bone of the inferior medial rotational acetabulum, thus shifting the femoral head medially and altering the resultant force. In Chiari's pelvic osteotomy, postoperative remodeling of the femoral head and acetabulum is required as the method does not create a weight bearing area totally covered by cartilage.

RAO on the other hand, shifts the original acetabular surface,

- (1) to adequately cover the femoral head, enlarging the weight bearing area through improvement of joint congruity,
 - (2) to decrease the shearing force through reduction of roof obliquity,
 - (3) to decrease the resultant force by the medial shift of the femoral head,
- which will sustain good congruity postoperatively for a long term.

In this long term follow up study, satisfactory

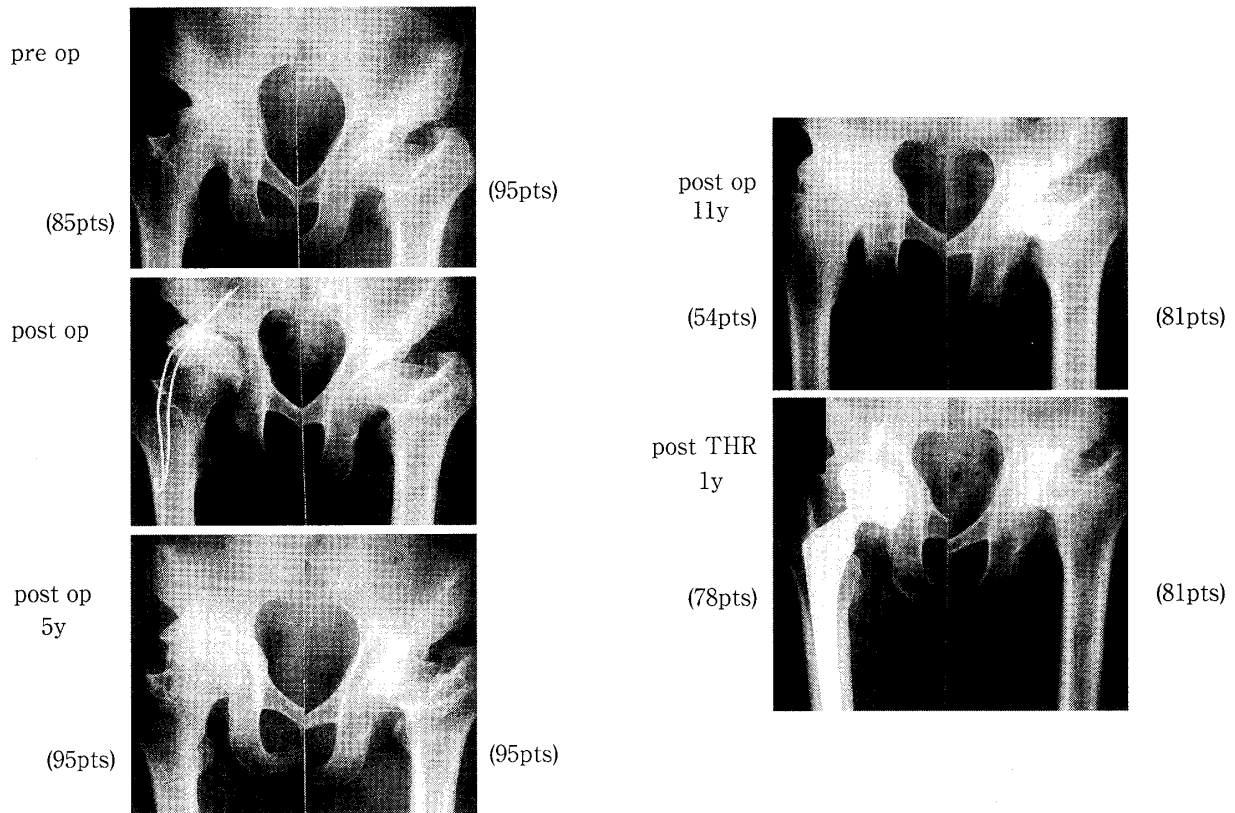


Fig. 11 Case 3 ; female 46 y

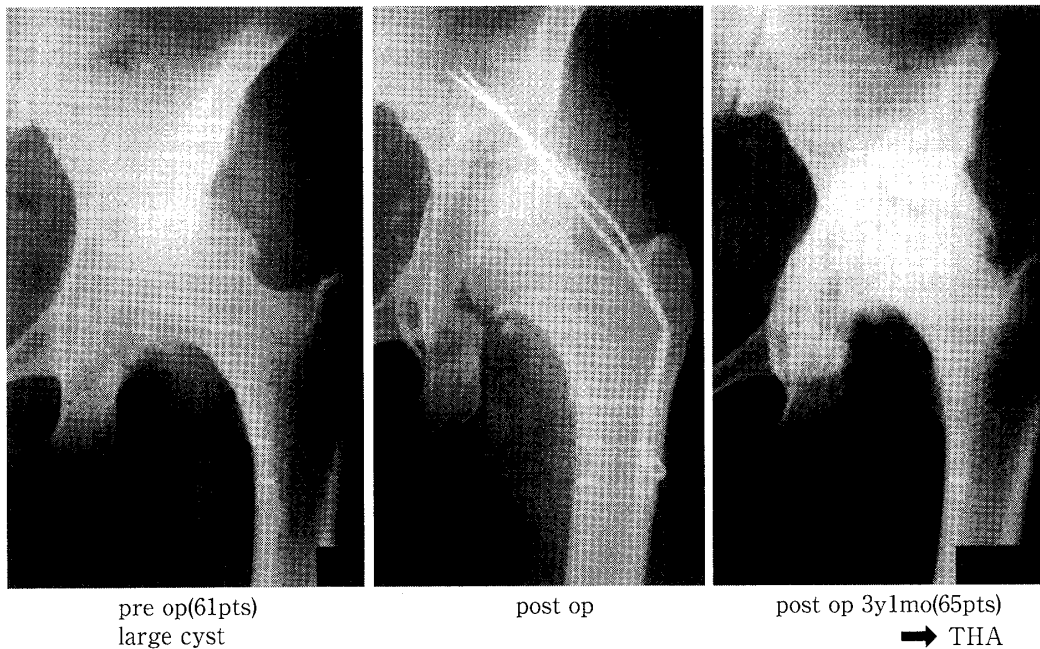


Fig. 12 Case 4 ; female 38 y

results were obtained in pre and early stage coxarthrosis with a survival rate of 97% at final fol-

low up time, indicating that satisfactory results can be obtained through RAO for early and pre

stage coxarthrosis.

For some patients in the terminal stage, long term excellent results are obtained when the procedure is conducted on young patients. In most advanced and terminal cases, good results are obtained for a long term. However, three cases in our study resulted in being only a time saving measure for THA. Excellent results were obtained for 10 years which led to THA, reasons pertaining to disappearance in joint space due to menopause.

To obtain satisfactory results over the long term, radiographs of the patient should be thoroughly analyzed to determine the precise procedure for each patient. Osteotomy should not be thin and careful consideration is necessary in conducting RAO when a large cyst exists, as it have lead to necrosis of rotational acetabulum.

References

- 1) **Hijikata H, Tagawa H**: Nihon de kouan mata wa kuhuu sareta kotsukiri jutsu—kankotsukyukai tenkotsukirijutsu. Seikeigeka MOOK **66** : 143–157, 1993 (in Japanese)
- 2) **Hijikata H, Umehara S, Takeishi H** : The op-

- erative technique of rotational acetabular osteotomy (RAO) for dysplastic hip. Hip Joint **23** : 452–459, 1997
- 3) **Nippon Ko-kansetsu Gakkai ed** : Hip Joint. Tokubetsu bessatsu 3.31.1997
- 4) **Iino S**: Neoacetabuloplasty. Rinsho Seikei-geka (Clin Orthopaed Surg) **3** : 917–925, 1968
- 5) **Tagawa H**: The treatment of coxarthrosis in adolescents and young adults. Hip Joint **1** : 108–114, 1975
- 6) **Tagawa H**: Indication and results of rotational acetabular osteotomy. Kansetsu Geka **3** : 2–10, 1983
- 7) **Hijikata H**: Rotational acetabular osteotomy—indication and operative procedure. Nihon Seikei Geka Gakkai Zashi (J Jpn Orthopaed Assoc) **65** (10) : 104–116, 1991
- 8) **Hijikata H, Umehara S**: Long-term follow-up study (over 10 years) of rotational acetabular osteotomy for the dysplastic hip: re-examination of the technique and indications. Orthopaed Intern Ed **3**(4) : 327–331, 1995
- 9) **Wagner H**: Osteotomies for congenital hip dislocation. In Proceedings of the 4th Open Scientific Meeting of the Hip Society, pp45–66, Mosby, St. Louis (1976)
- 10) **Eppright RH**: Dial osteotomy of the acetabulum in the treatment of dysplasia of hip. J Bone Joint Surg **57 A** : 1172, 1975

田川法による亜脱臼性股関節症に対する寛骨臼回転骨切り術

¹東京女子医科大学 看護学部 整形外科

²東京女子医科大学 医学部 整形外科

ヒジカタ ヒロミ タケイシ ヒロユキ ウメハラ シンエイ
 土方 浩美¹・武石 浩之²・梅原 新英²
 イケダ ヒロシ ミヤ ユウサク
 池田 寛²・宮 有作²

変形性股関節症に対する寛骨臼回転骨切り術（田川法，RAO）は，解剖学的に股関節再建を図り，長期にわたる手術効果の持続を目指すものである．われわれは1980年以來，531例626股のRAOを施行してきたが，今回10年以上観察し得た症例の長期成績を検討し，その結果および適応と限界につき述べる．

対象は112例134股（男性4例4股，女性108例130股），手術時平均年齢は31.9（7～52）歳，経過観察期間は平均142（120～193）カ月である．これらの症例をJOA score, X線映像評価，生存率につき検討した．RAOの適応として最も重要な条件は，CE角，臼蓋傾斜角を正常化することはもとより，術後関節適合性が良好となることであり，術前の機能撮影，関節造影の検討が重要である．また，骨壊死を生じさせないため薄い骨切りは禁忌である．厳密な適応と正確な手技で行えば前，初期例は長期にわたり良好な結果が持続できる．進行期，末期においても多くの症例は良好な結果を得ることができ，症例によってはTHAの時期を遅らせる意義もあると考える．