

Mini Review: Comparison of the results of treatment of developmental dysplasia of the hip with two approaches of femoral osteotomy and salter osteotomy

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ABSTRACT

Introduction: Developmental dysplasia of the hip joint (Developmental dysplasia of the hip or DDH) includes a wide range of disorders caused by the abnormal development of the hip, which can manifest from infancy or infancy. In some studies, the chance of hip dislocation has been reported to be higher in cases where osteotomy is not performed.

Methodology: The present study investigated the issue by reviewing more than 70 articles with keywords including "femoral osteotomy", "hip", "Medical Staff", "Health Care" and "salter osteotomy".

Results: Hip joint problems are among the most interesting orthopedic issues. Mechanical injuries and its diseases are important from a practical and economic point of view due to their prolongation and causing severe disabilities, the joint is academically significant in several ways. One of the joint diseases is hip dislocation before or during childbirth or shortly after. This disease is one of the most common congenital anomalies in the western race. So far, it has been determined that factors such as genetic and environmental factors play a role in its occurrence.

Conclusion: It seems that the use of CEA is more appropriate to evaluate the presence of hip dysplasia. Despite the good results of Salter's osteotomy in the treatment of patients with hip dislocation, there are some shortcomings in this method, including lengthening of the limb and the effect of pressure on the hip joint. Many variations of this method have been created by "Kalamchi" among others. Another modified method of this osteotomy has been performed by the author (F-M) in recent years.

Introduction

The full name of this disease is Developmental Dysplasia of the Hip, abbreviated as DDH. Congenital hip dislocation is one of the diseases of the body's movement system [1-3]. This disease is actually a congenital dislocation of the hip joint, but because the hip

joint is the most important hip joint, it is called a hip dislocation [4]. In these people, the acetabulum cavity is not formed properly during the fetal period and does not have enough shape or depth and cannot hold and preserve the head of the femur. The joint between the femur and the pelvis is called the hip joint. This joint consists of the placement of

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the head of the femur inside the cavity of the acetabulum, which is a part of the pelvis [5-7]. In some types of this disease, the head of the femur is completely outside the acetabular cavity, which is called complete congenital hip dislocation. In some others, the head of the femur is in the acetabulum cavity, but it is unstable and easily moves out and into it. The cause of this condition is the abnormal shape of the acetabular cavity, which is called dysplasia [8-10]. Therefore, they say, the patient has acetabular dysplasia or hip dysplasia. In dysplasia, the acetabular socket is small and cannot keep the head of the femur inside well, and as a result, this head is slightly displaced and causes partial dislocation in the hip joint, each of which alone is not enough for dislocation [11-13].

- ❖ The genetic laxity of the joint, which caused the instability of the hip joint, becomes dislocated in special situations [14-16].
- ❖ Hormonal laxity of the joint, which in the female sex, the hormone Relaxin, which is a ligament relaxant, is secreted by the uterus of the fetus in response to the hormones that activate the mother's pituitary gland, which has reached the blood of the fetus and causes joint instability, which itself justifies the higher prevalence of joint dislocation in girls [17].
- ❖ Genetic hip dysplasia in cases of developmental defects of the acetabulum and sphincter, which is always bilateral and probably equally prevalent in girls and boys, and is the cause of dislocation before birth, and if dislocation does not occur, it manifests as partial dislocation and osteoarthritis in adulthood [18-20].

The importance of these factors is not well understood, and current evidence suggests that there are two distinct types of hip dislocation [21-23].

1- Typical type: This dislocation probably occurs in cases where the ligaments are closed due to genetic or hormonal causes, and most of them are one-sided and easily repairable, and are more common in girls [24-26].

2- Teratogenic type: This dislocation is caused by dysplasia of the acetabulum and seraphus, which is always bilateral and with equal prevalence, and its treatment is often difficult (Figure 1) [27-29].

Causes of congenital hip dislocation in children

The cause of congenital hip dislocation is not well known. Some researchers believe that in some embryos, the acetabulum cavity is not formed properly and does not have enough depth to hold the head of the femur inside. Some others are of the opinion that hip capsule laxity is the cause of this disease [30-32]. Congenital hip dislocation is more common in some families. It seems that the prevalence of this disease is higher in societies that swaddle babies. Also, in areas where the mother hangs the baby on her back or in front of her stomach, this disease is less common. This difference is probably due to the proximity and distance of the baby's thighs in two different ways of tying and carrying him. Swaddling increases the likelihood of post-dislocation problems. Opening the baby's legs in front of the mother reduces the possibility of complications of congenital hip dislocation [33-35].

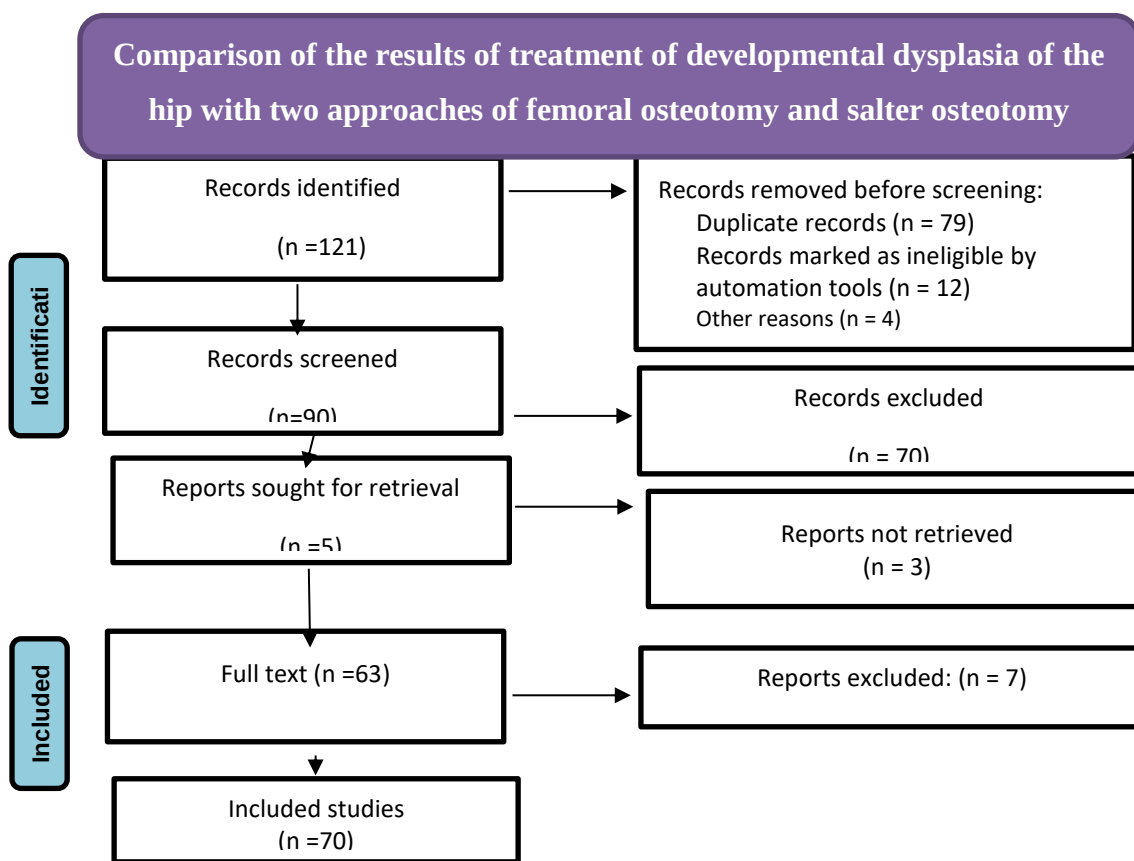


Figure 1. Infection in Patients from 2001 to 2024 Checklist

Congenital hip dislocation is more common in which children?

Congenital hip dislocation mostly affects the left hip joint. This disease is more common in girls, so that the prevalence of dislocation in girls is 9 times that of boys. Congenital hip dislocation can be unilateral or bilateral. It means that it is only on one side of the pelvis or on both the right and left sides of the pelvis [36-38]. This disease is unilateral in 60% of cases, and when it is seen only on one side of the pelvis, it is on the left side in 60% of cases. Congenital dislocation of the pelvis is more common in babies who are placed in the opposite position in the mother's womb. This disease is less common in children with low birth weight [39-41]. It is also less common in multiple births. An interesting point is that congenital hip dislocation is less common in

children born in winter, regardless of whether the mother's place of residence is in tropical or subtropical regions. Congenital hip dislocation is more common in the following cases:

- ✓ The first children of the family.
- ✓ White race [42].
- ✓ The presence of other congenital abnormalities in the child, such as torticollis or clubfoot.

Pathology of congenital hip dislocation

When the baby's femur head stays outside the acetabulum cavity for a while, both the growth of the head and the acetabulum cavity are disturbed. The acetabular cavity remains small and does not get enough depth [40]. Also, the head of the femur remains small and does not grow well. The neck of the femur remains thin and the trunk of the femur becomes thin and

small in diameter. These changes show that the growth of the bones takes its normal course only when they are correctly placed together. Being together is what ensures proper growth and development. In this disease, other changes gradually occur in the child's body. The capsule of the hip joint of these children becomes thick and the muscles around the hip joint, especially the adductor muscles (closer to the thigh) and the iliopsoas muscle, are shortened [29].

The more time passes after the birth of the baby and the treatment is delayed, these changes increase and make the treatment of the baby more difficult. On the contrary, the congenital hip dislocation of the spherical head of the femur is not inside the acetabular cavity, if the congenital hip dislocation is diagnosed early and the femoral head is placed inside the acetabulum cavity, the growth of the bones on both sides of the joint will take its normal course. and in many cases they make up for their backwardness [. However, if the head of the femur stays outside the acetabulum for a while, with the passage of time and the age of the child, the retardation of joint growth and its deformation will increase. This shows that in congenital dislocation of the hip or pelvis, time is the main point, and the diagnosis of this disease and its treatment should be started as soon as possible.

Symptoms of congenital dislocation of the hip vary depending on the age of the child. These symptoms are usually defined in two age ranges before and after three months.

What is the cause of congenital hip dislocation in adults?

As it is clear from the name of this disease, its cause is congenital and the joint is not formed properly during the fetal period and when the child is in the mother's womb. However, this is not conceivable for some patients. Some patients really believe that they fell from

someone's hand during birth and their hip was dislocated. Some other patients ask, if the dislocation in my pelvis is congenital, then why have I not had any problems until now, when I am, for example, forty years old. If my disease was congenital, its symptoms should have been present since birth. This is not the case. Congenital dislocation of the pelvis, even if it is complete, is usually not identified until the child begins to walk, when others notice that he is walking badly. If it is a partial dislocation and not a complete dislocation, it may not have any symptoms until old age, when the joint wears down gradually due to this disease, and this wear and tear manifests itself in the form of hip pain.

What are the symptoms of congenital hip dislocation?

The symptoms of this disease vary depending on the age of the patient. A baby with this disease has completely different symptoms from a two-year-old child with dislocation, and the symptoms of the patient in adults are completely different.

Symptoms of congenital hip dislocation in infants before three months

Congenital hip dislocation before three months of age has three important symptoms. Seeing these symptoms, every parent should suspect the existence of a disease in their child and immediately take him to the nearest pediatrician or orthopedic specialist.

Sign I: skin folds are naturally present in the groin area of all babies. In this disease, these folds may be non-parallel on both sides and the groin folds are more on the dislocated side.

Sign II: In this disease, the baby's hip joints are limited in movement, and especially the baby's two thighs do not open well, and the mother may not be able to open the baby's thighs well to change the diaper.

Sign III: The third sign of congenital dislocation of the pelvis in children is the Ortolani and Barlow's test.

These tests are performed by a doctor. The doctor lays the baby on his back on the bed and by holding the baby's thigh and leg, he fixes the hip joint with hand pressure, and when the pressure is removed, the joint opens again.

Symptoms of congenital hip dislocation in children after three months

At the age after three months, these symptoms change a little. The most important of these symptoms in the age after three months are:

1-Limited movement of the hip joint: At this age, the abduction movement of the thigh becomes more limited, and the mother or the doctor cannot easily move the child's thighs apart. The Ertolani and Barlow test can no longer be performed during this period, that is, the doctor can no longer place the joint with hand pressure.

2- Changing the shape of the pelvis: the bony prominence of the greater trochanter on the outside of the child's pelvis is more outward and prominent than usual.

3- The shortness of the body: the thigh on the side of the thigh looks shorter. When the child is laid on his back and his knees are bent, so that the soles of the feet remain on the ground, the knee on the dislocated side is lower than the knee on the healthy side, which is called the Galeazzi test.

4- Telescopic test: In this examination method, the doctor lays the child on his back on the bed and then holds the hip of the healthy side with one hand and holds the leg or thigh of the affected side with the other hand and moves along the thigh to the side. pulls down and pushes up. In the telescopic test, the doctor moves the child's thigh up and down. In the dislocation created in the hip joint because the head of the femur is not inside the acetabular

cavity, this maneuver makes the thigh move up and down easily.

5- Lameness: A child with congenital hip dislocation is slow to walk and limps while walking. When it is unilateral, when the child lifts the healthy leg off the ground and puts the support on the sick side, he bends his whole body to that side to walk in this way, Trendelenburg gait. they say When the dislocation is bilateral, the child puts each foot on the ground and bends the trunk to the same side, which is called waddling gait.

6- Increased lumbar lordosis: In these children, especially in the bilateral type, the lumbar arch is more than normal when standing.

7- Trendelenburg test: this examination is performed by a doctor. The doctor asks the patient to stand upright and face the wall and lean both hands on it to maintain balance. Then he asks him to lift the healthy leg from the ground and stand on the sick leg. In a sick person, due to the weakness of the thigh abductor muscles, the pelvis cannot maintain its balance, and the healthy side of the pelvis tilts down, and the child tilts its trunk towards the sick side in order to maintain its balance.

What are the symptoms of congenital hip dislocation in adults?

Symptoms of congenital hip dislocation in adults are usually bad walking or pain. If the dislocation is complete, the dominant symptom of the disease is usually lameness. This lameness is caused by the shortness of the dislocated leg and the weakness of the hip muscles, and it is more common in unilateral dislocations, although it is seen in a milder form in bilateral dislocations. People with this type of complete dislocation of the pelvis in their thirties or forties gradually experience pain in the pelvic area. If the dislocation is incomplete and in the form of a partial dislocation, usually the predominant symptom of the disease is

pain around the pelvis. This is a pain that usually occurs in the groin and at the age of thirty years or later. As the pain increases, walking is usually added to the previous symptom. Therefore, in a complete dislocation of the hip joint, the patient first limps, and after a few years, pain is added to it, and in a partial dislocation of the hip joint, the first symptom of the patient is usually pain, and after that, poor walking adds to the patient's problems.

Diagnosis of congenital hip dislocation

The diagnosis method is different depending on the age of the patient. At the age of six months, ultrasound is usually used for diagnosis. After that, the best method is imaging to diagnose a plain radiograph of the pelvis. The above radiographs show congenital hip dislocation on the left side. The drawn lines help to identify the dislocation.

Treatment of congenital hip dislocation in children

Treatment of congenital hip dislocation in children should be started as soon as possible after delivery. The earlier the treatment starts, the results can be achieved using simpler methods, the duration of the treatment is shorter and the result of the treatment will be better. It is not permissible to delay even a few weeks in the treatment of this disease. The more the patient's treatment is delayed and at an older age, the more unfavorable the result of the treatment will be and the more difficult the treatment will be. The type of treatment depends on the age at which the disease is diagnosed. The following method is usually used to treat these patients.

1- Treatment of congenital hip dislocation in babies: The treatment of congenital hip dislocation in babies is done by tying special plastic bands like a belt around the body, which is called Pavlik harness. The goal is to open the child's thighs with this device and keep the hip

joint in an open position for a period of about one to two months. In this situation, the head of the femur stays in the acetabular cavity, and keeping the femoral head inside the acetabular cavity helps its better growth. After some time, the bone head becomes stable inside the acetabular cavity and the Pavlik harness can be removed. This treatment can be done in children up to the age of six months. Of course, the younger the child is and the treatment starts at a younger age, the better the treatment result. Usually, when the child starts to walk on all fours (4-6 months old), this method of treatment is no longer effective and the next stage of treatment should be done.

2- Treatment of congenital hip dislocation at the age of 6-18 months: If the diagnosis of congenital hip dislocation is given at the age of six months to one and a half years, the treatment is more difficult. It is possible that the previously harnessed Pavlik can no longer help the patient. In children who come at this age, the doctor tries to lower the hip joint in the operating room under general anesthesia and keep the lower limbs and trunk in a special position for a while in a plaster mold. The plaster used for this purpose is called Spica cast.

Use of spica cast to keep the hip joint in place after closed or open insertion sometimes at the age of less than six months, the treatment with the belt mentioned above is not effective and the doctor uses the insertion method and Use plastering. In this possible treatment method, the treating doctor first puts the child's foot under tension with a weight for some time. Then, it may be necessary to cut the tightened tendons of the adductor muscles with a small operation in the groin area, and in the next step, the child's hip joint is lowered in the operating room under general anesthesia and plastered. Of course, it

is possible that the treating doctor did not use stretching or cutting the groin tendons and directly performed hip replacement and plastering. If the reduction of the hip joint in the pelvis is not successful in the operating room, the child's hip joint must be operated. In this operation, the pelvic orthopedic surgeon cuts all the tissues from the skin to the hip joint and then places the head of the femur inside the acetabular cavity. Then the tissues around the joint, especially the capsule of the hip joint, are somehow repaired, so that the joint remains in the same state and does not break again. After the surgery, the patient's lower limbs and torso are plastered [10]. Remember that the sooner the treatment of congenital dislocation of the hip starts, the more likely it is to be able to reduce the joint closed and without surgery, and the later the treatment starts, it is possible that closed reduction is no longer possible. Surgery may be required for implantation. Elite, sometimes it is possible that the hip joint of a child under six months does not fit closed and the child needs surgery, and the opposite is also possible, that is, it is possible that the hip joint of a one-and-a-half-year-old child can be reduced closed. and without surgery.

3- Treatment of congenital pelvic dislocation at the age of 1.5 years and above: At the age of one and a half years, in most cases, surgery is used to treat the dislocation. At this age, surgery is performed to open the dislocated joint. Because it is usually not possible to close the dislocation at this age.

Osteotomy surgery of the hip bone to change the angles of the acetabulum and help reduce the hip joint

At the age of one and a half years old, the shape of the pelvic bones usually changes, and apart from the reduction of the dislocation, there is often a need for surgery on the bone. In this type of congenital hip dislocation surgery, the

doctor cuts the pelvic bones in certain areas and places them in a suitable position, so that they fuse in the new position and the changed shape of the bones around the hip joint becomes more natural. This type of bone surgery is called Salter osteotomy. If the diagnosis and treatment of congenital hip dislocation is done after two years of age, the probability that the acetabular cavity will regain its normal shape is reduced. At this age, other surgeries may be used to reconstruct the acetabular cavity. Delayed treatment of congenital dislocation of the hip greatly increases the possibility of wear and tear in the hip joint area at an older age [11].

Treatment of congenital hip dislocation in adults

Many people in adulthood, i.e. after puberty, refer for the treatment of congenital hip dislocation. In these cases, although one cannot expect great results from the treatment, but the patient can be helped to a great extent, to live a more comfortable life. These patients usually go to the doctor for three reasons. Pain, lameness and limitation of hip joint movement Patients can be generally divided into three categories.

- 1- Partial dislocation in the hip joint without abrasion.
- 2- Partial dislocation in the hip joint with abrasion [17].
- 3- In complete dislocation of the hip joint.

1- Treatment of partial dislocation of the hip joint without friction in adults: in some patients, the congenital dislocation of the hip is not complete. This is actually a type of partial dislocation caused by the incomplete formation of the acetabular cavity. In these patients, the changes seen in the pelvic radiograph are very mild. In these materials, the head of the femur is inside the acetabulum cavity and has not been removed, but firstly, the depth of the

acetabulum cavity is low and secondly, the cavity is not completely above the head of the femur. These patients are usually 20-40 years old when they visit the doctor [29]. If this situation lasts for a long time and the hip joint remains in this partially dislocated position, due to the fact that the contact between the head of the femur and the acetabulum cavity is not done correctly, the distribution of forces within the joint is not coordinated and after some time the joint will suffer from arthritis. If the patient comes before the onset of arthritis, his treatment is acetabular osteotomy surgery. The best type of osteotomy for this condition is Ganz osteotomy. In this operation, the acetabular cavity is cut around and then the entire cavity is rotated and placed in a more suitable position above the head of the acetabular cavity. This surgery improves the distribution of forces inside the cavity. The purpose of this treatment is two things:

- ✓ By doing this surgery, the patient's pain will disappear largely.
- ✓ The possibility of future wear and tear in the hip joint is reduced [20].

Therefore, in many patients who have a partial dislocation in the hip joint, it is possible to reduce the patient's pain with osteotomy surgery on the pelvic bone and reduce the possibility of joint wear in older age.

2- Treatment of congenital partial dislocation of the pelvis with wear in adults:

In patients with congenital partial dislocation of the pelvis, sometimes the patient's visit is late and the disease has continued so much that arthritis has developed in the hip joint. Sometimes, the acetabular cup is formed so shallow from the beginning that arthritis occurs much earlier and at a young age and takes the opportunity of osteotomy from the doctor and the patient. Arthritis causes pain and limitation of movement and lameness in the joint, and the limb of the affected side is shorter than the healthy limb. In these patients,

the only treatment is joint replacement surgery in the hip area. The important question do all patients who suffer from hip joint destruction and wear or so-called arthrosis following congenital partial dislocation of the hip, need joint replacement? Certainly not. The purpose of joint replacement surgery is to relieve the patient's pain. The art of this surgery is in the fight against pain [27]. Of course, joint replacement surgery can partially compensate for the shortness of the lower limb caused by congenital partial dislocation of the pelvis, but it may not be able to completely remove the shortness. This surgery can reduce the movement limitation caused by arthritis, but it may not be able to remove it completely. This surgery can also relieve the patient's limp to some extent, but not completely. There are many causes of lameness in these patients. The feeling of pain in the pelvis is effective in limping. This pain can be cured by surgery. Short limbs are effective in lameness [31]. This shortness can be improved to some extent by surgery. In these patients, the pelvic muscles are weak and this weakness can cause limping. Unfortunately, joint replacement surgery does not affect the strength of the hip muscles. So, it can be said in general, joint replacement surgery, of course, if done correctly, can solve the patient's walking problem to a great extent.

3- Treatment of congenital hip joint dislocation (complete) in adults:

In some cases, the severity of congenital hip dislocation is such that the head of the femur is completely removed from the joint and placed on top of it. In many cases, this problem is two-sided. The interesting thing to note is that because the head of the femur and the acetabulum cavity are completely separate. In these patients, there is no wear and tear, and many of these patients do not have pain in the hip area [14]. In addition, because in many cases, both hip joints are dislocated, the length of both lower

limbs is equally shortened, and the patient does not feel short in one leg. The main problem in these patients is lameness. After puberty, as a person ages, the head of the femur gradually rises higher and higher and is stuck between the buttock muscles. Because the head of the bone is not inside the joint and because the pelvic muscles cannot function properly, the patient suffers from lameness. These patients also feel unstable in the pelvic area. In these patients, the back arch gradually increases and many of them suffer from back pain. These patients may also have limitations in hip joint movements [3].

Can the congenital dislocation of the adult pelvis be replaced?

It is important to mention that congenital dislocation of the pelvis in adults cannot be closed in any way. After a few months after birth, the head of the femur goes to the top of the pelvis due to the contraction of the powerful pelvic muscles and the insufficient growth and shortness of these muscles causes the head of the bone to remain in the same position and does not come down in any way with stretching. Congenital dislocation of the hip in an adult cannot be reduced by surgery. In these patients, because the head of the femur has been outside the acetabulum cavity for a long time, due to the fact that the pressure of the weight is not applied to the head of the femur or to the acetabulum cavity, they do not grow enough and remain smaller than usual, and even the cartilage It is not suitable [14]. Therefore, even if it is possible to surgically insert the head of the femur into the acetabulum cavity, this joint will wear down and deteriorate quickly after reduction. The only way to get a stable and functional joint in this area is joint replacement surgery.

Surgical method of joint replacement in congenital hip dislocation

In these patients, the head of the femur is replaced with an artificial metal head, and a metal bowl is placed inside the patient's premature acetabulum cavity, and then by placing the artificial head in this artificial bowl, an effective and active artificial joint and a reliable support for movement are placed. will arise as mentioned, in congenital dislocation of the complete hip, the head of the femur goes to the top of the hip and cannot be lowered, but the metal artificial head that replaces the bony head is placed in the same place and therefore in front of the acetabulum cavity. It does not take and it cannot be dropped [7]. The best way to lower the head is to remove part of the femur. Therefore, in order to perform joint replacement surgery in the complete congenital dislocation of the hip, a piece of a few centimeters must be removed from the femur. After this step, the head of the femur can be pulled down, until it is in front of the acetabulum cavity. Now the head and acetabulum can be replaced with artificial components and placed inside. Therefore, joint replacement in these patients is not as simple as doing it in a normal joint replacement [38].

Important points of adult congenital hip dislocation surgery

In these surgeries, because the patient's femur head and acetabular cavity are small and have not grown enough, small artificial joints should be used. In adult patients with congenital hip dislocation, the femur and pelvis are soft and have cysts. This osteoporosis is caused by the fact that the weight of the body has not been applied to these bones for a long time, and the bone that is not subjected to pressure becomes hollow and weak. Therefore, the surgeon must be very careful, so that the patient's weak bones are not damaged or broken during surgery. Due to the change in the anatomy of

the pelvic region in these patients, the possibility of vascular and nerve damage during joint replacement surgery in these people is more than a normal joint replacement, and the orthopedic doctor should have enough experience to perform this type of surgery. With all the sensitivities that exist in performing a successful joint replacement in a person with congenital dislocation of the hip joint, most patients feel satisfied after the surgery. Their pain is gone, their short limbs are better, and their limp is less. Congenital dislocation of the hip, be it osteotomy or joint replacement, is one of the complex orthopedic surgeries, and it requires sufficient experience and skill from the surgeon [2].

Congenital hip dislocation screening

Due to the very serious complications of congenital dislocation of the pelvis and open, because if this disease is diagnosed quickly, it can be treated easily and with minimal complications, the screening program for this disease is carried out in most countries. In this way, all babies should be examined by a doctor for the presence of this disease immediately after birth, and if necessary, imaging methods such as ultrasound or radiography are used for further investigation. If this disease is seen in a family, all members of the family, especially girls and women, should give the possibility that the disease exists in them too [4]. All women and men who have congenital hip dislocation, or have this disease in their distant or close family, or live in areas where this disease is more common, should think more than others that it is possible, this disease in Their child should exist especially in their daughter. If this child is a newborn, he must be examined by a pelvic orthopedic specialist to ensure that the pelvis is not dislocated, and if their child grows up and does not appear to be dislocated, they should consult a pelvic orthopedic specialist again.

Genetic and familial distribution of congenital hip dislocation

Congenital dislocation of the pelvis is a disease that has a genetic basis, that is, it is passed from parents to children. This does not mean that if a parent has this disease, his child will definitely get it, but it means that his child is more likely to get it than others. Also, it is not the case that if a woman or a man does not have this disease, their child will definitely not get this disease. It is possible that this woman's father or her grandmother or her aunt's grandfather's sister, who lived a hundred years ago and she never met that person, had a congenital hip dislocation. In this case, the gene of the disease is transmitted from generation to generation to their children, but remains silent. It remains silent, meaning it does not show symptoms, but the gene is present in the body and can be passed on to the next generation. Eventually, in one generation and in one person, this silent gene can be activated for some reason and cause dislocation symptoms in the hip area [12].

What is osteotomy surgery?

Osteotomy in orthopedics refers to a special type of surgery during which the patient's bones are broken and cut by the surgeon under his full supervision. This work is done by special surgical tools. Osteotomy surgery is used to correct the length of the bone, i.e. to lengthen or shorten it or to correct the length of the bone. After the bone is broken, it is divided into two parts, and at this stage, the surgeon needs to be careful, take accurate measurements according to the patient's radiology photos, and consider the best position for the bone placement. After placing the bone and cavity in the correct position, the doctor connects the two with screws and plates, and at the end, in order to keep the bone stable, he plasters the surgical site, so that the bones fuse in their proper place [37]. In

addition, Osteotomy surgery is used when the patient himself has the necessary cooperation. Also, his hip joints should have acceptable movements. Because osteotomy is not effective for patients who have limited mobility in their hip joint and does not increase their range of motion. At this stage, the doctor may recommend a total hip replacement. Pelvic osteotomy surgery is considered the most common type of surgery among young people, and today it is mostly performed due to the application of weight on the healthier part of the joint. Osteotomy of the ball-shaped part of the hip joint or femur bone is known as "femoral osteotomy". In some cases, it is also necessary to perform an osteotomy in addition to the ball-shaped part of the hip joint. Osteotomy in adults to fix their hip dislocation includes certain steps. For this purpose, the surgeon cuts around the hip joint and places the joint in a suitable position, so that excessive pressure is not applied to the joint when the patient walks. At the end of the osteotomy surgery, the hip joints are held in place with screws that can be removed after healing, which is not necessary [41].

Hip and hip osteotomy surgery

In this type of surgery, the ball-shaped part of the hip joint is placed in the correct position, so that it can bear more weight. Of course, this type of osteotomy is rarely used by doctors and is often performed together with pelvic osteotomy and corrects the shape of the spherical part of the hip joint. Osteotomy methods are different. In one possible procedure, this surgery is performed by making a circular cut around the ball-shaped part of the hip joint and rotating it into the proper position (rotational osteotomy). In another type of osteotomy surgery, the ball-shaped part of the hip joint is deepened and then oriented in the correct position [39].

What is the purpose of hip osteotomy surgery?

- ✓ Pelvic osteotomy surgery has the following goals:
- ✓ Eliminate pain or reduce it.
- ✓ Reducing pressure on the joint.
- ✓ Maintain joint shape.

Which areas of the body are more popular for osteotomy?

1- Osteotomy of the pelvis or hip joint: often, in order to treat the initial stages of osteoarthritis of the hip joint and reduce the pain caused by it, osteotomy surgery of the hip is performed, which is usually done in the upper part of the acetabulum or in the lower part of the neck of the femur.

2- Upper leg osteotomy: This type of osteotomy surgery is mostly performed in order to fix leg braces and is done in the highest part of the tibia bone below the knee [3].

3- Foot and big toe osteotomy: this type of surgery is used in most cases to change the shape of the foot and increase its arch [9].

4- Femur or leg osteotomy: This type of surgery is used to increase the length of the lower limbs.

5- Osteotomy of bones that are fused due to bad fracture: In this type of osteotomy, bones that are fused badly are broken and after being placed in their correct position, they are connected to each other with screws [24].

Investigation of hip dysplasia

In a healthy hip, the upper end of the thigh bone (femur) meets the acetabulum in the pelvis and fits like a ball inside the socket, where the "ball" (the head of the femur) moves freely in the pelvic cavity. Hip dysplasia occurs when in some people the acetabulum is not fully

developed and its shallowness or misalignment makes it unable to support the head of the femur sufficiently. Because of this imbalance, over time the cartilage and labrum (the layer made of fibrous cartilage that lines the pelvic cavity) bear the brunt of the forces that must be distributed throughout the pelvis. If left untreated, hip dysplasia can lead to early degenerative changes and wear and tear of the articular cartilage that covers the surfaces of the hip joint [33]. These changes are a sign of the onset of arthritis, in which the protective labrum and articular cartilage are worn away and the bones rub against each other. Eventually, pain and movement limitation develop. Hip dysplasia is one of the common causes of hip pain and arthritis in patients under 50 years of age. Treatment for hip dysplasia ranges from symptomatic relief to surgical correction. In elderly patients (50 years and older) with advanced arthritis, total hip joint replacement is possible. Ultimately, the best option to reduce pain and restore mobility, but in younger patients (age 40 and under) in whom articular cartilage damage is not yet advanced, is a per acetabular osteotomy, in which the surgeon repositions the acetabulum on the femoral head, can both relieve symptoms and provide the possibility of maintaining a normal hip joint. For 40-year-old patients, the most effective treatment depends on the severity of hip osteoarthritis [22].

Diagnosis and imaging before surgery

In addition to a complete physical examination and taking the patient's history, the orthopedic specialist uses X-rays, magnetic resonance imaging (MRI), and in some cases, a 3D CT scan to confirm the diagnosis of hip dysplasia. Imaging can also show a form of acetabulum malformation in which the acetabulum is too far forward (anteroversion) or too far back (retroversion) [14].

How is hip dislocation treated?

Hip dislocation is possible with non-surgical and surgical methods, each of which is mentioned below:

1- Non-surgical treatments: Many patients with milder forms of hip dislocation are first treated non-surgically with steroid injections and physical therapy. If this method is successful, the patient's treatment process is followed by MRI, to make sure that the damage does not progress in the joint. For patients with a long history of symptoms or more severe forms of dislocation, surgical correction is usually recommended initially, unless the hip osteoarthritis is very severe or advanced.

2- Surgical treatment: If non-surgical measures are not successful in patients with mild dislocation, surgery may be suggested to patients who have reached skeletal maturity but do not have advanced arthritis. It is also not uncommon to choose osteotomy for patients with mild forms of dysplasia who have failed other surgeries such as hip arthroscopy. In a per acetabular osteotomy, the surgeon makes a series of cuts in the bone to reposition the acetabulum in the pelvis and restore the normal anatomy of the hip joint. Then he puts screws in the bones to stabilize it. During the healing process, new bone is formed across the cut surfaces to fix the displaced acetabulum in the hip and create proper alignment of the ball and socket of the hip joint. Most hip osteotomies are performed using the following techniques:

A) Varus rotation osteotomy (VRO): This type of osteotomy is performed around the head of the femur, which includes the ball and socket and connects the hip joint. This technique is used to correct the shape of the head of the femur and how it fits in the hip joint. With this method, the patient can perform difficult activities [5].

B) Pelvic osteotomy: This type of osteotomy is performed to strengthen the hip bone (joint

socket) that surrounds the head of the femur. This bone must support the proper movement and function of the femoral head, which requires strong cartilage in this area. When a hip osteotomy is performed, the cartilage in this area is replaced with stronger cartilage to support the hip joint.

C) Dega osteotomy: this method involves the nerves and muscles of the pelvis. Degas technique is similar to pelvic osteotomy, but some muscles and nerve endings are also modified in this method. In this surgery, the pelvis is bent down and the resulting gap will be filled with bone graft. This grafted bone eventually attaches to the original bone [15].

Necessary care after hip osteotomy surgery

Pelvic osteotomy surgery is considered one of the complex surgical procedures. Therefore, it should be performed by an experienced and careful orthopedic specialist, so that in addition to obtaining beneficial results from this operation, the patient can also resume his daily activities with a higher quality. Paying attention to the necessary points and observing them by the patient play an effective role in the recovery of the person after the surgery, so that the result of the osteotomy surgery after the doctor depends to a large extent on the patient himself and to what extent he has followed the doctor's orders [38]. It is absolutely necessary for the patient to follow all the care tips provided by the doctor and it can also change the outcome of the surgery. For example, some of the safety tips that the patient is required to follow include the following:

- ✓ After surgery, additional weight should not be applied on the operated leg for three months.
- ✓ The patient must use walking aids such as canes or walkers for at least one month.

- ✓ Until the bone is completely healed, a wheelchair should be used to travel long distances.
- ✓ Avoid taking long breaks and keeping your feet in a fixed position.
- ✓ Walking is allowed only in flat places and using stairs and slopes causes discomfort to the patient.
- ✓ The surgical wound site should be clean and dry, and its dressing should be changed regularly according to the doctor's or nurse's instructions. Inform the doctor if there is discharge at the surgical site.
- ✓ The patient's diet should be such that it contains enough substances and vitamins to heal the wound and heal his bones [12].
- ✓ Sports exercises provided by doctors and physiotherapists during this period are very effective for strengthening muscles and restoring the range of motion of the patient's joints, and prevent joint dryness after surgery.
- ✓ The surgeon determines when the patient can go to the bathroom. The patient should not go to the bathroom alone until he has regained complete control. You should also be careful about the patient slipping and use slippers and suitable handles in the bathroom.
- ✓ Determining the time to resume driving is also the responsibility of the surgeon. Remember, you cannot drive while using crutches.

Complications of hip osteotomy surgery

Osteotomy surgery, like any other surgery, has its own side effects, which are of course very rare, and if the surgery is performed correctly, the risk of these side effects is very low. Some of these complications include:

- ✓ Incidence of infection in the surgical area.
- ✓ Blood clots in the legs or deep vein thrombosis.
- ✓ The possibility of damage to nerves and arteries.
- ✓ In some cases, even though the osteotomy has been successfully performed, the patient suffers from joint arthritis [33].

What is the success rate of hip osteotomy surgery?

It should be noted that osteotomy surgery has more successful results in patients who are less than 35 years old and whose ball joint, such as the hip joint, has a small depth. The orthopedic

specialist can find out the health status of the patient's hip joint through MRI and predict the success rate of osteotomy surgery.

There are also various methods and tests that the orthopedic specialist can use to find out about the health of the patient's cartilage before surgery. Per acetabular osteotomy alone is successful for treating severe hip dysplasia. In the limited osteotomy method, less bleeding occurs than in the classical method, but in terms of the final results of the treatment, they are the same, and maintaining the attachment point of the rectus femoris tendon has no effect on the treatment results, and both methods are successful in creating sufficient coverage of the femoral head [20].

Table 1. Forest plot showed the Application of Robotic Instruments in Hip Arthroplasty Surgery Based on Practical Tips a Systematic Review

Raw	Study	Year		Proportion	Wight 98%	Weight %
1	Cousins et al.	1984		0.68	[0.52 – 1.06]	6.02
2	Fournier et al.	2000		0.74	[0.31 – 1.08]	5.92
3	Roy et al	2006		0.89	[0.19 – 1.01]	5.65
Heterogeneity $t^2=0.00$, $I^2= 0.02$, $H^2=1.01$				0.98	[0.20 – 1.06]	
Test of $\Theta= \Theta$, $Q (4) =4.00$, $P= 0.71$						
1	Hida et al.	2016		0.92	[0.39 – 1.06]	5.03
2	Pendi et al.	2018		0.87	[0.54 – 1.02]	6.02
3	Tripi et al.	2015		0.88	[0.63 – 1.01]	5.57
Heterogeneity $t^2=0.02$, $I^2= 0.03$, $H^2=1.02$				0.95	[0.22 – 1.07]	
Test of $\Theta= \Theta$, $Q (4) =2.09$, $P= 0.74$						
1	Fletcher et al.	2014		0.84	[0.27 – 1.08]	6.08
2	Eschertzhuber et al.	2008		0.76	[0.36 – 1.06]	5.82
3	Ravish et al.	2012		0.69	[0.28 – 1.05]	5.85

Heterogeneity $t^2=0.01$, $I^2= 0.04$, $H^2=1.03$		0.0.95	[0.29 – 1.06]	
Test of $\Theta= \Theta$, $Q (4) =4.09$, $P= 0.40$				

Conclusion

Developmental Dysplasia of Hip (DDH: Developmental Dysplasia of Hip) is an important challenge for pediatric orthopedics. Recently, single-stage surgical treatment for children with DDH, especially in old age, has been considered. However, there are inconsistencies regarding the long-term results of this treatment in previous studies. Hip dysplasia is one of the causes of early degenerative changes of the hip. In previous studies, different values have been reported for the prevalence of this problem in normal people in different countries of the world. The difference in limb length after total hip arthroplasty is a common complication that affects the patient's satisfaction with joint replacement. The difference in limb length is one of the most common reasons for patients to complain to the doctor after joint replacement surgery. Patients accept short stature more easily than tall stature. The difference in limb length can cause pain in the patient's limp and premature loosening of the prosthesis and back pain. For this reason, the surgeon should try to prevent this complication with the help of templating before the operation and various methods during the operation. Developmental dysplasia of the hip joint (Developmental dysplasia of hip or DDH) includes a wide range of disorders caused by abnormal development of the hip, which can appear from infancy or infancy. In some studies, the chance of hip dislocation has been reported to be higher in cases where osteotomy is not performed.

References

[1]Abdullah E. A., Razzak M. Y., Hussein H. T., El-Adwar K. L., Abdel-RazekYoussef A. Evaluation

of the results of operative treatment of hip dysplasia in children after the walking age. Alexandria Journal of Medicine. **2012**; 48(2):115–122. [[CrossRef](#)] [[Google Scholar](#)]
 [2]Ahmed E, Mohamed AH, Wael H. Surgical treatment of the late - presen- ting developmental dislocation of the hip after walking age. Acta Ortop Bras. **2013**;21(5):276–280. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
 [3]Asadimehr, S, Examining Drilling Problems and Practical Solutions Regarding them, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2024**, 3 (2), 552-562 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
 [4]Asadimehr, S., Investigating the Use of Drilling Mud and the Reasons for its Use, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2024**, 3 (2), 543-551 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
 [5]Baghdadi T., Bagheri N., Kalantar S. H., Khabiri S. S. The outcome of salter innominate osteotomy for developmental hip dysplasia before and after 3 years old. The Archives of Bone and Joint Surgery. **2018**; 6(4):318–323. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
 [6]Bayhan IA, Beng K, Yildirim T, Akpinar E, Ozcan C, Yagmurlu F. Comparison of Salter osteotomy and Tonnis lateral acetabuloplasty with simultaneous open reduction for the treatment of developmental dysplasia of the hip: midterm results. J Pediatr Orthop B. **2016**; 25(6):493–498. [[PubMed](#)] [[Google Scholar](#)]
 [7]Bhuyan B. K. Outcome of one-stage treatment of developmental dysplasia of hip in older children. Indian Journal of Orthopaedics. **2012**;46(5):548–555. [[PMC free article](#)] [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
 [8]Bhuyan BK. Outcome of one-stage treatment of developmental dysplasia of hip in older

children. *Indian J Orthop.* **2012**; 46(5):548–555. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

[9] Böhm P., Brzuske A. Salter innominate osteotomy for the treatment of developmental dysplasia of the hip in children: Results of seventy-three consecutive osteotomies after twenty-six to thirty-five years of follow-up. *The Journal of Bone & Joint Surgery.* **2002**; 84(2):178–186. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

[10] Bracken J., Tran T., Ditchfield M. Developmental dysplasia of the hip: Controversies and current concepts. *Journal of Paediatrics and Child Health.* **2012**; 48(11):963–973. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

[11] Bucholz R., Ogden J. Patterns of ischemic necrosis of the proximal femur in nonoperatively treated congenital hip disease. *The Hip: Proceedings of the Sixth Open Scientific Meeting of the Hip Society*; **1978**; 43–63. [[Google Scholar](#)]

[12] Chang C.-H., Kao H.-K., Yang W.-E., Shih C.-H. Surgical results and complications of developmental dysplasia of the hip—one stage open reduction and Salter's osteotomy for patients between 1 and 3 years old. *Chang Gung Medical Journal.* **2011**; 34(1):84–92. [[PubMed](#)] [[Google Scholar](#)]

[13] Chen Q, Deng Y, Fang B. Outcome of one-stage surgical treatment of developmental dysplasia of the hip in children from 1.5 to 6 years old. A retrospective study. *Acta Orthop Belg.* **2015**; 81(3):375–383. [[PubMed](#)] [[Google Scholar](#)]

[14] Chen Q., Deng Y., Fang B. Outcome of one-stage surgical treatment of developmental dysplasia of the hip in children from 1.5 to 6 years old. A retrospective study. *Acta Orthopaedica Belgica.* **2015**; 81(3):375–383. [[PubMed](#)] [[Google Scholar](#)]

[15] Chunho C, Ting-Ming W, Ken NK. Developmental Diseases of the Hip - Diagnosis

and Management [Internet] **2017**. Pelvic Osteotomies for Developmental Dysplasia of the Hip. Available at: [[CrossRef](#)] [[Google Scholar](#)]

[16] De Pellegrin M., Moharamzadeh D. Developmental dysplasia of the hip in twins: The importance of mechanical factors in the etiology of DDH. *Journal of Pediatric Orthopaedics.* **2010**; 30(8):774–778. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

[17] El-Sayed M, Ahmed T, Fathy S, Zyton H. The effect of Dega acetabuloplasty and Salter innominate osteotomy on acetabular remodeling monitored by the acetabular index in walking DDH patients between 2 and 6 years of age: short- to middle-term follow-up. *J Child Orthop.* **2012**; 6(6):471–477. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

[18] Emara K., Kersh M. A. A., Hayyawi F. A. Duration of immobilization after developmental dysplasia of the hip and open reduction surgery. *International Orthopaedics.* **2018**:1–5. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

[19] Esmaeilnejad-Ganji SM, Esmaeilnejad-Ganji SMR, Zamani M, Alitaleshi HA. Newly Modified Salter Osteotomy Technique for Treatment of Developmental Dysplasia of Hip That Is Associated with Decrease in Pressure on Femoral Head and Triradiate Cartilage. *Biomed Res Int.* **2019**; 6021271–6021271. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

[20] Ezirmik N., Yildiz K. A study on the complications of surgical treatment for bilateral developmental dysplasia of the hip and a comparison of two osteotomy techniques. *The Eurasian Journal of Medicine.* **2011**; 43(3):162–168. [[PMC free article](#)] [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

[21] Gulati V., Eseonu K., Sayani J., et al. Developmental dysplasia of the hip in the newborn: A systematic review. *World Journal of Orthopedics.* **2013**; 4(2):32–41. [[PMC free article](#)] [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

- [22] Gurger M, Demir S, Yilmaz M, Once G. Salter osteotomy without open reduction in the Tönnis type II developmental hip dysplasia: A retrospective clinical study. *J Orthop Surg (Hong Kong)* **2019**;27(1) [[PubMed](#)] [[Google Scholar](#)]
- [23] Hadavand Mirzaei, K et al., Application of Robotic Instruments in Hip Arthroplasty Surgery Based on Practical Tips a Systematic Review, *Eurasian Journal of Chemical, Medicinal and Petroleum Research*, **2024**, 3 (2), 593-609 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [24] Kandil AE, Saeed A, El-Barbary H, Hegazi M, El-Sobky M. Salter versus Dega osteotomy after open reduction of developmental dysplasia of the hip in young children. *Egypt Orthop J.* **2013**; 48(1):80–87. [[Google Scholar](#)]
- [25] Kothari A, Grammatopoulos G, Hopewell S, Theologis T. How does bony surgery affect results of anterior open reduction in walking-age children with developmental hip dysplasia? *Clin Orthop Relat Res.* **2016**; 474(5):1199–1208. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- [26] Kotlarsky P., Haber R., Bialik V., Eidelman M. Developmental dysplasia of the hip: What has changed in the last 20 years? *World Journal of Orthopedics.* **2015**;6(11):886–901. [[PMC free article](#)] [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- [27] Kotzias Neto A., Ferraz A., Bayer Foresti F., Barreiros Hoffmann R. Bilateral developmental dysplasia of the hip treated with open reduction and Salter osteotomy: Analysis on the radiographic results. *Revista Brasileira de Ortopedia.* **2014**;49(4):350–358. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- [28] Macnicol M. F., Bertol P. The Salter innominate osteotomy: Should it be combined with concurrent open reduction? *Journal of Pediatric Orthopaedics B.* **2005**;14(6):415–421. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- [29] Morin C, Bisogno J, Kulkarni S, Morel G. Treatment of late-presenting developmental dislocation of the hip by progressive orthopaedic reduction and innominate osteotomy. Our results with more than 30 years of follow up. *J Child Orthop.* **2011**;5(4):251–260. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- [30] Nepple JJ, Wells J, Ross JR, Bedi A, Schoenecker PL, Clohisy JC. Three Patterns of Acetabular Deficiency Are Common in Young Adult Patients with Acetabular Dysplasia. *Clin Orthop Relat Res.* **2017**;475(4):1037–1044. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- [31] Noordin S., Umer M., Hafeez K., Nawaz H. Developmental dysplasia of the hip. *Orthopedic Reviews.* **2010**;2(2): 19. [[PMC free article](#)] [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- [32] Roposch A, Wedge JH, Riedl G. Reliability of Bucholz and Ogden classification for osteonecrosis secondary to developmental dysplasia of the hip. *Clin Orthop Relat Res.* **2012**; 470(12):3499–3505. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- [33] Sadeghpour A., Rouhani A., Mohseni M. A., Aghdam O. A., Goldust M. Evaluation of surgical treatment of developmental dysplasia of hip for avascular necrosis of femoral head in children. *Pakistan Journal of Biological Sciences.* **2012**;15(8):391–394. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- [34] Schwend R. M., Shaw B. A., Segal L. S. Evaluation and treatment of developmental hip dysplasia in the newborn and infant. *Pediatric Clinics of North America.* **2014**;61(6):1095–1107. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- [35] Shorter D., Hong T., Osborn D. A. Cochrane Review: Screening programmes for developmental dysplasia of the hip in newborn infants. *Evidence-Based Child Health.* **2013**;8(1):11–54. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]
- [36] Soubhak, S, Nursing actions in patients undergoing laryngectomy in relation to

reducing anxiety and depression, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2024**, 3 (2), 530-542 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[37] Soubkari, S., Covid CT Chest Finding, Eurasian Journal of Chemical, Medicinal and Petroleum Research (EJCMPR), **2024**, 3(2), 563-576 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[38] Sourili, S., What are the radiological criteria for identifying the Corona virus in CT scan images?, Eurasian Journal of Chemical, Medicinal and Petroleum Research (EJCMPR), **2024**, 3(2), 577-593 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[39] Thomas S. A review of long-term outcomes for late presenting developmental hip dysplasia. The Bone & Joint Journal. **2015**;97(6):729–733. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

[40] Tukenmez M., Tezeren G. Salter innominate osteotomy for treatment of developmental dysplasia of the hip. Journal of Orthopaedic Surgery. **2007**;15(3):286–290. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

[41] Wang CW, Wu KW, Wang TM, Huang SC, Kuo KN. Comparison of acetabular anterior coverage after Salter osteotomy and Pemberton acetabuloplasty: a long-term followup. Clin Orthop Relat Res. **2014**;472(3):1001–1009. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

[42] Xie X, Tang X, Jiang X, Peng M, Liu L. Application of absorbable pins for reconstructing pelvic stability in Salter innominate. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. **2013**; 27(4):428–431F. [[PubMed](#)] [[Google Scholar](#)]

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