



## Osteotomies for acetabular dysplasia in adults and adolescents

### *Erişkin ve ergenlik dönemlerinde asetabuler displazi için yapılan osteotomiler*

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*Kalça displazisi tedavisinde amaç yük taşıma pozisyonunda femur başı ile asetabulum uyumunu normalleştirme, geç dönemde de ağrısız, yerinde ve fonksiyonel bir kalça elde etmektir. Kalça displazisinde anormallik nede ni asetabulumda (sıglık ya da yönelim bozukluğu) ve femur başında (şekil bozukluğu, subluksasyon, varus veya valgus) olabilir. Bu nedenle, osteotomi öncesi yapılacak değerlendirme, planlama ve hasta seçimi çok önemlidir. Asetabuler displazi kalça osteoartritinde en önemli etken dir. Asetabuler osteotomi sırasında aşırı düzeltme önemli bir sorundur. Bu makalede asetabulumla yönelik çeşitli yöntemleri ele alarak kendi uygulamamızdan bahsetmeyi amaçladık.*

*The aims of treatment for acetabular dysplasia are the normalization of the relationship between the femoral head and acetabulum on weight bearing position, and to provide a painless, stable, and functional hip in the long-term. The reason of this abnormal relationship may arise either from the acetabulum (deficiency, maldirection) or the femoral head (aspheric, subluxation, valgus, varus). For this reason, preoperative planning, assessment, and patient selection are very important. Acetabular dysplasia is the main reason for hip osteoarthritis. Overcorrection is an important complication of acetabular osteotomies. This review summarizes different kinds of acetabular osteotomies with relevant presentation of our technique.*

Treatment of acetabular dysplasia in young patients with mechanical inharmonious is a procedure which gains time. For this reason enflamatuar diseases must be excluded.

Mechanical inharmonious is an increase of force applied to the unit surface as a result of reduction of a contact surface between the femoral head and the acetabulum. is the reducing of femur head and the pressure given to the contact surface. This shows itself as a sclerosis, labral tear at acetabulum and cyst formation with femoral head shape distortion at a long period. If acetabular dysplasia is not treated osteoarthritis will be the final result. Murphy et al said that if the depth/width ratio of acetabulum is less than %38 and CE angle is less than 15°, osteoar-

trit would develop in these patients. But for mild displazi if there's no subluxation, in order to give treatment decision, the patients complaints should be waited to occur. Many attempt was defined for the correction of of acetabular insufficiency. If there's any pathology on femur, it must be corrected also. The aim is to obtain a spherical adapted hip. The ideal is to keep the femur head in its original and having an acetabulum to fit it. But this is not possible every time. Sometimes the femoral head may be big and acetabulum may be too shallow to cover it. If subluxation continous on the abduction graphics that or no fit, other methods should be considered. The attempts for acetabulum can be discussed in two groups. The ones that're made without concantric reduction or spheric adaptation. (Chiari,Shelf

Staheli) The ones that're made as concentric reduction;. can be grouped as; Salter osteotomy, triple osteotomy, Ganz (Bernese), spheric osteotomies (Wagner, Eppright, Ninomia).

### Evaluation before surgery

Choosing patient and evaluation is very important. Acetabular osteotomy can be made up to 55 years old patients after the triple cartilage is closed.

In inflammatory diseases, these kinds of attempt cannot be performed. The aim is to treat the damaged mechanics. Unless correct choosing of the patient and patients are adequately informed, important problems can be faced during these attempts which already have high risk amounts. This evaluation is made at two main topics.

#### Clinic

1. *Movement space of joint : If possible joint movements should be free*

2. *Pain, Effort Capacity, Limping : pain in adolescent dysplasia before the surgery is important. This pain may graze to the knee so hip should be inspected. Lomber hernia or torn meniscus diagnosis can be made wrongly.*

3. *Shortness, Atrophy : If shortness is not supported for a long time, it can cause dysplasia on the opposite hip.*

4. *Stability : Hip joint should be well evaluated during the physical examination. Dislocation can occur on an unstable dysplastic hip after osteotomy.*

5. *Noromuscular examination : Must be done to all patients with care.*

#### Radiology

The main part of radiologic evaluation is direct graphics. Taking standard graphics and the quality of the first one is important. If its possible, the suitable hip is the hip that's femur head is round (spheric). Also the head acetabular harmony must be expected in the abduction graphics.

1. *Pelvis anterior posterior (AP) graphy : Must be taken when the patient is standing on foot.*

2. *30° Abduction internal rotation and flexion graphies : Is important at operational planning for osteotomy technics and for choosing osteotomy place.*

3. *False profile graphy shows the insufficiency of anterior wall. Image is taken as; Sick hip close to cassette, feet is parallel to cassette and for the other hip, 20-25° in posterior.*

4. *If its needed, by computer based tomography (BT), spiral tomography, imaging with magnetic resonance (MRG) and dynamic evaluation under scope, the most harmonious point between femur head and acetabulum is determined.*

### Radiologic calculations

This helps to evaluate and compare the same types of works and the results of the attempts. Its better to learn out if the graphs were taken in standards or not before the calculation. The calculation which is made by taking a non-standard graphy will make us to get a wrong conclusion.

1. Acetabular angle

2. Anterior and lateral CE angle (24-37 is the normal angle)

3. Acetabulum depth / width ratio

4. Subluxation

a) *Lateral* : Head-ilio-ischial line distance

b) *Vertical* : The distance of Acetabulum inferior – femur head below

### The reason of surgical

1. Normalization the inharmoniousness of femur head acetabulum.

2. Preventing the late degenerative arthritis development.

3. Obtaining a functional and fitting hip

4. Preparing a suitable prosthesis place for a future period.

### Chiari osteotomy

Can be applied if there's any hip subluxation at birth with incongruity between head and acetabulum. The femoral head is big and acetabulum is too small to cover. Should be chosen if subluxation and incongruity is seen on abduction graphics. It is a time gaining attempt. It can be applied from 4 years up to older ages. Iliac osteotomy is done just above the capsular attachment. Distal part is %50 medialized so this makes a bone support over femoral head. The pressure on the head, slid to medial. The lever

arm of hip abductors increases. The real meaning of acetabular reorientation can't be provided. Metaplasia on capsule occurs. If it is made with suitable indication, supplies more time for prosthesis to be done.

### Shelf operation

Is applied for hips that do not have spherical harmony. Acetabular reorientation cannot be obtained. It had working space in Perthes disease and paralitic subluxations. It is also known as the first acetabular attempt. Many kinds of Shelf operations were described but we'll discuss about Staheli technique. The main point of the technique is to support acetabular superior and lateral part with graft. Acetabulum is tried to widened by placing a graft above the capsule under lateral head of the rectus femoris. For unstable hips, plaster fixing is needed. The study that is made at 1981 with a limited number of patients with cerebral palsy was first published at 1984. The osteotomy can be compared with Chiari osteotomy. Indications are the similar. Shelf application can be added after Chiari osteotomies. Its a less morbid approach but can be applied bilaterally.

### Operations at concentric reduction

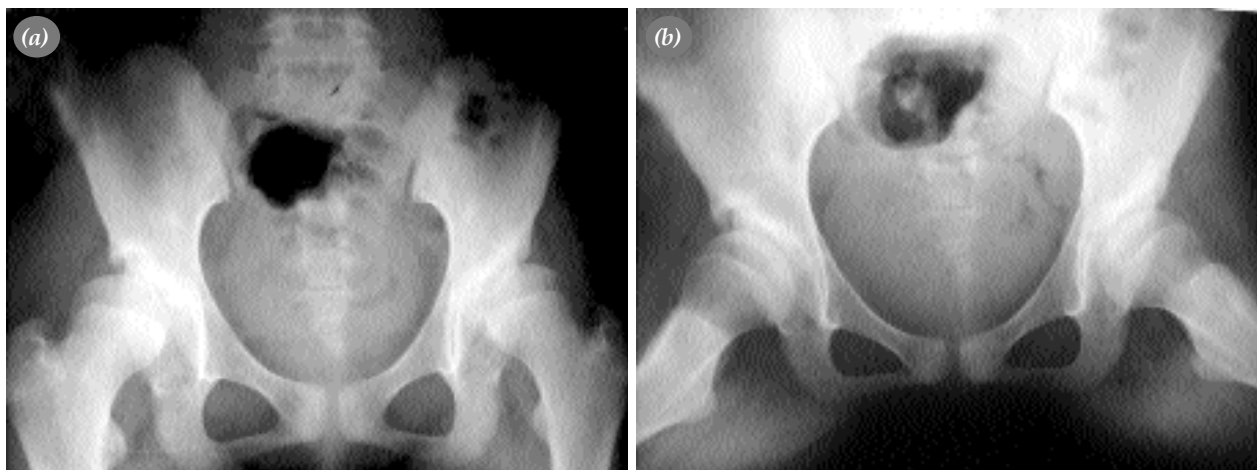
From these attempts, the correction effect of Salter osteotomies for adult dysplasias are effective for only mild dysplasias. It can be applied to adults if CE angle is more than  $10^\circ$  or concentric reduction of hip with  $20^\circ$  abduction. Because of limited correction effect, more correction should not be applied. Over correction with salter osteotomies

results in , retroversion in acetabulum and lateralization in joints.

At 1972 Stell modified the osteotomy by cutting the ischion arm using a separate incision. The supra-acetabular osteotomy that is made after pubic arm osteotomies using an iliofemoral approach is like a Salter osteotomy. Triple osteotomy can be applied when the triple cartilage is open. In this osteotomy, because the bone cuts are away from joint earned correction occurs as a result of major bone separations.

Especially because of strong sakropelvic ligament, the correction is limited in order to prevent the insufficiency of osteotomies which are away from joints. Tonnis defined an osteotomy near to the joint by using triple incisions. By this way, he reduced the negative effects of correction of sakropelvic ligaments. During this technique, ischion arm osteotomy is made when the patient lies prone. For the second osteotomy, patient is turned supine. But in this method, at the beginning, lack of posterior support is covered by plaster. Afterwards, more internal examination was made in order not to use plaster .

Special osteotomies are needed to make spheric acetabular osteotomies that are defined by Wagner, Epright Ninomiya . After these osteotomies which are close to acetabulum, risk of avascular necrosis development and inner joint fracture is high. For the last years, Ninomiya had used the technique close similar to the triple osteotomy.



**Figure 1.** Bilateral developmental hip dysplasia of a 13 years old girl. Spherical congruence present at 30 degree abduction



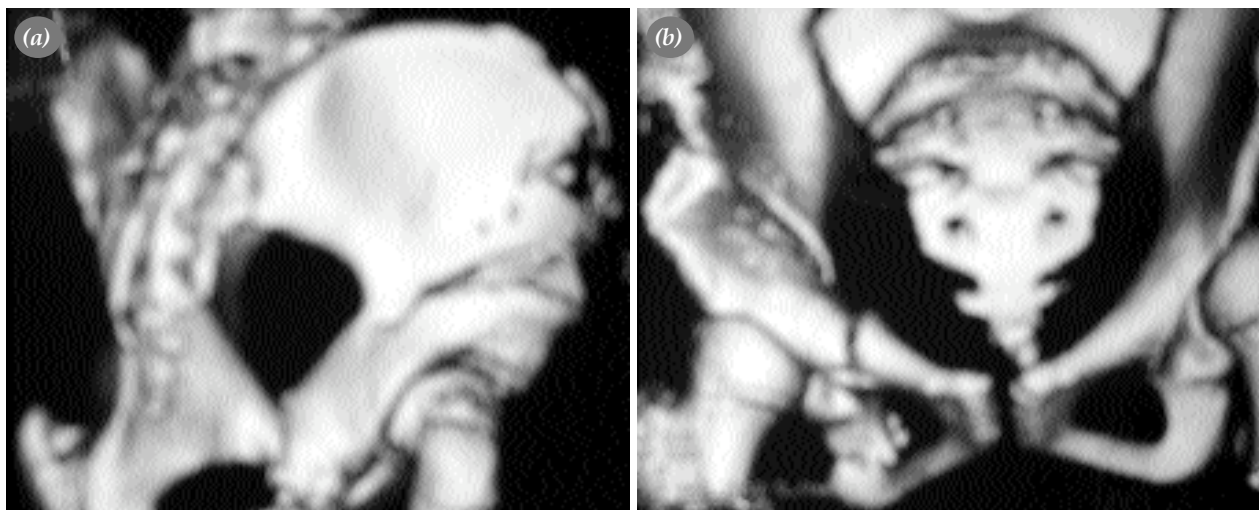
**Figure 2.** Same patient's post operative 8 month of right and 2 month of left hip graphies.

The periacetabular osteotomy technique which is popularized by Ganz, is used mostly used one at the moment. It is entered by Smith Peterson iliofemoral insicion. All the osteotomies are made by one cut when the patience lies supine. Iskion arm is cut as incomple by entering between capsule and m.iliopsoas without seeing and under skopy control. For this high anatomy knowledge and skill is needed. There must be special osteotomes. Posterior colon is strong, anatomicaly. It is technically hard, the unwanted situation risk is high, learning curve is low. At the same time its possible to open the capsule for the fixation of inner joint patalogy. In this osteotomy over korrection is a main problem. Because the osteotomy surfaces are not spheric, for stability after fixation, three screws must be used.

### Incomplete triple ostoetomy technique

1. An incision is made parallel to the gluteal fold, with the patient's lying on his one side. Sciatic nerve isn't revealed. Ischion arm is cut near acetabulum, seeing just over the attachment of the biceps femoris. A 7-8mm wedge is removed on lateral with the aim to facilitate the rotation. At that time the hip is on extention, and the knee is on the flexion. After the tissues are closed, patient is changed to supine position by extracting the rolls under hip

2. It's entered with Smith Pertersen or ilioinguinal incision. M. sartorius isn't divided. The fibers of M. tensor fascia lata and front fibers of m. gluteus medius are removed with a sharp dissection until gluteal tubercule. M rectus femoris isn't divided. Bicortical triangle greft under crista is removed



**Figure 3.** Detailed view of right hip osteotomy with tri dimensional spiral tomography.

with a saw, medial structures are removed as saving with gauze. In this way, cosmetic deformation doesn't occur at the iliac crista. And pubis limb osteotomy is performed by ilio-inguinal incision through which iliac osteotomy is performed. This osteotomy is done through the medial side of m. psoas for fat patients; and done by its lateral as releasing psoas tendon in thin patients. Acetabular osteotomy is completed with a curved osteotomy between SIAS and SIAI, using a cutting motor at the beginning, continued with a curved osteotome without entering a sciatic incisure. Posterior colon is left undamaged. After all osteotomies have been completed, making acetabulum turned without being used shanz screw is achieved with flexion abduction and external rotation movements to the leg (figure 4 position).

Iliac graft is placed in the cavity formed after correction. Even though strength occurs as much as no needs to Kirschner wire, fixation is made with a Kirschner wire. Its end is bend under skin to prevent it to remove easily and to slide. Drain isn't been used. Mechanic methods are applied to prevent deep ven trombose (DVT). Early motion is given to the patient. Beginning from the first day of postop, the patient is walked with a pair of crutches, without giving him any loads.

With incomplete iliac osteotomy, more stabil and controlled correction of the acetabulum is achieved in its original place. When much correction necessity happens, breaks can exist in this osteotomy, but this break doesn't make any problem because of the support point of acetabulum not being lost.

### **The advantages of Incomplete triple osteotomy**

1. It makes correction of acetabulum possible in its original place.
2. It's more stabil osteotomy
3. Less internal fixation material is needed
4. Fixation of plaster cast isn't required.
5. Recovery time of posterior colon is less when it remained undamaged anatomically
6. Neurovascular damage risk is low because of that it doesn't enter to the sciatic incisure.
7. Scopy isn't required.
8. Blood transfusion requirement is low.

### **Equipment and method**

Between 1995-2006, In SB İstanbul Göztepe Training and research Hospital second Orthopedics Clinic, incomplete triple osteotomy has been applied to 54 hips of 47 patients (6 men, 41 women; average age 23.5; among 11-44). There were 7 bilateral, 22 right, 32 left hip dysplasia. Femoral correction was applied to two patients at the same treatment. In the beginning, closed reduction plus plaster cast had been applied to ten patients, acetabular and femoral side interference had been applied to five patients. Operation was applied to three of these patients because of opposite hip symptomatic dysplasia. Because of shortness related to poliomyelitis, lengthening to the opposite extremity was applied for one patient. Average following time was 4.5 years (6-96 months). Average correction on acetabular angle was 10.2 (2-23) degrees, average correction on CE angle was 20 (0-35) degrees. As a complication, intraarticular fracture was occurred in one patient, lateral femoral cutaneous nerve anesthesia was occurred in 23 patients, superficial skin necrosis was occurred in 2 patients. Deep inflammation was occurred in one case, and DVT was occurred in one case. Redislocation, myositis ossification, avascular necrosis in acetabulum and nonunion wasn't occurred. 70 degrees hip flexion developed in a patient because of intraarticular fracture and nonunion which was occurred in ischion limb in another patient didn't cause any problem. All important complications except deep ven trombose were seen in the first 24 patients' group. These complications weren't seen in the second 23 patients' group.

### **Discussion and conclusion**

Today Ganz technique has taken place as a popular method in all the world. But its learning curve is low; and the complication rate at the beginning is high. Not seeing any unwanted important case except DVT according to the first study, on the extra 23 patients whom we operated after publication of the method which we applied, support this.

Not occurring any sciatic nerve injury in this method is because of that cutting ischion limb seeing and with a different incision; and because of that iliac osteotomy not heading towards sciatic incisure. The another difference of the iliac osteotomy in our

method from Steel and Tonnis technique is that acetabular osteotomy is incomplete like Pemberton osteotomy. The difference of these methods that is defined in adults. Posterior column staying undamaged anatomically has made stability increased. So the necessity of fixation with plaster cast or too many internal fixation tools are decreased. Even in two patients, internal fixation hasn't been performed because of this stability. Healing in this way has been faster and without problems. Another advantage is controlled correction. One of the important problems which over correction causes is the possibility of seeing anterior impingement associated with the hip flexion restriction. This is an important problem in Ganz technique nowadays. We didn't make any corrective action labral pathology opening the joint during operation. We think of that getting back to normal on the load distribution between acetabulum and femur head is more important. Radiological control during operation hasn't been performed in our cases during operation. There is no need to this for experienced surgeons because of that all osteotomies are performed seeing directly. But at the beginning, when performing this type of osteotomy, if it's possible, radiological control would decrease the error. In some cases, retroversion developed in acetabulum but this hasn't made any important problem. But this is a controllable situation. Single Kirschner wire can be extracted from under skin with a limited anesthetic. As a conclusion, the technique of incomplete triple osteotomy is easy to learn and to be performed in the conditions with basic operating room equipments without scopy.

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