

ON THE BIFURCATION OPERATION BY THE
v. BAEYER-LORENZ PROCEDURE, AND THE
„LOW OSTEOTOMY“ OF SCHANZ

BY

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In cases of diseased hip-joint, recourse has been had more and more in recent years to subtrochanteric osteotomy.

According to *Hoffa*, the first osteotomy of the femur was performed by *Barton* in 1826. In 1856 *v. Langenbeck* recommended that the operation should be made subcutaneously, and in 1872 *v. Gant* suggested that the division be made subtrochanterically. The technique was perfected by *v. Volkman*; the femur was exposed by means of a lateral incision over the trochanteric region, whereupon a linear or wedged shaped osteotomy was carried out. By 1885 he had performed the operation 19 times.

In 1894 *Kirmisson* published an account of four cases of *Luxatio cox. cong. bilateralis*, treated on one side with a subtrochanteric osteotomy. He established that the bloody reposition of the luxated caput femoris, as carried out by *Hoffa*, could not be adopted if the patient was more than ten years old. In *Kirmisson's* opinion, the subtrochanteric osteotomy was a good palliative measure. It was not dangerous, and resulted in improved function and carriage. It should be employed, above all, when a flexional and adductive contracture had arisen. Although *Kirmisson* had only performed the operation unilaterally, he advised its bilateral application. The procedure consisted of a simple osteotomy subtrochanterically and the correction of the deformity, but *Kirmisson* did not aim at effecting an osseous

support for the pelvis, nor a tension of the pelvo-trochanteric musculature.

In a dedicatory publication of 1899 *Hoffa* stressed the sub-trochanteric osteotomy as indicated in deformities after coxitis in coxa vara, and in unilateral irreducible luxations of the hip-joint. There was no essential difference between *Kirmisson's* and *Hoffa's* technique. The former performed a transverse, the latter an oblique osteotomy, which *Hoffa* regarded as an important advance, as it rendered possible a lengthening of the shortened bone by as much as 5 cm in the most favourable circumstances. Before the osteotomy, myotomies were performed on the musculature of the adductors. Like *Kirmisson*, *Hoffa* advised the procedure, as the method was safe and functionally helpful.

In 1899 *Kondring*, *Hoffa's* assistant, published a detailed account of *Hoffa's* 8 cases. He considered the operation indicated for unilateral luxations of the hip-joint in patients of more than 10 years of age when a bloody or bloodless reposition had no prospect of success. On the other hand, he considered the operation contra-indicated for bilateral luxations where the caput was freely movable towards the os ilium, as also with inflammations of the caput femoris, or when this pressed on and provoked paralysis of the nerv. ischiadicus. *Kondring* touches on all the imaginable methods of treatment apart from osteotomy, i. e. *Hoffa's* bloody reposition, resections of the caput with a view to obtaining nearthrosis between the trochanter and the ilium, and *König's* attempt with a periosteal lappet. He did not find any method fully satisfactory.

After the operation, 6 of *Hoffa's* 8 patients were laid on extensions and 2 were laid in plaster of Paris. Like *Kirmisson* and *Hoffa*, *Kondring* was satisfied with the results obtained.

It is therefore curious that, as far as I could discover, there is no mention of this method during the next 20 years, either in Germany or France, except in a paper by *Froelich*.

At the close of the Great War in 1918 *v. Baeyer*, and shortly afterwards, in 1919, *Lorenz* announced the subtrochanteric osteotomy as a new method in the treatment of irreducible luxa-

tions of the hip-joint, and not long afterwards *Schanz* published yet another method, the so-called »low osteotomy«.

Between *v. Baeyer* and *Lorenz*, a dispute arose about the right of priority. Since then *Lorenz* has acknowledged that the method was used simultaneously and independently by *v. Baeyer*. The fact remains that the method has become known under the name of »The Lorenz bifurcation operation«.

What *v. Baeyer* aims at in the first place with the procedure is to make the pelvo-trochanteric musculature able to function. This can be effected to a certain degree by a subtrochanteric osteotomy, as the two fragments heal after the operation at a certain angle to each other. Practically viewed, this is brought about by the distal fragment—the leg—being so abducted that a laterally and posteriorly open angle arises. Then, when the leg has been brought down to a position parallel with the other, the region of the trochanter is forced outwards and downwards, stretching the pelvo-trochanteric musculature. *V. Baeyer* advocates an oblique osteotomy. The distal end of the fragment is to rest against the pelvis as near the acetabulum as possible, and if possible the point shall press into the bottom of the cavity. At the time of publication he had had only one case, but was pleased with the result. The position of the body and flexibility were good, except as regards the adduction, which had been lost. No real increase in the shortening had taken place.

Lorenz considered the most important thing to be the procuring of an osseous support in the acetabulum for the pelvis. He regarded it as of minor importance that the pelvotrochanteric musculature should be stretched simultaneously, but his determined endeavour to give the pelvis a firm support led, in his opinion, to a fundamental difference between the bifurcation operation and *Kirmisson's* osteotomy.

Lorenz performed the osteotomy on a level with the cavity, from which it follows that the higher the trochanter has been pushed up, the lower down the femur the osteotomy must take place. After the procedure *Lorenz* advises an abduction angle of 30 to 40 degrees, and warns against making the abduction greater. The risk one then runs is that the bone, after healing, cannot be

brought down to the normal position. No myotomy or tenotomy is performed. After the operation, the fragments should be so placed that the upper fragment lies laterally and close to the distal one, the end of which consequently forms the point of the angle, which is to be replaced in the acetabulum. Through this the upper fragment, after healing, gets a direction from behind; downwards-inwards, when seen from above.

In his first publication *Lorenz* advised 12 weeks' plaster of Paris treatment; later, he made it 7 to 8 weeks. After the plaster had been removed, there should be massage, baths and gymnastic treatment.

Lorenz tried various osteotomies, but ended by recommending an oblique osteotomy with a direction from without, inwards from below, and upwards. He advises against extension treatment before the operation. He does not think there is any risk that the fragments will not heal together.

Lorenz expects the procedure to result in a well supported pelvis without lordosis and with negative Trendelenburg, increased tension and function of the pelvotrochanteric musculature, (*v. Baeyer*), good mobility and good endurance in walking. The good mobility is said to be due to a kind of nearthrosis arising between the distal end of the fragment and the acetabulum, which is covered by the capsule, which is as a rule thickened. The radiogram should show that the distal end of the fragment points straight into the acetabulum with the proximal fragment lying broadly lateral to the distal. According to *Lorenz*, the shortening may increase slightly, but not so as to be of any importance.

The technique of the operation is as follows: The patient is laid on the healthy side with diseased leg slightly bent and considerably adducted, so that the femur covers the articular cavity. After the oblique osteotomy has been performed, the patient is laid on his back, the proximal fragment being kept in its position, while the distal one is abducted and thrust up towards the acetabulum. Having made sure that the fragments are placed in the right position towards each other, (see above), one can suture the soft parts and apply the plaster of Paris.

Lorenz has praised the method in a number of publications. As far as I know, the last time he did so was at the orthopaedic congress at Graz in 1924, where he pronounced the following opinion:

»Man könnte eigentlich sagen, dass das Wesen der Bifurcation mit der subtrochanteren Osteotomie überhaupt wenig zu tun hat, weil diese letztere nur eine präliminäre, vorbereitende Massnahme für den Hauptakt der Operation ist, und dieser Hauptakt heisst Reposition. Unter der Regel »a potiori fiat denominatio« sollte die Bifurcation viel eher als palliative blutige Reposition, denn als subtrochantere Osteotomie bezeichnet werden, obwohl sie von dieser letzteren ausgegangen ist, deren letzten Entwicklungsmöglichkeit bedeutet.«

On that occasion he considerably widened the sphere of application of the subtrochanteric osteotomy. He now recommends it for:

1. irreducible hip-joint luxations in cases where the patient has trouble of any kind;
2. luxations that reluxate;
3. the so-called osteomyelitic luxations, *i.e.* when the caput collum part has been lost owing to septic infection;
4. paralytic iliac luxations;
5. irreducible traumatic luxations;
6. coxa valga luxans;
7. pseudarthrosis post fractura colli femoris;
8. cases of painful deforming arthritis;
9. certain cases of congenital displacement in the development of the femur, when the defective and luxated upper end of the femur can often be replaced by a bifurcation operation;
10. certain cases of tuberculous coxitis, where the caput has healed without the acetabulum being quite filled up (incongruence);
11. *Lorenz* even suggests that the bifurcation operation could be employed in the stage of acute tuberculous coxitis, in order to relieve the diseased joint.

In 1921 *Schanz* published his method, the »low osteotomy«. He advanced the following:

When any strain is thrown on the luxated bone, Trendelenburg's phenomenon is positive, i.e. the healthy side sinks down in walking until the lower edge of the pelvis finds support against the femur of the luxated side; not until then can the healthy leg be advanced. The act of walking thus consists of two phases, the former of which is injurious, but can be eliminated, according to *Schanz*, by an osteotomy on the diaphysis of the femur on a level with the lower edge of the pelvis, and by constructing an abduction angle. The proximal fragment is thereby forced to lie close to the pelvis and to move along the medial surface of the pelvis, but the distal fragment moves parallel with the longitudinal axis of the body.

The operation is performed upon an orthopaedic table. In order to control the fragments, so that displacements or other faulty positions may not arise, *Schanz* employs two long screws which are introduced into the bone, parallel with each other, below and above the place of the osteotomy. After suture they must be outside the skin. After the lower fragment has been abducted, the screws cross one another and can be fastened together at the place where they cross. They are removed as soon as sufficient stability has been obtained.

To obtain the right abduction angle between the fragments, *Schanz*, before operating, takes a radiogram with the luxated bone at its greatest possible adduction. The place where the femur borders on the lower edge of the pelvis is marked on the plate, and from this point a line is drawn parallel with the medial axis of the body. The angle thus obtained is measured, and is easy to reconstruct at the operation.

Schanz considers it to be no disadvantage that the osteotomy is made far from the joint, for it lessens the danger of ankylosis. After the operation a large hip plaster of Paris is applied, and must remain for 8 to 9 weeks.

He is very pleased with his results. Gait and carriage are improved, and the ugly lordosis is diminished or disappears.

Schanz has had many followers. Thus, the »low osteotomy« is used exclusively at the »Oscar Helene Heim« in Berlin (Mommsen, Graz). *Schanz* has also met with a good deal of

criticism. *Lorenz* condemns the »low osteotomy«, because it never furnishes a firm fulcrum for the pelvis. The method furnishes gliding surfaces between the upper fragment and the wall of the pelvis, so that only a partial support is obtained.

Shortly afterwards, *Hahn* published a paper based on 9 cases, of which 7 were bilateral, and established the fact that it may be difficult to obtain a correct abduction angle with the bifurcation operation. He considered an angle of 30 to 40 degrees suitable, but at the same time one should aim at a certain hyper-extension of the leg in the hip. From the radiogram, which *Hahn* always took from 8 to 10 days after an operation, he found as a rule that the distal fragment points into the cavity, as *Lorenz* had stated, but that the proximal fragment, owing to the hyper-extension, was only in bad contact with the other. Despite this, he obtained good consolidation in every case after the patient had lain in plaster of Paris for 8 weeks, whereupon 8 weeks subsequent treatment was administered.

Of the results he writes that the patients were freed from pain. Carriage and gait were improved, and the lordosis disappears, but all the patients' relatives affirm that a limp remains. The musculature of the seat works better, Trendelenburg became negative in 5 cases and weakly positive in 4 cases. Mobility is generally good; the adduction alone is circumscribed. After the procedure, patients were able to walk long distances, 4 of them being able to walk without pain for 3 to 4 hours, and one for 6 to 8 hours. No additional shortening worth mentioning arose in the simple cases.

Schulte considered the hyper-extension recommended by *Hahn* to be risky, as the angle of the osteotomy would thereby be displaced towards Scarpa's triangle and the vascular fascicle.

In 1923, *F. Loeffler* discussed the question of the operative treatment of irreducible hip-joint luxation, and dealt thoroughly with *v. Baeyer-Lorenz's* method.

He recommended it. In bilateral cases the lordosis is entirely corrected, the pelvis is well supported, and the gait is considerably improved, with greater power of endurance. The mobility

is increased, and the abduction in particular is improved in all patients. The shortening of the leg he regarded as of minor importance, as it can usually be rectified by an elevated shoe.

In cases at an age of 14—15, where the caput can be drawn down to the level of the cavity, *Loeffler* considers that a bloody reposition by the *Deutschländer* method may be attempted. In all other cases of irreducible hip-joint luxations, especially if the patient has any pain, he advises the bifurcation operation in preference to *Schanz's* »low osteotomy«.

Wittek, in a paper of 1924, says he has not performed a bifurcation operation himself, but has seen and examined a number of patients, who had not been satisfied with the result. He cites *Loeffler*, moreover, who had written: »Ich muss ganz offen gestehen, dass ich mit der Beweglichkeit nicht ganz zufrieden war, ja selbst vollständige Versteifungen erlebt habe«. *Wittek's* chief contention is that it is not possible to conceive that the mobility should be good after a bifurcation operation, for the luxated caput is fixed in a luxation cavity, owing to the thickened capsule, so that after the operation two pivots arise, one round the point of the angle caused by the osteotomy, the other between the caput femoris and the luxation cavity.

Hass considered this argument faulty. Between 1924 and 1928 he published a number of articles, without really adducing anything new. He entirely adopts *Lorenz's* point of view, and shares his opinion as regards indication, technique and result.

Hass has attempted to control the results by X-rays. After a successful operation the radiogram shows that the point of the distal fragment lies in the rudimentary cavity, but it is impossible to determine how deep in the point of the angle lies. *Hass's* attempts to take photographic plates from the side have failed. He assumes that there arises a kind of nearthrosis between the old cavity and the point of the osteotomy angle. When in use, this point becomes more and more worn and rounded, and thickens. *Hass* denies that an ankylosis can arise if the interposed capsule breaks, for the contact surfaces are too small. He admits, on the other hand, that a certain restriction in movement may arise in all cases, especially as regards adduction.

In opposition to *Wittek*, *Hass* remarks that this argument only holds good if the caput femoris is fixed close to the wall of the pelvis, but these cases are not suited to the bifurcation operation. It is only the cases in which the condyle is freely movable that should be osteotomized. In such cases the pivot, according to *Hass*, lies in the cavity. The upper fragment forms a short lever, which accompanies the movements of the leg without any hindrance from musculature or capsule. The adduction alone may be reduced, owing to excessive tension in the pelvotrochanteric musculature. Of the value of this tension he seems to be doubtful, but does not appear unwilling to support *v. Baeyer's* view.

Hackenbroch considers *Lorenz's* osteotomy better than *Schanz's* »low osteotomy«, but the result, in his opinion, depends above all on whether one has succeeded in replacing the angle of the osteotomy in the cavity. His technique is that of *Lorenz* and *Hass*. He does not think there is any risk of a relapse.

Natzler holds the *v. Baeyer-Lorenz* method to be far superior to other palliative operations. The angle of abduction can, according to him, be increased in certain cases up to 50 or 60 degrees. He does not believe there is any risk of pseudarthrosis at the place of the osteotomy. The method yields good capacity of movement without pains, and a good bearing. He has never seen any ankylosis, but in two cases, where he had performed *Schanz's* »low osteotomy«, he had seen the angle of the osteotomy gradually straightened out. He is unable to give any satisfactory explanation of this, but observes that *Hackenbroch*, *Deutschländer* and *König* senior had had a similar experience.

The enthusiasm for the palliative method of treatment that exists in Central Europe, is not found in France. In 1925 *Froelich* (Nancy) published an article based on 19 cases of congenital irreducible luxations of the hip-joint, treated with subtrochanteric osteotomy carried out just in front of the acetabulum. *Froelich* is on the whole favourably inclined towards it. Yet he considers that the method should only be adopted when the patients are in pain of any kind. As regards technique, the place of the osteotomy, the angle of abduction (45 degrees), plaster of

Paris treatment, röntgen control and subsequent treatment, we need only add to what has been said above that *Froelich* advises 12 weeks' plaster treatment. It should be noted that he warns against the risk of the upper fragment being possibly pushed too far forward, thus becoming a danger to the vessels just below the ligamentum inguinale.

Froelich has observed that, when the patient is resting after the completion of the treatment, there is a little space between the point of the angle of the osteotomy and the acetabulum, which space disappears when pressure is thrown on it, showing that the pelvis rests closely against the angle section. If the capsule breaks, the author states that crepitations can be heard, caused by the point of the angle rubbing against the cartilage of the acetabulum. Consolidation was obtained in 3 months in every case except one, where the healing took 7 months.

The author considers that the best results are obtained when both fragments meet at a point, which can be replaced in the cavity. Then, in favourable cases, we get negative Trendelenburg, a good carriage and faculty of movement. Yet there is always a certain risk of relapse. *Froelich* puts it as follows: »Les récidives sont possibles, l'angle que fait les deux fragments de l'ostéotomie sous-trochantérienne a toujours une certaine tendance à la longue à se redresser au bout de quelques mois ou années. Mais ce redressement ne nous a donné que dans l'observation 3 un retour à l'état antérieur à l'opération et seulement une diminution du bon résultat dans l'observation 12 et dans l'observation 13, et dans ces deux derniers cas il s'était agi primitivement d'une véritable bifurcation.« A relapse arises, owing to the tension in the pelvotrochanteric musculature, but together with a definite traction being effected by the adductors on the lower fragment, so that the upper one has to perform a rotating movement in a direction upwards-medially, which happens especially if the consolidation is not firm. The author thinks that the shortening can be troublesome in unilateral cases, but that a certain compensation is obtained by an elevated shoe and a lowering of the pelvis on the short side. In unilateral cases

Froelich advises oblique osteotomy and permanent traction in order to obtain the much needed lengthening of the shortened leg.

Finally, in touching on *Schanz's* osteotomy, the author merely states that it appeals to him, though he has no personal experience of it.

The same year that *Froelich* published his paper, the treatment of irreducible hip-joint luxations was discussed at the 7th French Orthopaedic Congress.

The discussion was opened by *Lance*, who reviewed the various methods in detail, with their advantages and disadvantages. At some length he described all the osteotomies according to the methods of *Kirmisson*, *Froelich*, *Hahn* and *Schanz*. His general judgment runs: »L'ostéotomie sous-trochantérienne haute »au point d'élection« de M. *Kirmisson*; l'ostéotomie »en face du cotyle« de M. *Froelich*, celle tout à fait basse »ischiatique« de *Schanz* sont des opérations sans danger, d'exécution facile, surtout si l'on est muni d'une bonne table orthopédique, permettant de faire le plâtre sans avoir à déplacer le malade.« Against these osteotomies he puts the bifurcation, which he looks upon as having a number of drawbacks. First and foremost, he considers bifurcation risky, for the point of the lower fragment looks like the mouthpiece of a flute, and to push this point from below and behind into the cavity means a danger to the vessels. If the reposition of the angle of the osteotomy is successful, this must result in reduced mobility or ankylosis, for it is impossible to imagine how movement can take place in a joint, which at once moves round two articular axes. (*Wittek*). Owing to the difficulty of obtaining good lateral plates, bifurcation patients are only photographed from the front. *Lance* means then, that it is impossible to judge at what point the pelvis is supported by the angle of osteotomy, but he thinks it probable that this takes place in front of the acetabulum; and *Nové-Josserand* and *Froelich*, moreover, have shown that the support does not consist of the angle-point of the osteotomy, but of the upper fragment, which looks like the short limb of an L.

In two of *Lance's* cases the lower fragment rested against

the acetabulum, but in both cases mobility became more and more restricted, and was finally lost altogether.

Lastly, *Lance* considers that the long after-treatment makes the method unnecessarily expensive and protracted. But he admits that if one keeps on long enough, there may be patients who can both walk and sit without difficulty. The reason for this is, according to *Lance*, that the angle-point of the osteotomy gradually gets worn down and rounded off, and this shows that there is no question of an osseous support in the acetabulum. In bilateral cases, *Lance* counsels great care, especially with elderly patients, for there is great danger of a considerable reduction of the mobility, and even if this can be tolerated in unilateral cases, it is intolerable in bilateral ones. His opinion is that the bifurcation means an increased shortening of 2 to 4 cm, i. e. a grave disadvantage. He finds the gait ugly; so did *Hahn* and *Loeffler*. Finally he cites the risk of relapse mentioned by *Froelich*, which is caused more especially, he thinks, by a bad callus at the place of the osteotomy and the traction of the pelvotrochanteric and adduction musculatures. *Lance* even asserts that the bifurcation operation is attended with a special risk of relapse.

Noré-Josserand also professed his misgivings. He had treated six cases, and found that the disadvantages that accompanied the bifurcation operation were not so great as he had expected. No marked reduction in the power of motion or ankylosis was to be feared as a rule, unless the abduction was made too great. On the contrary, he considers that the nearthrosis obtained after the osteotomy does not sufficiently fix the hip-joint. A recumbent patient has a considerably smaller degree of fixation than a patient who throws weight on the leg, and the active flexion in a lying position is therefore bad. The result of the operation varies from case to case, for not only do the angle of abduction when loaded and the external pressure play their part, but also the tension in the soft parts. Even a successful bifurcation does not yield such a firm support as a radiogram taken from in front seems to show. If a patient is studied by X-rays, we can see that with an outward rotation of the leg the

point of the angle moves forward from the pelvis, and in a number of instances the angle disappears altogether. The pelvis is then without support. There can therefore never be any question of a real reposition of the angle of the osteotomy into the cavity. As a matter of fact, the acetabulum is filled up with fibrous tissue and covered by a thickened capsule which prevents reposition. In most cases, it is possible to palpate the osteotomy angle in Scarpa's triangle, for the upper fragment seldom points straight into the acetabulum, but downwards and forwards. The gait is certainly improved, but it is ugly because most patients are troubled by the position of the abduction and the shortening.

In fine, *Nové-Jossierand* does not regard the bifurcation as marking any real progress. The results are as good with the other osteotomies, which, being less risky, are therefore preferable.

During a visit to *Lorenz's* clinical hospital in Vienna, *Reich*, the American, became an enthusiast for the *v. Baejer-Lorenz* method, and in 1925 he published his experience of 5 cases, all operated between 1923—1924. *Reich* holds exactly the same point of view as *Lorenz* and *Hass* with regard to indications, the technique of the operation, its after-treatment and result; also as regards the correction of a possible shortening. His conclusions are: The bifurcation operation is indicated in all cases of irreducible luxations of the hip-joint in which the acetabulum is not very shallow or the caput femoris is fixed in an extra cavity.

Any procedure must, above all, aim at eliminating the lordosis, for that proves that the pelvis has found a firm support. Although an ideal method should give an anatomically correct result, and the bifurcation is only a palliative measure, yet it yields such good results and is so safe that it can be recommended. Moreover, it does not require an especially long treatment: as a rule, 16 weeks at most suffice.

Colonna, too, is of the same opinion. He thinks, contrary to *Lance* and *Nové-Jossierand*, that the method is best in the bilateral cases of irreducible congenital luxation of the hip-joint. In unilateral cases there is, according to *Colonna*, the disadvantage that the already shortened leg becomes still shorter after the operation.

At the Graz Congress *Lorenz* mentioned a number of different conditions of disease and deformity suited for treatment by the so-called bifurcation operation (see above).

Since then *Hass* has advocated the same cause, and these two have been backed by others who advise the subtrochanteric osteotomy for defective conditions of the hip-joint. (*Loeffler, Schösz, Kienle, W. J. Galland, C. S. Löwendorf*).

In a good number of cases of luxatio coxae cong. irrepon. I have performed either the bifurcation operation of the »low osteotomy«. Furthermore, I have published a paper on the subtrochanteric osteotomy. The osteotomy varied according to the individual circumstances, being now made linear, now wedge-shaped, but always with a view to obtaining a firm osseous support for the caput fragment that remains in the acetabulum.

Finally, I have also performed a number of osteotomies for osteomyelitic luxations, and in a few cases of coxa vara cong. in elderly patients, I have extirpated the caput femoris and then performed an osteotomy on the femur, a method suggested by *Schanz*.

As I have become doubtful of the value of this treatment for cases of lux. cox. cong., I have made a subsequent examination of these cases to see what results were obtained, and to see what light they throw on a number of debated questions. The material does not suffice to exhaust these problems, but the result are illustrative enough to be worth publishing.

For each hip-joint I have tried to consider the following questions:

- I. The osteotomy and the angle of osteotomy.
- II. The mobility and its centre, and how the pelvis is supported with different positions of the leg.
- III. The posture of the body and the ability to walk.

This subsequent examination was started in the autumn of 1933. The oldest case was operated on 18/8 1925, the last (case no. 27) on 31/8 1932. All the patients have been summoned here and examined, both clinically and radiographically. The X-rays were carried out at the Allmänna Sahlgrenska Hospital by Dr.

C. G. Zachrisson, after I had explained to him the questions that I desired radiographically answered. I am greatly indebted to him for the care and interest he has devoted to the work. All the hip-joints have been taken in various positions, both in the usual manner and stereoscopically, and the mobility of the hip-joints studied by means of X-rays.¹⁾

My method of treatment does not differ from what has already been indicated, both as regards bifurcation and Schanz's »low osteotomy«. For the sake of completeness, however, I shall here state my method.

1. *The bifurcation operation*

The patient is anesthetized on an Albee table with legs fastened in a parallel position. The osteotomy is then performed right in front of the place where *Arteria femoralis* pulsates beneath the *Ligamentum inguinale* (right in front of the acetabulum). I aim at avoiding sharp points and splinters, and chisel right through the bone. As far as is possible, I try to shape a lower fragment point that is not too sharp. I never perform Hass's oblique osteotomy, nor do I aim at a perforation of the capsule. It seems to me to be much better to retain the soft parts between the lower fragment and the acetabulum; the risk of ankylosis is diminished, and the patient has the advantage of not suffering the danger of damage to the cartilage. Immediately after the chiselling-off, the leg is abducted, and at the same time I attempt, by holding the recumbent patient round the buttocks, to lift the point of the angle in towards the acetabulum. The leg is abducted so much that a goniometer placed with one arm in the longitudinal direction of the leg and the other along the connecting-line between *Spin. iliae anter. super.* shows an angle of 140° to 145°. The soft parts are then sutured and a large hip plaster of Paris is applied, this remains for 8 weeks. A week after the operation X-rays are taken to see whether the desired angle has been obtained between the frag-

¹⁾ The reproductions of the X-rays could not, of course, visualize the true facts, as they only show the sides of the angles lying in the same plane, and not, as the facts are, in different planes.

ments; if not, the position is corrected. It should be noted that at the old clinique in Gothenburg X-ray photography was not available. All the cases were photographed at the Allmänna Sahl-grenska Hospital. Control photographs only exist, therefore, for cases operated after 1/7 1928; this may affect the earlier results. The after-treatment consists of massage, baths and walking-exercises. This also goes on for 8 weeks. More than one side was never operated at the same seance.

II. Schanz's »Low osteotomy«.

The operation was likewise performed on an Albee table, and only one side at a time; this was adhered to in spite of the fact that there was, practically speaking, no risk of ankylosis. The angle between the fragments was determined as Schanz has indicated it, (see p. 6), and in many cases I have also used Schanz's long screws. For the rest, the operation proceeds analogously with what has been stated above. In these cases, too, the patient is kept in plaster of Paris for 8 weeks, and the after-treatment also lasts 8 weeks.

My material is based on 30 patients, 29 of whom had congenital luxation of the hip-joint, and one, No .17, an insufficiency of the hip-joint, probably owing to a septic process in his youth. 17 of the cases are single, and 13 double-side; 43 hips in all. 3 are males, the others females. Of the males one had a double-sided luxation. He was operated at the age of 10. The two others were operated at the ages of 9 and 16, respectively. Of the females with double-sided luxation one was 9 years old, 4 were 10, and 2 were 14 years old. The ages of the others were 15, 17, 19, 23, and 37, respectively. Thus, patients of all ages. Of the female patients with single luxation, one was 5 years old. She had originally had a double-sided luxation, but one side was replaced bloodlessly by Lorenz's method; the other side had been repeatedly replaced. One patient was 9 years old, three were 10, two were 11, one 14, three 16, and two 35. The four others were 21, 23, 30, and 43, respectively. In 10 of these 30 patients Schanz's low osteotomy was performed (Nos. 8, 10, 11, 12, 13, 14, 17, 19, 21, and 30). Of these 10 cases 3 were bilateral, 7 unilateral, i. e. 13 hips in all.

The cases dealt with below are given in the order in which they were admitted to the clinique, but they have also been provided with a special number for this publication, from 1 to 30. Thus, if case 8 is mentioned, and I wish to point out that it is the right or left side, this is marked No. 8 R (right) or No. 8 L (left).

At the bifurcation operation, the abduction is generally calculated at 35° to 45° , as previously mentioned. In some exceptional case, e. g. No. 29 R, the abduction was made less, because the caput had been fixed in an extra cavity. Like Hahn, I have found it difficult to get the angle exact with the Lorenz bifurcation operation, owing, of course, to great mobility in the upper fragment. When the angle between the fragments was measured after the operation, it varied very considerably, as shown by Table A.¹⁾ What strikes me as the weakest point about the Lorenz operation is that it seems to be a mere chance if, at the operation, the desired angle is immediately obtained.

The picture obtained from the radiogram after removal of the plaster of Paris is not a lasting one. During the next few years, a post-operative moulding takes place, that it, not only the point of the angle of osteotomy is rounded off and worn down, but it also becomes coated over, so that all unevennesses disappear, and in many cases the angle of osteotomy becomes more or less straightened out after a few years (see Table A).

The bifurcation operation has been performed on 20 persons altogether, half of whom had a bilateral luxation, i.e. 30 hip-joints in all. In two cases, only a medial displacement of the diaphysis femoris had taken place, and an angle of osteotomy in the Lorenz sense of the word is thus lacking in these cases (No. 3 L and No. 9 L). I also considered it advisable to omit the cases in which the straightening-out amounts to 5° at the most, for a certain faulty percentage must of course be present.

If we examine the remaining cases (see Table D), we shall

¹⁾ The extent of the variation is between 115° and 155° , i.e. 40° . The greatest abduction 65° will be seen in case 23 R; the least 25° in case 29 R.

find that an actual straightening-out took place in 16 cases, though not over 10° in 5 cases (Nos. 15 R, 16 R, 20 R, 22 L, 25 R), and a maximum of 15° in 3 cases (Nos. 1 L, 23 R, 25 L).

In 8 cases there was consequently a considerable variation in the straightening-out, between 20° — 25° — 30° up to complete relapse (1 R, and 29 R).

Several factors may have influenced this straightening-out.

It is probable that very young patients in whom the development of the skeleton is not complete, have a marked disposition to favour plasticity, and also that the callus is, in the early stage, comparatively plastic and pliant; moreover, both weight and the shape of the pelvis must also play a part. In a standing position, the weight of the body is thrown on to the pelvis, which rests either on the most projecting part of the angle of osteotomy or on the upper fragment.

The feet are fixed against the ground and the trochanter major of the pelvotrochanteric musculature. The funnel-like, wedge-shaped pelvis exercises pressure in the direction of the line of the joint as well as towards the sides, a sort of spraying effect.

All these factors undoubtedly play a part, though it is impossible to say which is the decisive one.

It cannot be the age alone, even if patient No. 1 is 15 years old, No. 2 11, No. 4 10, No. 18 also 10, No. 20 14, and No. 26 also 14; however, the seventh patient, No. 27, is 19, and there, on the right side, a 30° straightening-out has taken place, and in case No. 29, who is 23 years old, a relapse has even set in.

In the cases where the pelvis rests on the caput and where the diaphysis forms a direct continuation in the perpendicular direction, just as in the cases where the acetabulum is suspended on a part of the lower diaphysis, like a hat on a peg (5 R and 15 L), no such straightening-out has taken place. The former cases represent coxa valga position with caput subluxated (3 L, 6 L and 9 L).

If we examine the cases where the Schanz operation was performed, we shall find (see Table A) that of the 13 hip-joints straightening-out had taken place 8 times, though in 3 cases

not more than 10° (14 R, 17 L and 19 R). Two have straightened out 15° (No. 11 L and 13 R), and one (No. 11 R) no less than 30° . Moreover, 10 L and 12 R are straightened-out to the point of relapse.

The patients whose straightening-out is very considerable, Nos. 10, 11 and 12, are all between 5 and 10 years of age. Those with a slight (10°) one, or none at all, are all older (16, 21, 30, 35, 37).

From what I have adduced, it would therefore be prudent, in my opinion, *not to perform this operation on patients in their early years, and certainly not in childhood.*

It is of paramount importance to establish the function in a hip-joint where a bifurcation operation or a low osteotomy has been performed. Only in a small number of the cases of the bifurcation operation does one succeed (No. 5 R, 15 L) in getting part of the lower fragment to remain in the acetabulum. In these cases all movements take place round the part of the lower fragment as a centre within the acetabulum. To this belongs also No. 17 L, where a low osteotomy was performed, but where a remnant of the collum remains in the acetabulum, and where all movements take place round this bone-pivot.

It is far commoner for the point to lie below, or below and in front of, or even laterally below the lower compass of the acetabulum, and the boundary between what may be called a »low bifurcation« of this kind and Schanz's osteotomy then becomes undefined. We must take into account that when weight is thrown upon it, the upper fragment is displaced upwards along the side of the pelvis. In either case the movements will evidently become similar.

If then the boundaries between what I may call the low bifurcation and Schanz's low osteotomy are undefined as regards the height taken up by the upper fragment, the similarity becomes still more marked if we study it from the functional view-point.

As I have mentioned, it is difficult, with the Lorenz operation, to get the point of the lower fragment to point right into the acetabulum, and there is also a certain risk of ankylosis.

In most cases the point of the acetabulum stands, instead, in proximity to the acetabulum. From the place of the osteotomy, the upper fragment shall in such cases, when in a middle position and in good function, be directed obliquely upwards laterally and backwards, and the angle consequently be open backwards and outwards. The same is the case with »the low osteotomy«. The difference is only that the place of the osteotomy, calculated from the point of the trochanter, lies somewhat lower down on the diaphysis in the Schanz cases. What is most interesting in these cases appears to me to be the manner in which the rotation movement is performed.

With inward rotation the point of the angle is directed to a greater extent in towards the acetabulum. At the same time, the opening of the angle is directed—when the movement is maximal—laterally or almost laterally. This means that the pelvis is well supported both in a middle position and with inward rotation. With outward rotation from the middle position the caput-collum part performs a rotary movement backwards and medially, and the opening of the angle is, in the same proportion as the movement increases, directed almost or entirely backwards. With this the point of the angle rotates out from the pelvis, which then loses its support more and more the greater the outward rotation becomes. Round what, then, does this rotation take place? *Wittek* has emphasized that it is impossible to imagine a movement round two centres, and this is, of course, true.

After most cases of bifurcation, as well as after a Schanz operation, the pelvis gets supported in surface. Gliding-planes arise, a kind of pseudarthrosis-like phenomenon, peculiar to these cases. Between the wall of the pelvis and the supporting part of the diaphysis there is more or less thick layer of soft part, which conditions the mobility between these gliding-planes. These may vary very considerably in superficies, and may be displaced on the upper fragment from the place of the osteotomy up towards the trochanter-collum part. The variations are extremely great.

A mention in the present cases and X-rays reports of the

movement centre does not therefore mean a central point but, somewhat figuratively the central part in the gliding-joint that is being spoken of. In other words, the movement-centre corresponds to the central part of the gliding-plane that supports the pelvis. All movement consequently takes place here, though, naturally, round different axes. If we look at the cases, handled here, we shall find that this form of function occurs in the following cases where bifurcation was performed: 2 L, 4 R & L, 7 L, 15 R, 16 R, 18 L, 20 R & L, 22 R & L, 23 R & L, 24 R & L, 26 L, 27 R & L, 28 R and 29 L. As regards Schanz's cases, we have the same state of things in cases 8 R, 10 L, 11 R & L, 12 R, 13 R & L, 14 L, 21 L and 30 R.

Lastly, there is a somewhat more unusual type of movement. In such cases, the osteotomy has produced a kind of straightening-out of the collum-diaphysis angle, or the diaphysis, after the osteotomy, has merely been displaced medially in relation to the caput. In both cases, the caput stands, moreover, in an extra cavity, the whole being very much like a coxa valg. position, with caput standing in a subluxated position. In these cases, all movements take place round the caput. Such cases are Nos. 3 L, 6 L and 19 L; the last a Schanz operation. Where the trochanter was considerably dislocated upwards, as is especially frequent in old patients, and where there was consequently a danger that the osteotomy might lead to ankylosis, I have performed Schanz's low osteotomy, which I consider to be free of risk in this respect. To risk ankylosis in conjunction with a considerable shortening of the leg, I regard as aggravating the patient's condition.

For the sake of completeness, I may here record that the osteotomies were performed at very varying heights, from the intratrochanteric osteotomies for a number of bifurcation operations to a distance of 14 cm. from the point of the trochanter (see Table B).

I do not think there is any risk of pseudarthrosis, either with the Lorenz bifurcation operation, or with Schanz's low osteotomy. Nor have I observed any risk to the vessels in the front of the thigh.

During the first few years, while I was, so to speak, still feeling my way, I exposed the angle of osteotomy and rounded it off once or twice when the point of the osteotomy angle had been very prominent in front, an operation which is extremely simple, and which only retards the healing by some 10 days. Latterly I have not done this. As the cases show, I could, in the final status of a number of cases, palpate the angle of osteotomy in Scarpa's triangle, without this being of any risk to the patient, or causing him any discomfort: (8 R, 8 L, 14 R, 19 R and 27 L).

With regard to the risk of ankylosis, there are two cases that are worth noticing, viz. 6 R and 27 R. The former represents a firm osseous healing process between the angle of osteotomy and the pelvis. The medial projecting part of the lower fragment has perforated the soft parts that had covered the acetabulum, and an injury on the cartilage of the joint may be assumed. This gradually led to a complete ankylosis as related by *Nové-Josserand*, *Lance* and *Loeffler*. It should be remarked that the patient did not feel any discomfort until 10 days after the leg had been brought down into a parallel position. It began with pain, and the mobility of the leg rapidly decreased.

The other case shows that if the caput is fixed in an extra cavity, this constitutes a sort of contra-indication. In No. 27 R an extra cavity was discovered, in point of fact, but I erred in taking it to be so shallow that there could scarcely be any risk of reduced function. After removal of the plaster, the patient had good mobility to begin with, and he had no very great difficulty in bringing the leg down to a parallel position, but during the after-treatment the mobility diminished more and more until at last there was a real ankylosis, with inflected and adducted position, with shortening and increased lordosis.

To restore the mobility, the caput had to be extirpated. At the operation, it was discovered that the caput and the capsule of the joint had been firmly soldered together, which bound the caput firmly against the wall of the pelvis. That the occurrence of an extra cavity constitutes a contra-indication has been clear-

ly pointed out by *Hass* in his controversy with *Witteck*. But the contra-indication is not absolute. In many cases an extra cavity has occurred (see the X-rays reports) without this giving rise to any complications. The reason probably is that not only are the extra cavities generally very shallow, but also that the capsule of the joint is so wide and slack that the head is practically free. In many cases where the extra cavity is too deep, the easily performed extirpation of the caput should promise well for a satisfactory result.

Both the bifurcation operation and Schanz's osteotomy result in normal lordosis in the great majority of cases, and with that the prospect of a good carriage. But this also depends upon the degree of shortening. If it does not amount to more than 3 cm., or at the most 4 cm., it can satisfactorily be compensated by elevating the heel. Table C shows the shortening, before and after the operation (at the final status). As a rule the operation increases the shortening by one or two cm. In rare cases the femur may be lengthened a couple of cm. by the operative procedure. (See case 7). If there is a danger of the shortening being too great, which may happen especially in unilateral cases, we shall find a certain contra-indication. In a number of cases, however, e.g. 3, 14 and 17, I found that, in spite of considerable shortening (7 and 11 cm., respectively), the patients were very well satisfied with their condition after the operation. Practically without exception, following on a successful bifurcation operation or low osteotomy, walking is painless and the patient can go a long distance without becoming tired. In a great number of cases these patients have a good enduring mobility, though rarely as good as that of a perfectly healthy person.

As a standard for a satisfactory endurance, I have taken such data showing that patients can move about all day in their profession or such statement purporting that they can walk about 3 miles. I shall particularly mention the following cases:

No. 3, who keeps her house like a healthy person;

No. 5, who works without difficulty as farming pupil and executes the same work as his healthy comrades;

Nr. 17, moving about all day and attending to a big boarding-house on the West Coast;

No. 21, who moves about both outside and inside, supervising and leading the work in a big public school.

Moreover, patients Nos. 2, 4, 9, 10, 12, 13, 15, 16, 18, 20, 21, 23, and 24 show a good endurance, even if it is not normal.

Only the two cases of ankylosis Nos. 6 and 27, mentioned before, and cases Nos. 1, 7 and 29 do not show any satisfactory improvement of gait and endurance.

It is very exceptional when these patients obtain a nice gait. As a rule they always limp, waddle or jerk, in a word, their gait is ugly. The gait is best when a point or a part of the lower fragment resides in the acetabulum, as in case No. 5. However, the shortening must not be too pronounced.

SUMMARY

Both the Lorenz bifurcation operation and Schanz's low osteotomy are safe operations for the patients and can absolutely be recommended, when the patient has pains and shows reduced mobility powers. From the social point of view, the relatively long treatment does not play any part, since the patient can reckon to become able to earn.

From the technical point of view, the osteotomy is in fact easy to perform, but the Lorenz bifurcation has a big disadvantage, in this that it is difficult to obtain the exact abduction angle required, and it is difficult to fit the middle part of the lower fragment into the acetabulum. Sharp points must be avoided. The upper fragment must lie on the lateral part of the lower fragment and from there be directed in a middle position outwards, upwards, backwards (not vertical).

In successful cases the Lorenz bifurcation gives the best results but the bifurcation also gives rise to a certain risk of ankylosis not found in the low osteotomy.

Compared with the functional results that can be obtained, the increased shortening only plays, in most cases, an inferior part.

None of the methods must be used, except in desperate cases, before the patient has reached 15 years, as otherwise there is a certain risk of relapse.

RÉSUMÉ

La bifurcation de Lorenz et l'ostéotomie basse de Schanz sont toutes deux des opérations n'offrant aucun risque pour le malade et sont à recommander lorsque le malade se plaint de douleurs et présente une mobilité réduite. Du point de vue social, le traitement relativement long ne joue aucun rôle, puisque le malade aura ensuite la possibilité de gagner sa vie.

Du point de vue technique, l'ostéotomie est, en réalité, facile à exécuter, mais la bifurcation de Lorenz présente un grand désavantage, en ceci, qu'il est difficile d'obtenir l'angle d'abduction exact exigé et de bien ajuster la partie médiale du fragment inférieur dans l'acétabulum. On devra éviter les pointes acérées. Le fragment supérieur devra être placé sur la partie latérale du fragment inférieur et, de là, être dirigé en position médiale, en dehors, en haut, en arrière (non verticalement).

Dans les cas réussis, la bifurcation de Lorenz donne les meilleurs résultats, mais la bifurcation comporte aussi un certain risque d'ankylose que l'ostéotomie ne présente pas.

Comparé aux résultats fonctionnels pouvant être obtenus, le raccourcissement plus grand survenant ne joue, dans la plupart des cas, qu'un rôle secondaire.

Aucune de ces méthodes ne devra être employée, excepté dans les cas désespérés, si le malade n'a pas atteint l'âge de 15 ans, car dans le cas contraire on risque une récurrence.

ZUSAMMENFASSUNG

Die Bifurcation von Lorenz und die niedrige Osteotomie von Schanz sind beide für den Patienten gefahrlose Operationen und können empfohlen werden, wenn der Patient Schmerzen hat und verminderte Beweglichkeit zeigt. Vom sozialen Standpunkt gesehen spielt die relativ lange Behandlung gar keine Rolle, da der Patient mit Verdienstmöglichkeiten nachher rechnen kann.

Vom technischen Standpunkt gesehen, ist die Osteotomie tat-

sächlich leicht auszuführen, die Lorenz'sche Bifurcation aber hat einen grossen Nachteil, da es schwer ist, den genauen erforderlichen Abduktionswinkel zu erhalten, und den medialen Teil des unteren Fragmentes in das Acetabulum hineinzupassen. Scharfe Spitzen müssen vermieden werden. Das obere Fragment soll auf dem lateralen Teil des unteren Fragments liegen und davon in einer mittleren Stellung, auswärts, aufwärts, rückwärts (nicht senkrecht) gerichtet werden.

In gelungenen Fällen gibt die Lorenz'sche Bifurcation die besten Resultate, jedoch zeigt die Bifurcation eine gewisse Ankylosgefahr, welche in der niedrigen Osteotomie nicht vorkommt.

Im Vergleich mit den funktionellen Resultaten, welche erhalten werden können, spielt die vermehrte Verkürzung meistens nur geringe Rolle.

Keine von diesen Methoden soll gebraucht werden, ausgenommen in verzweifelten Fällen, bevor der Patient 15 Jahre ist, da andernfalls eine gewisse Rezidivgefahr vorliegt.

TABLE A.
Showing angle of osteotomy in degrees.

Bifurcation.

Case	Side	Age at op.	After op.	Final condition.
1.	R	15	120	140
	L		120	135
2.	L	11	130	150
4.	R	10	140	140
	L		140	160
5.	R	16	140	140
6.	L	10	130	130
7.	L	23	150	150
15.	R	17	120	130
	L		130	135
16.	R	10	140	150
18.	L	10	120	150
20.	R	14	135	145
	L		125	150
22.	R	10	145	145
	L		135	145
23.	R	9	115	130
	L		130	130
24.	R	10	145	145
	L		150	155
25.	L	43	140	155
26.	L	14	130	150
27.	R	19	120	150
	L		125	125
28.	R	11	130	140
29.	R	23	155	straightened-out
	L		150	150

Schanz.

Case	Side	Age at op.	After op.	Final condition.
8.	R	37	135	135
	L		140	145
10.	L	9	130	straightened-out
11.	R	10	115	145
	L		125	140

TABLE A.
Schanz (cont.)

Case	Side	Age at op.	After op.	Final condition.
12.	R	5	140	straightened-out
13.	R	14	135	150
	L		135	150
14.	R	30	130	140
17.	L	35	110	120
19.	R	21	115	125
21.	L	35	130	130
30.	R	16	140	140

TABLE B.

Showing distance of osteotomy-angle from point of trochanter major.

Bifurcation.

Case	Side	Cm.
1	R. & L.	10
2	L.	9
3	L.	Intertrochanter
4	R. & L.	8
		10
5	R.	Intertrochanter
6	L.	10
7	L.	10
9	L.	Intertrochanter
15	R. & L.	8
16	R.	9
18	L.	9
20	R. & L.	10
22	R. & L.	9
		8
23	R. & L.	8
		7
24	R. & L.	8
25	L.	9
26	L.	8
27	R. & L.	10
		11
28	R.	9
29	R. & L.	9

Schanz.

Case	Side	Cm.
8	R. & L.	10
		14
10	L.	12
11	R. & L.	10
12	R.	9
13	R. & L.	13
		11
14	R.	14
17	L.	9
19	R.	12
21	L.	11
30	R.	11

TABLE C.
Showing shortening.

Bifurcation.

Case	Side	Age at op.	Before op.	Final condition.
1	L.	15	2 cm.	2 cm.
2	L.	11	5 »	5 »
3	L.	10	4 »	7 »
4	—	10	none	none
5	R.	16	4 cm.	6 cm.
6	R.	10	?	3 »
7	L.	23	9 »	5½ »
9	L.	16	4 »	2½ »
15	L.	17	1 »	1 »
16	R.	10	5 »	7½ »
18	L.	10	5 »	7 »
20	R.	14	?	2 »
22	—	10	none	none
23	R.	9	none(?)	2 cm.
24	R.	10	3 cm.	3 »
25	L.	43	5 »	6 »
26	L.	14	2 »	5 »
27	—	19	none	none
28	R.	11	4 cm.	6 cm.
29	—	23		Relapse

Schanz.

Case.	Side.	Age at op.	Before op.	Final condition.
8	L.	37	none	1 cm.
10	L.	9	4 cm.	4 »
11	L.	10	none	3½ »
12	R.	5	2½ cm.	2½ »
13	L.	14	none(?)	1 »
14	R.	30	7 cm.	11 »
17	L.	35	9 »	11 »
19	R.	21	4 »	6 »
21	L.	35	6 »	6 »
30	R.	16	4 »	5 »

TABLE D.

Showing position of point of angle and centre of movement.

Bifurcation.

Case.	Situation of pt. of angle.	Angle straightened No. of degrees.	Centre of movement.
1 R	1 full cm. below and in front of lower part of anterior edge of acetabulum	20°	Trochanter minor
1 L	do.	15°	Trochanter minor
2 L	A good 2 cm. below upper part of acetabulum on a level with lower edge of cavity	20°	In the ilium immediately above acet.
3 L	Point of angle almost entirely lacking	—	Caput
4 R	1 cm. laterally and below the central part of acetabulum	0	Caput
4 L	do.	20°	Caput
5 R	Point of lower fragment in acetabulum	0	Point of angle
6 R	Anchylolysis	—	—
6 L	c. 3 cm. below lower front edge of acetabulum	0	Caput
7 L	Towards upper part of acetabulum	0	Upper part of acetab.

Table D. Bifurcation (cont.)

Case.	Situation of pt. of angle.	Angle straightened No. of degrees.	Centre of movement.
9 L	Subluxation position	—	Caput
15 R	Immediately in front of anterior edge of acetabulum	10°	Round a point in the basal part of the upper side of angle
15 L	In acetabulum	5°	Point of angle
16 R	A good 2 cm. below the upper part of the top of the cavity	10°	On middle of the upper side of angle
18 L	2 cm. below acetabulum	30°	Middle of upper side of angle
20 R	Somewhat in front of and below anterior edge of acetabulum	10°	On upper side of angle near top of trochanter major
20 L	Just laterally of upper edge of cavity	25°	Near middle of upper side of angle
22 R	Below the edge of the acetabulum, in front of it laterally	0	Caput and collum
22 L	do.	10°	Caput and collum
23 R	c. 1½ cm. laterally and below the anterior, lower edge of the cavity	15°	Mainly the extra cavity
23 L	do.	0	do.
24 R	Immediately beside and on a level with the anterior edge of the cavity	0	Upper side of angle near collum. (Trochanter major).
24 L	do.	5°	do.
25 L	A few cm. to the side of acetabulum	15°	Just below collum

Table D. Bifurcation (cont.)

Case.	Situation of pt. of angle.	Angle straightened No. of degrees.	Centre of movement.
26 L	c. 2 cm. to the side of the anterior edge of cavity on a level with the middle part of the acetabulum	20°	Upper side of angle near collum
27 R	Below and in front of lower edge of acetabulum	30°	On upper side of angle in middlemost part
27 L	Just in front of and below anterior edge of acetabulum	0	In the middle of the upper side of angle
28 R	On a level with anterior edge of acetabulum, c. 1 cm. below middle	10°	Immediately above the acetabulum
29 L	Immediately below upper edge of acetabulum	0	Middle part of upper side of angle at the medial edge

Schanz's osteotomy.

Case.	Situation of pt. of angle.	Angle straightened No. of degrees.	Centre of movement.
8 R	Immediately below and in front of the edge of the acetabulum	0	Middle part of upper side of angle
8 L	In fixed external rotation just above lower edge of pelvis	0	Caput-trochanter section
10 L	Middle of acetabulum	almost straightened out	Caput
11 R	Just below anterior edge of acetabulum	30°	Region of trochanter section
10 L	Middle of acetabulum	almost straightened out	Caput

Table D. Schanz' osteotomy (cont.)

Case.	Situation of pt. of angle.	Angle straightened No. of degrees.	Centre of movement.
12 R	c. 10 cm. below and just in front of acetabulum. Trochanter minor is on a level with cavity edges	20°	Middle part of upper side of angle (almost straightened out)
13 R	c. 3 cm. below anterior, lower edge of acetabulum	15°	Near trochanter major
13 L	do.	0	do.
14 R	c. 3 cm. below anterior, lower edge of acetabulum	10°	Caput region
17 L	Stump of collum in acetabulum. Point of angle at lower edge of pelvis	10°	Stump of collum
19 R	2 cm. below and in front of lower, anterior edge of acetabulum	10°	Caput
21 L	2 cm. below lower part of acetabulum	0	In lower half of upper side of angle
30 R	Just in front and c. 1 cm. below lower edge of cavity	0	Middle part of upper side of angle

CASE HISTORIES

A. Cases of Bifurcation operation.

No. 1 (6954) Female, Aet. 15. S. A. J.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Waddles, soon tires; left leg 2 cm. short.	Anamnesis Walking capacity pains shortening before op.	<i>Final condition on 12/12 33.</i>
Bifurcation on both sides. Right side 27. 11. 26. Angle of osteotomy 120°. Left side 22. 1. 27. Angle of osteotomy 120°. On the left side a sharp end points from the lower fragment right into the acetabulum.	Operation angle of osteotomy in degrees	
The first radiogram taken on the right side has been lost. There is no radiogram until 3 years after operation.	Notes	
8 years.	Time since op	
Limps, walks out for 2 or 3 hours, but becomes tired and gets pains.	Type of walk and time	
Lordosis normal; Trendelenburg on the right side is weakly positive, on left side negative.	Lordosis Trendelenburg	
Left leg 2 cm. short.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Maximum 10° to 15° on both sides.	Inflexion	
10° on both sides.	Abduction	
Right side 15°, left side lacking.	Adduction	
None.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 12. 12. 1933.

Angle of osteotomy. Rt. side c. 140°, left c. 135°

Distance of angle from apex of trochanter. C. 10 cm. on both sides.

Appearance. Rt. side, slightly rounded off; same on left side.

Point of the angle formed by lower fragment in both cases. Angle directed obliquely backwards and outwards.

Position of the angle in central position. Rt. side: point of angle lies a full cm. below and in front of lower part of anterior acetabular edge. Trochanter minor points into the middle part of acetabulum. Upper side of angle parallel with anterior edge of acetabulum. Left side: the same, except that the trochanter minor part and the part of the angle-side lying below it forms a surface which is separated by a column of a mm.'s breadth or so from the acetabulum area, which is so transformed that it has become similar in form to the adjoining parts of femur. In the lower parts the crevice is partly blotted out.

Position and appearance of collum and caput. Both well developed on both sides. Collum vertically directed.

Extra socket. A small one immediately above acetabulum directed obliquely backwards and outwards.

Acetabulum. Rt. side: slightly filled up. Left side: transformed according to the adjoining upper side of the angle.

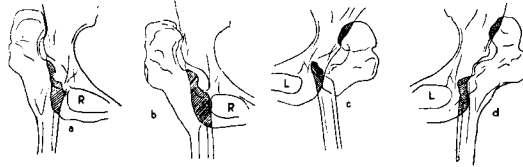
Position of angle with inward and outward rotation. Right side: slight movements round trochanter minor section. Left side: no movements demonstrable in the radiogram.

Position of collum and caput. See above.

Centre of movement. Right side: trochanter minor section.

Standing position as in lying.

Notes



1 R. 1 a = Middle position 2½ years after op. — 1 b = Middle position, lying.
1 L. 1 c = Middle position op. — 1 d = Middle position, lying.

No. 1. — SUMMARY. — Angles of osteotomy straightened out; on left side from 120° to 135°, on right side from 120° to 140°. The sharp point on left side worn down. Angles of osteotomy open on both sides obliquely backwards and outwards. On both sides, the point lies 1 cm. below anterior part of anterior edge of acetabulum. Centre of movement, on both sides, is at trochanter minor region. The pelvis is well supported on the left side, but on the right the diaphysis glides upwards somewhat before Trendelenburg becomes negative. Position is good, but ability to walk is not satisfactory. Limbs. Shortening is unchanged.

No. 2 (7733). Female, aet. 11. A. L. K.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Attempt at bloodless reposition was made at the age of 5, but was unsuccessful. Left leg 5 cm. short. Tires very quickly when walking, and then complains of pain.	Anamnesis Walking capacity pains shortening before op.	<i>Final condition on 12/12 33.</i>
Bifurcation. Left side, 6. 5. 31. Angle of osteotomy 130°.	Operation angle of osteotomy in degrees	
2½ years.	Time since op.	
Limbs without raised heel. Normal walk since heel was raised. Moves indoors all day long, about 2½ miles out of doors.	Type of walk and time	
Lordosis normal. Trendelenburg negative.	Lordosis Trendelenburg	
5 cm. Heel raised 4 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Passive inflexion normal, active inflexion 40°.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
External rotation normal, internal lacking.	Rotation	
No palpation.	Angle of osteotomy stretched to	

X-rays on 13. 12. 1933.

Left hip:

Angle of osteotomy 150°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter on the film 9 cm. (reduced measure c. 8 cm.).

Appearance: rounded off, with indication of jaggedness. Inconsiderable spool-shaped swelling in immediate proximity to angle.

Point of the angle formed by distal fragment of femur.

Position of the angle in central position in lying position a full 2 cm. below upper part of acetabulum, i.e. on a level with lower edge of socket. The upper side of angle runs parallel with anterior upper edge of socket, c. 2 cm. below it. Medial edge of lower side of angle reaches in height to lateral edge of socket.

Position and appearance of collum and caput. Slightly atrophied. Collum directed chiefly vertically. Caput lies immediately lateral of and behind ilium, c. 9 cm. above bottom of socket.

Extra socket is lacking.

Acetabulum blocked up.

Position of angle with inward and outward rotation. With attempt at inward r. same position as in middle position. With outward r. the angle of osteotomy moves laterally. At the same time caput and collum shift medially. The centre of movement lies in the ilium part just above acetabulum.

Position of collum and caput. See above.

Centre of movement. See above.

Standing position. Mainly unchanged position of femur in relation to pelvis. Upper side of angle approaches socket part through increased awryness of pelvis. With inward and outward rotation no displacement upwards.

Notes. Right hip; normal.



2 L. 2 a = Middle position op. — 2 b = Middle position, lying. — 2 c = Lying, internal rotation. — 2 d = Lying, external rotation. — 2 e = Standing, internal rotation. — 2 f = Standing, external rotation.

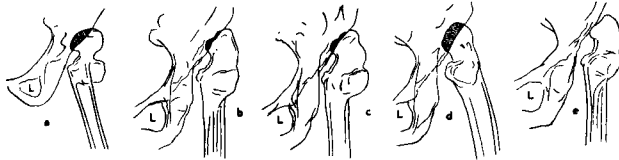
No. 2. — SUMMARY. — The angle of osteotomy straightened out from 130° to 150°. It is open obliquely backwards and outwards. The point of the angle is formed by the distal fragment. In a recumbent middle position the point is 2 cm below the upper part of the acetabulum. The centre of movement lies in the ilium region just above the acetabulum. The pelvis is well supported in a middle position and internal rotation, but not with external rotation. Ability to walk indoors normal, somewhat reduced out of doors. Limps. Bearing good. Shortening not increased.

No. 3 (7763). Female, aet. 10. E. M. A.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Limbs badly, soon tires, shortening on left side 3—4 cm.	Anamnesis Walking capably pains shortening before op.	<i>Final condition on 20/11 33.</i>
Bifurcation. Left side on 18. 8. 25. Trochanter section forms a right angle to diaphysis and almost straight continuation of femur. Caput lies within the extra joint-socket. X-rays (von Bergen) on 21. 6. 27: »An osteotomy just below Trochanter minor has resulted in a healing-together with the lower fragment in front of the upper one, and c. 4 cm. shortening.«	Operation angle of osteotomy in degrees	
An operative attempt was made on 12. 1. 27 to lengthen the femoral diaphysis, but without any result.	Notes	
About 8½ years.	Time since op	
Limbs very much without footgear; with raised heel there is a slight waddle. Can manage the house perfectly well.	Type of walk and time	
Lordosis normal. Trendelenburg negative.	Lordosis Trendelenburg	
7 cm., with 4½ cm. raising of heel.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 20. 11. 1933.

Angle of osteotomy. Left hip: angle almost straightened out, lies in the immediate vicinity of trochanter section, which, together with collum, is slightly deformed (lumpy). Caput atrophic, collum directed vertically. Collum part and superposed part of caput luxated c. 11 cm. upwards and lies immediately to the side of and behind the lateral edge of ilium. With inward rotation mainly unchanged position; with outward r. the caput part glides somewhat medially.

Acetabulum is shallow and rather wide. Above and to the side of it there is an indication of a shallow extra-socket. In standing position unchanged position.



3 L. 3 a = Middle position one year after op. — 3 b = Middle position, lying. — 3 c = Lying, internal rotation. — 3 d = Lying, external rotation. — 3 e = Middle position, standing.

No. 3. — SUMMARY. — Angle of osteotomy not present in this case. Collum-trochanter section forms a straight continuation of the diaphysis. The centre of movement lies in the caput. Ability to walk normal, at least indoors. Bearing good. Limps. Shortening increased from 4 cm. to 7 cm.

No. 4 (8194). Female; aet. 10. A. M. A.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bil. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Both legs of equal length; walks with troublesome limp.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Right side on 30. 10. 26, left 24. 7. 27. Right lower fragment points straight into acetabulum. Upper fragment displaced 2 cm. down on outer side of diaphysis. Angle of osteotomy on both sides 140°.	Operation angle of osteotomy in degrees	<i>Final condition on 27/11 33.</i>
7 years.	Time since op.	
Moves about indoors all day long, and can take walks of 1 to 1½ hours; does not limp.	Type of walk and time	
Lordosis normal, Trendelenburg neg. on both sides.	Lordosis Trendelenburg	
None.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 27. 11. 33.

Angle of osteotomy: right side 140°, directed obliquely backwards and outwards; left side 160°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter: right side c. 8 cm. (reduced 6½ cm). left side c. 10 cm. (reduced 8¼ cm).

Appearance. R. side: Point of angle well pronounced with a beaked

superposing that points immediately behind the front edge of acetabulum in a middle position. L. side: soft rounded-off curvature. Trochanter minor shows increased width, lies against upper edge of acetabulum in a shallow depression.

Point of the angle formed by lower fragment on right side, while on left both angle fragments are completely fused.

Position of the angle in central position: on right side c. 1 cm. laterally and below middle part of acetabulum, upper angle-side parallel with lateral edge of pelvis. Same conditions on left side.

Position and appearance of collum and caput. On right side both vertically directed. Caput lies c. 9 cm. above acetabulum on lateral edge of ala ossis ili. Same on left side.

Extra socket. Indication of one above acetabulum on right side and left.

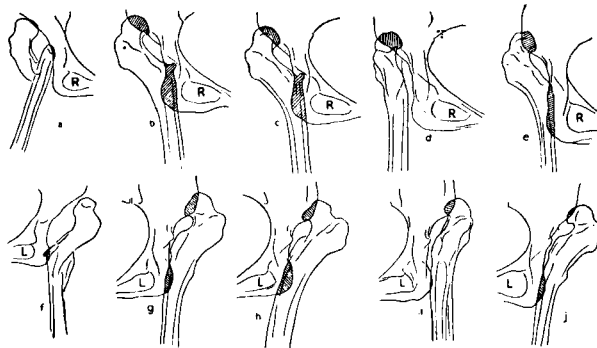
Acetabulum on both sides tolerably blocked up.

Position of angle with inward and outward rotation. With attempt at inward r. unchanged position on both sides. With outward r. the angle is directed backwards on both sides.

Position of collum and caput. Both make the indicated glide movements on both sides.

Centre of movement on both sides chiefly with caput as middle point.

Standing position. Right side: inconsiderable dislodgment upwards of caput. Left side: as in lying position.



4 R. 4 a = Middle position op. — 4 b = Middle position, lying. — 4 c = Lying, internal r. —
4 d = Lying, external r. — 4 e = Middle position, standing.
4 L. 4 f = Middle position op. — 4 g = Middle position, lying. — 4 h = Lying, internal r.
— 4 i = Lying, external r. — 4 j = Standing, middle position.

No. 4. — SUMMARY. — Angle of osteotomy on right side unchanged 140°. The bone-peg entering the acetabulum has almost disappeared. Angle of osteotomy on the left side has straightened out to 160°. The angle-points are formed by the lower fragment on the right side, while on the left the fragments have quite fused together, forming an even convexity. Both angle-opening turn obliquely backwards and outwards. On both sides, the movements take place chiefly with caput as centre-point. The pelvis is supported in the middle position and with internal rotation, but not with external rotation. In a standing position, the upper fragment is pushed upwards along the pelvis. Walking capacity indoors normal, out of doors somewhat reduced. Bearing good. Does not limp. No shortening.

No. 5 (8139). Male; aet. 16. T. J.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. dex. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Right leg 3½ cm. short. Patient limps very much, soon tires, and complains of pains.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Right side on 21. 7. 26. Angle of osteotomy 140°. Medial part of lower fragment is right in acetabulum.	Operation angle of osteotomy in degrees	
Circa 7½ years.	Time since op	<i>Final condition on 14/12 33.</i>
Normal. Since his operation has been able to do all his work as agricultural pupil without tiring.	Type of walk and time	
Lordosis normal. Trendelenburg negative.	Lordosis Trendelenburg	
6 cm.; heel raised 4 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
15°.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 14. 12. 1933.

Angle of osteotomy c. 140°, directed obliquely backwards and outwards. Its distance from point of trochanter c. 8 cm. (reduced measure c. 6½ cm.).

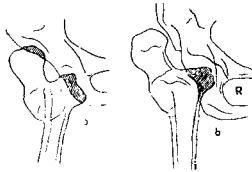
Distance of angle from apex of trochanter. Osteotomy performed immediately below trochanter minor, which is enlarged to well twice its size and with its point lies in acetabulum, which is slightly blocked up. Trochanter minor point is slightly irregular.

Position and appearance of collum and caput. Right hip: caput lies immediately laterally of a shallow, well developed extra socket immediately above acetabulum. It is directed backwards upwards. Collum and caput well developed. Collum vertically directed and inconsiderably outwards and backwards. Left hip: normal.

Position of angle with inward and outward rotation. With outward r. the trochanter minor point moves slightly to the side, and at the same time the caput and collum take a slightly more medial position. With inward r. no change in position.

Centre of movement. The enlarged trochanter minor part supports acetabulum, and round this the movement chiefly takes place.

Standing position. No change in position compared with lying position.



5. R. 5 a = Middle position op. — 5 b = Middle position, lying.

No. 5. — SUMMARY. — Angle of osteotomy unchanged. The end of the lower fragment resting in the acetabulum has been transformed and has assumed a caputlike appearance. Centre of movement lies in the bone-peg. The pelvis is well supported in all positions. Bearing and walking capacity without remark. Shortening increased by 2½ cm.

No. 6 (2850). Female; aet. 10. S. A. F. A.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg + both sides.	Lordosis Trendelenburg	
Patient walks very badly indeed, limping and dragging herself along.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Right side on 18. 8. 26. Osteotomy goes through Trochanter minor. Caput—Trochanter part lies laterally of diaphysis. Its longitudinal axis is parallel with longitudinal axis of the diaphysis. Left side on 8. 1. 27. Angle of osteotomy 130°. The osteotomy was performed opposite the lower edge of acetabulum.	Operation angle of osteotomy in degrees	<i>Final condition on 20/11 33.</i>
About 7 years.	Time since op	
Right hip-joint ankylosis in 20° flexion and 15° adduction. Anchylotic walk. Patient can walk for 3 or 4 hours, but then gets pains in the back.	Type of walk and time	
Lordosis further increased, Trendelenburg negative on both sides.	Lordosis Trendelenburg	
Though there is no actual shortening, the deformity on the right side means a practical shortening of 3 cm.	Shortening in cm Elevation of heel	
Mobility only on left side. Normal.	Stretching	
70°	Inflexion	
30°	Abduction	
10°	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 20. 11. 1933.

Left hip:

Angle of osteotomy amounts to 130°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter, c. 10 cm.

Appearance, rounded off.

Point of the angle formed by both fragments.

Position of the angle in central position c. 3 cm. below lower front edge of acetabulum. Trochanter minor part well developed, size of thumb-end, is directed towards middle part of acetabulum, and with its point reaches to about 1 cm. from edges of acetabulum.

Position and appearance of collum and caput. Collum and caput slightly atrophied. Collum directed vertically. Caput lies in a shallow extra socket, immediately above acetabulum. Extra socket directed obliquely backwards and outwards.

Extra socket. See above.

Acetabulum. Slightly blocked up.

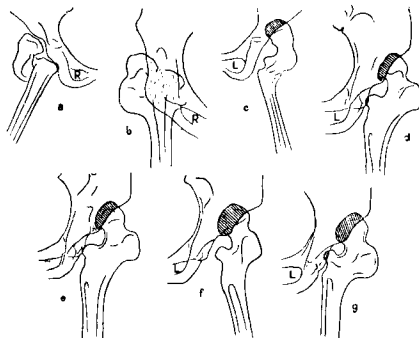
Position of angle with inward and outward rotation. With inward r. no change in middle position. With outward r. the angle is directed further back.

Position of collum and caput. Rotation movements take place round caput.

Centre of movement. Caput.

Standing position. Same as in lying.

Notes. Right hip, ankylosis.



6 R. 6 a = Middle position op. — 6 b = Middle position.
 6 L. 6 c = Middle position op. — 6 d = Middle position, lying. — 6 e = Lying, internal r.
 — 6 f = Lying, external r. — 6 g = Middle position, standing.

No. 6 — SUMMARY. — Right-sided post-operative ankylosis with flexion-adduction position. Angle of osteotomy on left side unchanged 130°. Opening of angle directed obliquely backwards and outwards. Trochanter minor points to acetabulum, and is thickened. Caput remains in the shallow extra cavity. All movement takes place round the head of the joint. In the middle position, the pelvis, when weight is thrown upon it, sinks towards the trochanter minor section. With external rotation, the pelvis is not firmly supported. Bearing and walking capacity not normal, owing to the ankylosis. There is a shortening of practically 3 cm. on the right side.

No. 7 (8500). Female; aet. 23. G. B.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Walks with a bad limp and tires after half-an-hour's walk, when she complains of pains in hip and back. 9 cm. shortening. Radiogram shows caput in a shallow extra socket.	Anamnesis Walking capacity pains shortening before op.	<i>Final condition on 27/11 33.</i>
Bifurcation. Left side on 30. 4. 27. Angle of osteotomy 150°. Owing to X-rays discovery, scarcely 30° abduction.	Operation angle of osteotomy in degrees	
Owing to 20° genu. valg. sin., a corrective supracond. osteotomy was performed on 25. 2. 28. At the same time an attempt was made to lengthen the femur diaphysis.	Notes	
About 6½ years.	Time since op.	
Walks with a limp, partly owing to shortening, partly to considerable atrophy in the hip muscles. Walks from 20 minutes up to an hour. Was at once admitted for renewed massage treatment, and at the New Year, 1934, could walk 2 hrs.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
5½ cm.; heel raised 4 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Considerably reduced.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 27. 11. 1933.

Left hip:

Angle of osteotomy c. 150° directed backwards laterally.

Distance of angle from apex of trochanter c. 10 cm. (reduced measurement c. 8½ cm.).

Appearance. On point of angle of osteotomy a thin layer, separated from the upper part of the shallow socket by a gap scarcely ½ cm. broad. Upwards this layer passes into the trochanter minor. Increased thickness of bone near and on this layer.

Point of the angle formed by lower fragment.

Position of the angle in central position obliquely backwards and lateral. The upper side of the angle runs parallel in the main with the lateral edge of the pelvis.

Position and appearance of collum and caput. Both collum and caput atrophic. Collum directed upwards medially, caput lies in the soft parts immediately to the side of and behind the edge of the pelvis, c. 9 cm. above the middle part of the acetabulum.

Extra socket is indicated immediately behind and above acetabulum.

Acetabulum considerably filled up. Its upper part slightly sclerotic, with an uneven layer. Immediately below this the point of the angle of osteotomy.

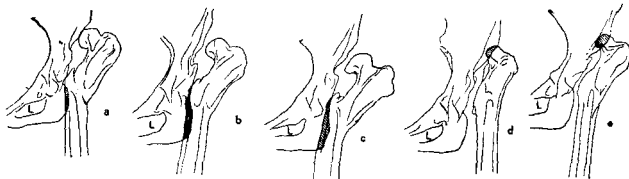
Position of angle with inward and outward rotation glides towards upper part of socket.

Position of collum and caput. With outward rotation the caput wanders medially, and with inward rotation it takes the opposite direction.

Centre of movement. Upper part of acetabulum.

Standing position. Unchanged position compared with standing.

Notes. Right hip: Caput levelled off in its upper medial surface, rests with this against the upper part of the slightly filled-up acetabulum. In the soft parts immediately outside the upper edge of the socket is a calcareous shadow of about the size of a brown bean.



7 L. 7 a = Middle position two years after op — 7 b = Middle position, lying. — 7 c = Lying, internal r. — 7 d = external r. — 7 e = Standing, middle position.

No. 7. — SUMMARY. — Angle of osteotomy unchanged 150°. The point is formed by the lower fragment. In the middle position, the opening of the angle is directed obliquely, backwards and laterally. Centre of movement is a point in the upper part of the acetabulum. The pelvis is supported in all positions except with external rotation. There is an indication of an extra socket, but the capsule of the joint must be very wide, not preventing the movement of the head. In a standing position, the situation is unchanged compared with the lying one. Walking capacity is improved. Bearing good. Limbs. Shortening diminished from 9 to 5½ cm. Right side: Caput is in a subluxation position.

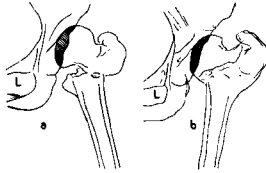
No. 9 (8813). Female; aet. 16. A. K.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Walks with a limp, but fairly easily for 1½ hours. Shortening 4 cm. The radiogram taken at time of admission showed that there was an extra socket, but it was very shallow.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Left side on 12. 2. 1930. Osteotomy performed intertrochanterally, and the lower fragment was displaced half the breadth of the bone medially, without any abduction worth mentioning, as the caput was well fixed in the extra socket. No angle of osteotomy was aimed at.	Operation angle of osteotomy in degrees	
3 years.	Time since op.	<i>Final condition on 1/12 33.</i>
Normal gait with raised heel.	Type of walk and time	
Lordosis normal. Trendelenburg negative.	Lordosis Trendelenburg	
2½ cm. shortening; heel raised 2 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 1. 12. 1933.

Left hip: The reduced caput enters a shallow extra socket, which lies immediately above and behind the acetabulum, only separated from it by a thin ridge. All the acetabulum is choked up. An osteotomy had been performed immediately below the trochanter section, at the back of which a ladder-shaped ledge had consequently been formed.

The angle of osteotomy is open in front and forms an angle of 140° . It lies free in the soft parts at a distance from the pelvis of *c.* 5 cm.

Right hip: An extra socket formation similar to the one on the left side. A reduced caput like that on the left side enters the extra socket. Otherwise no changes to be observed.



9 L. 9 a = Middle position op. — 9 b = Middle position lying.

No. 9. — SUMMARY. — Caput femoris has a steady position in an extra cavity lying immediately close to, above and behind acetabulum. The diaphysis is shifted medially in relation to caput. The angle of osteotomy is open in front and forms an angle of 140° . It lies free in the soft parts, 5 cm. from the pelvis. The movement takes place with caput as centre. Walk, bearing and mobility normal. Shortening diminished from 4 to $2\frac{1}{2}$ cm. Right side shows that the caput is here in a subluxation position.

No. 15 (9978) Female; aet. 17. I. G. M. S.	No. Name	Data before final condition.
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Walks badly for short distances, easily grows tired and then has pains. <i>C.</i> 1 cm. shortening of right leg.	Anamnesis Walking capably pains shortening before op.	
Bifurcation. Right side on 14. 8. 29. Angle of osteotomy 115° to 120°. Left side on 15. 5. 29. Angle of osteotomy 130°. On the left side the osteotomy was performed intertrochanterally.	Operation angle of osteotomy in degrees	
About 4 years.	Time since op.	
Walks out 2 or 3 times daily for about 2½ miles at a stretch. With raised heel the gait is normal.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Left leg 1 cm. short, counterbalanced by raised heel.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Patient has free passive inflexion on both sides, but when lying can only inflect 60°; similar on both sides.	Inflexion	
Right 20°, left 15°.	Abduction	Final condition on 11/12 33.
Reduced on both sides.	Aduction	
Lost on both sides.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 9. 12. 1933.

Angle of osteotomy. Right side, c. 130°. Left side, c. 135°.

Distance of angle from apex of trochanter on right side, c. 8 cm., on left side, c. 8 cm.

Appearance. Right side: lower fragment protrudes in a point, slightly rounded off. Left side: point formed by the medial edge of the slightly transformed trochanter minor part.

Point of the angle formed by. See above.

Position of the angle in central position. Right side: Directed obliquely backwards and outwards. The beak-shaped point lies immediately in front of the anterior edge of acetabulum. Upper side of angle parallel with acetabulum-edge. Left side: point of angle which is made up of trochanter minor lies within acetabulum. Upper side of angle is parallel with edge of acetabulum.

Position and appearance of collum and caput. Right side: Both directed obliquely upwards and outwards, slightly atrophic. Left side: both form a fork open upwards and outwards. Caput lies outside the anterior edge of a shallow extra socket.

Extra socket: on both sides immediately above acetabulum a shallow extra socket directed obliquely backwards and outwards.

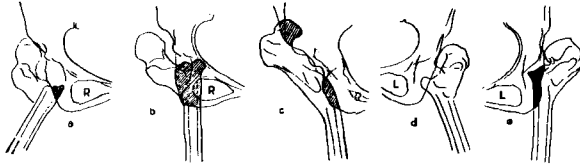
Acetabulum on both sides slightly blocked up.

Position of angle with inward and outward rotation. Only small changes on both sides.

Position of collum and caput. On both sides slight oscillations.

Centre of movement on right side round a point in the basal part of the upper side of the angle; on left side round the tenon of acetabulum.

Standing position unchanged in the main.



15 R. 15 a = Middle position op. — 15 b = Middle position, lying. — 15 c = Middle position, standing.

15 L. 15 d = Middle position op. — 15 e = Middle position, lying.

No. 15. — SUMMARY. — Angle of osteotomy on right side straightened out from 120° to 130°, on left side from 130° to 135°. On the right side, the point of angle is formed by the lower fragment, which protrudes and forms the front branch of a fork, the rear branch of which is formed by the upper fragment. This points obliquely backwards and outwards. The point of the angle is immediately in front of the anterior edge of acetabulum. The centre of movement on right side is a point in the basal part of the upper fragment. On this side, the pelvis is supported in the middle position and internal rotation, but not in external rotation.

On the left side, the point of the angle lies within the acetabulum, and round this point all movements take place, the pelvis being supported in all positions. Walking capacity good. Bearing normal. Does not limp. Left leg 1 cm. too short.

No. 16 (10554). Female; aet. 10. E. M. K.	No. Name	Data before final condition.
Lux. cox. cong. dex. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Limps since birth. Limp has steadily increased. No other trouble. Right leg 5 cm. short.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Right side on 27. 11. 29. Angle of osteotomy 140°. From lower fragment a sharp point is directed right into the acetabulum.	Operation angle of osteotomy in degrees	
About 4 years.	Time since op.	
Girl's parents very well satisfied with result. She walks with raised heel, with very slight limp, all day long without experiencing tiredness or pain.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Shortening 7½ cm. Elevation of heel 6 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Outward rotation normal, inward r. limited.	Rotation	Final condition on 5/12 33.
Not palpable.	Angle of osteotomy stretched to	

X-rays on 5. 12. 1933.

Right hip:

Angle of osteotomy 150°, with central position of foot, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter, 9 cm.

Appearance, rounded off with inconsiderable thickening.

Point of the angle formed by lower fragment.

Position of the angle in central position, lying: a full 2 cm. below upper part of socket-roof. Upper side of angle parallel with lateral edge of the pelvis. Trochanter minor part small and slightly levelled.

Position and appearance of collum and caput: slightly atrophied. Collum directed obliquely upwards and inwards. Caput lies immediately behind the lateral edge of ilium.

Extra socket lacking.

Acetabulum slightly blocked up.

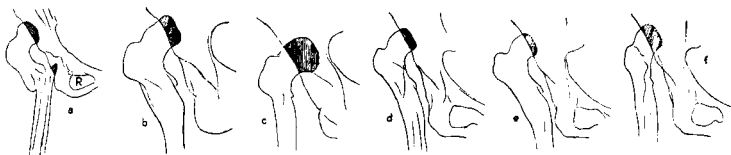
Position of angle with inward and outward rotation. With inward r. the angle of osteotomy approaches the acetabulum a little; with outward r. it slightly parts from it. With inward r. caput and collum move a little away from ilium and laterally, but in the opposite direction with outward r.

Position of collum and caput. See above.

Centre of movement is about in the middle of the upper side of angle.

Standing position. In the main as in lying position.

Notes. Left hip: no changes observable.



16 R. 16 a = Middle position op. — 16 b = Standing, internal r. — 16 c = Standing, external r. — 16 d = Middle position, lying. — 16 e = Lying, internal r. — 16 f = Lying, external r.

No. 16. — SUMMARY. — The angle of osteotomy straightened out from 140° to 150°. In the middle position of the foot, the angle is open obliquely backwards and outwards. The sharp point has disappeared, and the radiogram shows a rounded convexity, the most projecting part of which is formed by the lower fragment. This part lies a full 2 cm. below the roof of the cavity. The upper side of the angle is parallel with the lateral edge of the pelvis, and the concavity is directed obliquely backwards and outwards. The pelvis is supported in the middle position and with internal rotation, but not with external rotation. The centre of the movement is on the middle of the upper side of the angle. Walking capacity normal. Bearing improved. Limbs. Shortening increased by 2½ cm.

No. 18 (10827). Female; aet. 10. E. V. P.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Walks with a limp, which has increased during the last few years. No other trouble. Left leg 5 cm. short.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Left side side on 28. 5. 30. Angle of osteotomy 120°. The osteotomy at lower edge of acetabulum.	Operation angle of osteotomy in degrees	
About 3½ years.	Time since op.	
Can move about like a normal child, but limps a little.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Shortening 7 cm. Heel raised 5 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Internal rotation lost, external normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	<i>Final condition on 1/12 33.</i>

X-rays on 2. 12. 1933.

Angle of osteotomy. Left hip: 150° directed obliquely backwards and outwards in central position of foot.

Distance of angle from apex of trochanter, 9 cm.

Appearance: rounded off with slight thickening.

Point of the angle formed by lower fragment.

Position of the angle in central position, lying: 2 cm. below acetabulum. Lower side of angle reached in height to lateral parts of socket. Upper side of angle runs parallel with lower part of os ilium.

Position and appearance of collum and caput: collum directed almost vertically. Caput lies c. 5 cm. above and behind acetabulum.

Extra socket: a shallow extra socket is indicated.

Acetabulum blocked up.

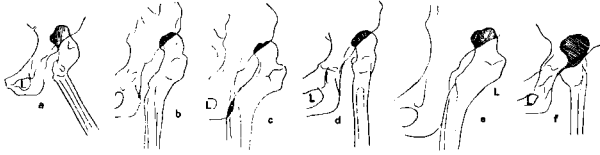
Position of angle with inward and outward rotation. With inward r. the point of the angle moves in under acetabulum. With outward r. it moves away from it.

Position of collum and caput with inward and outward rotation a slight lateral and medial displacement, respectively.

Centre of movement in middle of upper side of angle.

Standing position: the upper side of angle approaches the socket and the parts lying above it. The difference amounts to 2 cm. as against lying position.

Notes. Left hip: no changes to be seen.



18 L. 18 a = Middle position op. — 18 b = Middle position, lying. — 18 c = Lying, internal r. — 18 d = Lying, external r. — 18 e = Standing, internal r. — 18 f = Standing, external r.

No. 18. — SUMMARY. — The angle of osteotomy straightened out from 120° to 150°. The radiogram shows an even convexity, the concavity of which is directed obliquely backwards and outwards. The highest point of the vaulting lies 2 cm. below the acetabulum. The pelvis is supported in the middle position and with internal rotation, but not with external. The movement centre is in the middle of the upper side of the angle. In a standing position, the upper fragment is pushed up towards the cavity. The difference is 2 cm. as compared with the lying position. Walking ability good. Carriage good. Limps. Shortening increased by 2 cm.

No. 20 (11592). Female; aet. 14. H. K.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bil. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Walks with great difficulty, owing to hard contractures in the adduction muscles of both hip-joints. Can only walk out with the help of a stick.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Right side on 19. 11. 30. Angle of osteotomy 135°. From the lower fragment a sharp point is directed up towards the shallow acetabulum. Left side on 21. 1. 31. Angle of osteotomy 125°.	Operation angle of osteotomy in degrees	<i>Final condition on 11/12 33.</i>
Three years.	Time since op.	
Patient is well satisfied; is never tired; has no pain. Says she can walk for long distances, but limps on the right side.	Type of walk and time	
Lordosis +. Trendelenburg negative on both sides.	Lordosis Trendelenburg	
Right leg 2 cm. short. Heel raised 1½ cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
70°.	Inflexion	
10° to 15°.	Abduction	
Normal.	Adduction	
Outward rotation normal. Inward rotation restricted on both sides to half.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 11. 12. 1933.

Angle of osteotomy: right side, 145°, directed obliquely backwards and outwards. Left side, 150°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter: right side, 10 cm (red. measure c. 8½), left side, 10 cm. (red. measure c. 8½).

Appearance. Right side evident angle. In soft parts medially and behind point of the angle some chalky shadows the size of grains. Left side: on point of angle a thin wedge-shaped layer; just medially of this a chalky shadow scarcely the size of a pea.

Point of the angle formed by lower fragments on both sides, which have merged well with the upper.

Position of the angle in central position. Right side: somewhat in front of and under anterior edge of acetabulum. Left side: immediately lateral of the upper edge of socket. Side of upper angle runs parallel with pelvis on both sides.

Position and appearance of collum and caput. Right side: collum and caput somewhat atrophied. Collum in central position directed vertically and medially. Caput situated 10 cm. above middle part of acetabulum. Left side: similar, save that caput is less developed. Caput lies c. 12 cm. above middle part of acetabulum.

Extra socket. Right side: small, well marked extra socket. Tumid edges immediately above acetabulum. Left side: a similar but somewhat smaller extra socket.

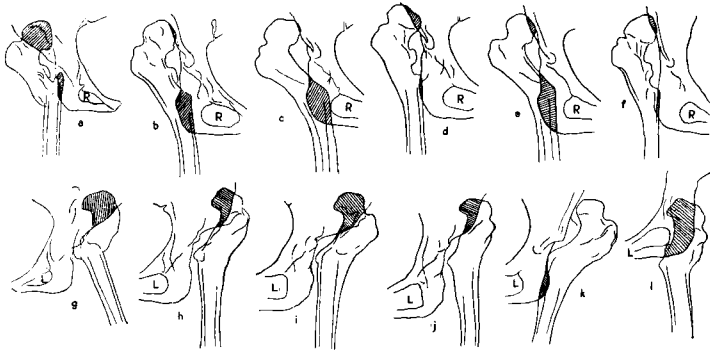
Acetabulum. Slightly filled up on both sides.

Position of angle with inward and outward rotation. Right side: with inward r. inconsiderable medial shift of angle. With outward r. the angle is directed further backwards. Left side: with attempt at inward r. no demonstrable change in position. With outward r. the angle moves laterally and is directed further back.

Position of collum and caput. With rotation both show slight glide movements on both sides, especially marked on left side.

Centre of movement with rotation lies on right side on upper side of angle near point of trochanter, on left side more in the middle of the side of the angle.

Standing position. On right side the caput is shifted upwards a cm. or so. Left side: same as on right, the upper side of the angle on both sides approaching the lateral edge of the pelvis.



20 R. 20 a = Middle position op. — 20 b = Middle position, lying. — 20 c = Lying, internal r. — 20 d = Lying, external r. — 20 e = Standing, internal r. — 20 f = Standing, external r. — 20 L. 20 g = Middle position op. — 20 h = Middle position, lying. — 20 i = Lying, internal r. — 20 j = Lying, external r. — 20 k = Standing, internal r. — 20 l = Standing, external r.

No. 20. — SUMMARY. — Angles of osteotomy straightened out. Right side from 135° to 145°, left from 125° to 150°. Both angles open obliquely backwards and outwards. Both angle-points formed by lower fragment. The right one lies somewhat in front of and below the acetabulum's anterior edge, the left one just laterally of the upper edge of the cavity. Centre of movement lies, on the right side, on the upper side of the angle near the top of the trochanter major; on the left side, more in the middle of side of the angle. The pelvis is supported on both sides in the middle position and with internal rotation, but not with external. Walking capacity normal. Bearing good. Limps. Whether shortening was increased as a result of the operation is impossible to say.

No. 22 (12020). Female; aet. 10. A. M. J.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Patient has always walked with a waddle. Has pains in the back, and the lordosis is almost at right-angles. Has to be helped to school. No certain shortening.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Right side on 22. 8. 31. Angle of osteotomy 145°. Left side on 28. 4. 31. Angle of osteotomy 135°.	Operation angle of osteotomy in degrees	<i>Final condition on 13/11 33.</i>
About 2½ years.	Time since op.	
Patient walks about all day in the house without trouble, but only takes short walks out of doors. Gait is somewhat waddling.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
None.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 20. 11. 1933.

Angle of osteotomy. Right side, 145°, in central position directed obliquely backwards and outwards. Left side, 145°, do. do. do.

Distance of angle from apex of trochanter. Right side, c. 9 cm. reduced measure 7½ cm. Left side, c. 8 cm. (red. 6¾ cm.).

Appearance: both sides rounded off.

Point of the angle formed by both fragments on both right and left. Place of osteotomy difficult to distinguish from adjoining parts.

Position of the angle in central position. Right side: immediately below edge of acetabulum, and somewhat in front and to the side of it. Trochanter minor just below upper edge of socket, slightly protruding. Left side: same.

Position and appearance of collum and caput. Right side: collum vertically directed. Caput atrophic, lies c. 8 cm. above middle part of acetabulum, immediately behind the lateral edge of os ilium. Left side: similar.

Extra socket is lacking on both sides.

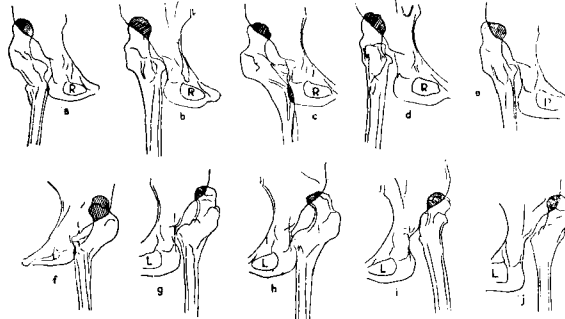
Acetabulum filled up.

Position of angle with inward and outward rotation. Right side: with inward r. the upper side of the angle slides in under acetabulum, and the angle is directed more laterally. With outward r. the angle is directed backwards through the swinging out of the upper side of the angle. Left side: similar.

Position of collum and caput. Mainly retained position on both right side and left.

Centre of movement on both sides with caput and collum as axis.

Standing position. Right side: caput is shifted upwards c. ½ cm. Left side: caput is shifted upwards c. ½ cm.



22 R. 22 a = Middle position op. — 22 b = Middle position, lying. — 22 c = Lying, internal r. — 22 d = Lying, external r. — 22 e = Middle position, standing.
 22 L. 22 f = Middle position op. — 22 g = Middle position, lying. — 22 h = Lying, internal r. — 22 i = Lying, external r. — 22 j = Middle position, standing.

No. 22. — SUMMARY. — Angle of osteotomy on right side unchanged. On left side, increased from 135° to 145°. Angle-openings on both sides point obliquely backwards and outwards. Both fragments meet at the point of the angle on both right and left side. Point of the angle on the right side is immediately below the edge of the acetabulum, and somewhat in front of and to the side of it. Trochanter minor just below upper edge of cavity. Same conditions on left side. Centre of movement, on both sides, the caput-collum region. In a standing position, the caput is forced up ½ cm. on both right and left side. The pelvis is supported in all positions, save with external rotation. Walking capacity indoors, normal, diminished out of doors. Waddles. Bearing good. No shortening.

No. 23 (12172) Female; aet. 9. S. S.	No. Name	Date before final condition.
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Patient walks very badly, with legs crossing each other. Radiograms show shallow extra sockets.	Anaesthesia Walking capacity pains shortening before op.	
Bifurcation. Right side on 16. 12. 31. Angle of osteotomy 115°. Left side on 2. 3. 32. Angle of osteotomy 130°.	Operation angle of osteotomy in depress	
About two years.	Time since op.	Final condition on 27/11 33.
Parents consider that child can move like other children. She walks without difficulty for more than 3 miles, but waddles slightly.	Type of walk and time	
Lordosis somewhat too great. Trendelenburg negative.	Lordosis Trendelenburg	
Right leg 2 cm. short. Heel raised 2 cm.	Shortening in cm. Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Left: normal. Right: only dislocation movements.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 27. 11. 1933.

Angle of osteotomy. Right and left hips: 130°. Both open obliquely backwards and outwards.

Distance of angle from apex of trochanter. Right, 8 cm. (Reduced measures 6¾ cm.). Left, 7 cm. (Red. measure, 6 cm.).

Appearance. Right: rounded off, indication of spool-shaped intensification. Left: similar conditions.

Point of the angle formed by both fragments on the right side, and by lower fragment on left side.

Position of the angle in central position. Right side: About 1½ cm. laterally and below anterior lower edge of socket. Upper side of angle runs parallel with anterior edge of socket. Left side: similar position.

Position and appearance of collum and caput. Right side: collum and caput somewhat atrophic. Caput little pronounced; lies with its medial edge in a shallow extra socket immediately above acetabulum. Left side: similar conditions.

Extra socket. See above.

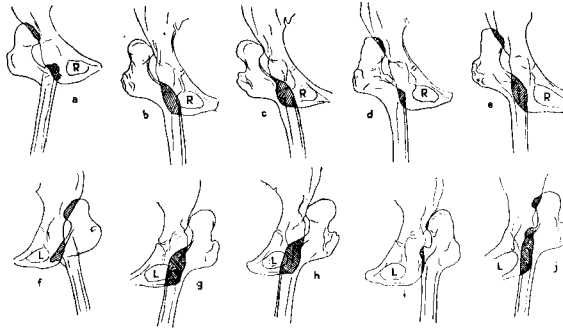
Acetabulum; slightly filled up.

Position of angle with inward and outward rotation. Right side: with inward r. no change of position (central position). With outward r., in the main unchanged. Left side: Similar, save that with outward r. the angle is shifted backwards.

Position of collum and caput. On both sides indicated glide movement out and in with inward and outward r.

Centre of movement. Mainly extra socket, both right and left sides.

Standing position. Right side: indicated shift of caput upwards. Left side: caput shifted about 1 cm. upwards.



23 R. 23 a = Middle position op. — 23 b = Middle position, lying. — 23 c = Lying, internal r. —
 23 d = Lying, external r. — 23 e = Middle position, standing.
 23 L. 23 f = Middle position op. — 23 g = Middle position, lying. — 23 h = Lying, internal r. —
 23 i = Lying, external r. — 23 j = Middle position, standing.

No. 23. — SUMMARY. — Angle of osteotomy on left side unchanged 130°. On right side, straightened out from 115° to 130°. Points are rounded off on both sides. They are formed on the right side by the two fragments, on the left by the lower fragment. On the right side, the point lies just below the anterior edge of the cavity, on the left side, just below and in front of the anterior edge of the cavity. Both angles are open obliquely backwards and outwards. Centre of movement lies mainly in the extra cavity, both on right and left side. Pelvis is supported in the middle position and with internal rotation, but not with external. On the left side, the caput is displaced 1 cm. upwards when weight is thrown on it. Walking capacity normal, but waddling. Bearing good. Right leg is 2 cm. too short.

No. 24 (12206). Male; aet. 10. L. Y. A.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
The boy has always limped and has had difficulty in walking. Right leg is 3 cm. short.	Anamnesis Walking capacity pains shortening before op.	<i>Final condition on 12/12 33.</i>
Bifurcation. Right side on 16. 9. 31. Angle of osteotomy 145°. The right osteotomy yielded a flute-like point on lower fragment, and patient felt pain when the after-treatment was to begin. The point was chiselled off on 23. 11. 31. Left side on 13. 1. 32. Angle of osteotomy 150°. The left osteotomy borders on the upper edge of trochanter minor.	Operation angle of osteotomy in degrees	
About two years.	Time since op.	
Patient moves freely. Goes out for 3 miles without pain or tiredness, but there is a slight waddle in the gait.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Right leg 3 cm. short. Heel raised 2 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal passive bending, but actively not more than 30° on both sides.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
No inward rotation on either side. Outward r. normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 12. 12. 1933.

Angle of osteotomy. Right side, 145° , directed obliquely backwards and outwards. Left side, 155° , directed obliquely backwards and outwards.

Distance of angle from apex of trochanter. Right side c. 8 cm. (red. measure c. $6\frac{1}{2}$ cm.). Left side c. 8 cm. (red. measure c. $6\frac{1}{2}$ cm.).

Appearance. Right side, medially and close to point of angle, a slight stratification. A similar one also on the left side, beakshaped.

Point of the angle formed by the lower fragment on each side.

Position of the angle in central position. In both cases the points of the angle lie just laterally of and on a level with the anterior edge of the socket.

Position and appearance of collum and caput. On both sides the collum and caput are pushed up behind ala ossis ilii.

Extra socket is lacking on both sides.

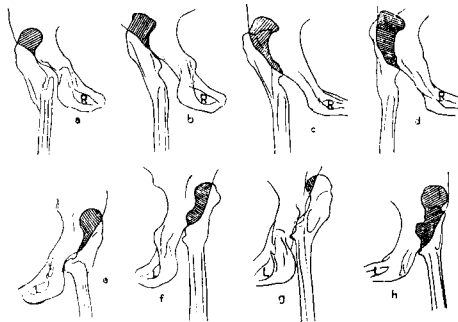
Acetabulum filled up on both sides.

Position of angle with inward and outward rotation. With attempt at inward r. unchanged position on both sides. With outward r. the angles are directed backwards.

Position of collum and caput. Collum and caput rotate on both sides with moderate movements laterally and medially.

Centre of movement on both sides lies on upper side of the angle near the collum.

Standing position. Indicated shifting upwards of both capita.



24 R. 24 a = Middle position op. — 24 b = Middle position, lying. — 24 c = Standing, internal r. — 24 d = Standing, external r.
24 L. 24 e = Middle position op. — 24 f = Middle position, lying. — 24 g = Standing, internal r. — 24 h = Standing, external r.

No. 24. — SUMMARY. — Angles of osteotomy on right side unchanged 145° , on left side, straightened out from 150° to 155° . The point is formed on both sides by the lower fragment, and in both cases the points of the angles lie just laterally of and on a level with the anterior edge of the cavity. Both angle-openings point obliquely backwards and outwards. Centre of movement lies on both sides on the upper side of the angle near the collum. (Trochanter major). The pelvis is supported in the middle position and with internal rotation, but not with external. Walking capacity normal but waddling. Bearing good. Right leg 3 cm. too short: not increased by operation.

No. 25 (12289). Female; aet. 43. E. A.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased. Trendelenburg +	Lordosis Trendelenburg	
Patient has always limped, but the trouble did not really arise until a year before the operation. She walks with the help of a stick for 5 or 10 minutes at most. Left leg 5 cm. short.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Left side on 29. 9. 31. Angle of osteotomy 140°.	Operation angle of osteotomy in degrees	
About two years.	Time since op.	<i>Final condition on 11/12 33.</i>
Patient walks about the house with a limp, but without pain. Out of doors she can move about for an hour at most.	Type of walk and time	
Lordosis +. Trendelenburg +.	Lordosis Trendelenburg	
Shortening 6 cm. Heel raised 4 cm.	Shortening in cm. Elevation of heel	
Too great. Relapse.	Stretching	
Too great. Relapse.	Inflexion	
Too great. Relapse.	Abduction	
Too great. Relapse.	Adduction	
Too great. Relapse.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 11. 12. 1933.

Left hip:

Angle of osteotomy 155°, in central position directed straight backwards.

Distance of angle from apex of trochanter about 9 cm. (red. measure c. 7½ cm.).

Appearance. Proximal and distal fragments lie irregularly for a distance of c. 4 cm.

Point of the angle formed by lower fragment.

Position of the angle in central position. Angle lies a couple of cm. laterally of acetabulum.

Position and appearance of collum and caput. Both somewhat atrophied. Caput lies luxated upwards c. 10 cm. and is on the back of the lateral part of ala ossis ilii. Collum directed upwards medially.

Extra socket. Indications of a small extra socket above acetabulum.

Acetabulum. Somewhat filled up.

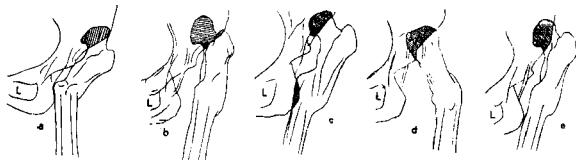
Position of angle with inward and outward rotation. With inward r. the angle swings slightly medially. With outward r. the angle is directed almost medially. (Open medially).

Position of collum and caput. Both make glide movements with outward and inward rotation, inwards and outwards respectively.

Centre of movement lies just below collum.

Standing position: the caput moves upwards about 1 cm., the upper side of the angle approaching the pelvis in central position. With outward and inward rotation no change in height.

Notes. Right side: normal finds.



25 L. 25 a = Middle position op. — 25 b = Middle position, lying. — 25 c = Lying, internal r. — 25 d = Lying, external r. — 25 e = Standing, internal r.

No. 25. — SUMMARY. — Angle of osteotomy increased from 140° to 155°. Point formed by lower fragment, and lies a couple of cm. to the side of acetabulum. The angle opens straight backwards. The operation has consequently not brought about the desired stabilizing of the pelvis. The improvement that undoubtedly did take place can most likely be attributed to partly the increased tension in the pelvo-trochanteric musculature, partly to rest, massage and hydropathy. The centre of movement lies just below the collum. Patient walks with a limp. Walking capacity not satisfactory. Lordosis remains. Shortening increased by 1 cm.

No. 26 (12439). Female; aet. 14. M. L. W.	No. Name	Data before final condition.
Lux. cox. cong. sin. Lordosis increased. Trendelenburg +.	Lordosis Trendelenburg	
Patient walks without much trouble, but limps on left side and has 2 cm. shortening.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Left side on 18. 11. 31. Angle of osteotomy 130°.	Operation angle of osteotomy in degrees	
About two years.	Time since op.	
Walks indoors without trouble all day long, and takes walks out of doors for an hour. When heel was raised, the limp became almost imperceptible.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Shortening 5 cm. Heel raised 3 cm.	Shortening in cm. Elevation of heel	
Normal.	Stretching	
Patient inflects passively normally, but actively not more than 30°.	Inflexion	
Normal.	Abduction	Final condition on 1/12 33.
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 2. 12. 1933.

Left hip:

Angle of osteotomy 150°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter c. 8 cm. (red. measure c. 6¾ cm.).

Appearance. Pronounced angle with a small beak-shaped formation medially.

Point of the angle formed by lower fragment.

Position of the angle in central position lies c. 2 cm. laterally of anterior edge of socket on a level with middle part of acetabulum. Upper side of angle runs parallel with lateral edge of os ilium.

Position and appearance of collum and caput. Both slightly atrophied. Caput well separated from collum, which is directed vertically. Caput lies luxated upwards c. 9 cm. from middle part of acetabulum, on the back of the lateral edge of ilium.

Extra socket. Indications of one just above acetabulum, directed laterally backwards.

Acetabulum rather filled up.

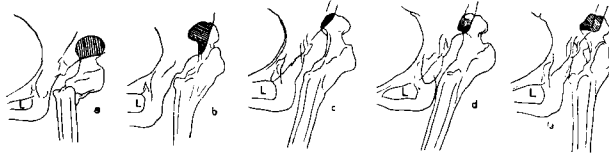
Position of angle with inward and outward rotation. With inward r. the angle moves inconsiderably to a more medial position. With outward r. the angle is shifted backwards.

Position of collum and caput. With inward rotation collum and caput move laterally, with outward rotation medially.

Centre of movement lies on the upper side of angle near collum.

Standing position. Caput is moved upwards a few cm., while the upper side of the angle approaches the lateral edge of ilium.

Notes. Right side, normal finds.



26 L. 26 a = Middle position op. — 26 b = Middle position, standing. — 26 c = Middle position, lying. — 26 d = Lying, internal r. — 26 e = Lying, external r.

No. 26. — SUMMARY. — Angle of osteotomy straightened out from 130° to 150°. Point of angle formed by the lower fragment. It lies about 2 cm. to the side of the anterior edge of the cavity on a level with the middle part of the acetabulum. The opening of the angle points obliquely backwards and outwards. The centre of movement lies in the upper side of the angle near the collum. The pelvis is supported in the middle position and with internal rotation, not with external rotation. In a standing position, the caput is shifted upwards a few cm., the upper side of the angle then approaching the lateral edge of the ilium. Walking capacity normal indoors, reduced out of doors. Bearing good. Slight limp. Shortening of left leg increased by 2 cm.

No. 27 (12511). Female; aet. 19. I. V. L.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Patient has always walked badly, with a limp; now tires after 5 minutes' walk. Left leg 2½ cm. short. The first X-rays showed caput on right side fixed in a well developed extra socket.	Anamnesis Walking capacity pains shortening before op	<i>Final condition on 5/12 33.</i>
Bifurcation. Right side on 31. 8. 32. Angle of osteotomy 120°. Left side on 18. 5. 32. Angle of osteotomy 125°. From the lower fragment a rather sharp point is directed towards the acetabulum. The upper fragment crosses the lower one. At the after-treatment of the right side it proved impossible to obtain free mobility. Gradually there arose an apparently complete ankylosis with flexion-adduction contracture and shortening. Patient therefore walked badly, with a marked limp. At the beginning of 1934 the caput part on the right side was consequently extirpated. The after-treatment is still going on as this is being written, and early in April (1934) the patient had good mobility on this side.	Operation angle of osteotomy in degrees	
Left side, about a year and a half.	Time since op	<i>Final condition on 5/12 33.</i>
	Type of walk and time	
	Lordosis Trendelenburg	
	Shortening in cm Elevation of heel	
Left side normal.	Stretching	
Left side passive 70°, active 30°.	Inflexion	
Left side normal.	Abduction	
Left side normal.	Adduction	
Left side: inward rotation lost, outward r. normal.	Rotation	
Palpable on left side in Scarpa's triangle.	Angle of osteotomy stretched to	

X-rays on 6. 12. 1933.

Right hip:

Angle of osteotomy c. 150°, in central position directed obliquely backwards and outwards.

Distance of angle from apex of trochanter c. 10 cm. (reduced measure c. 8½ cm).

Appearance. Rounded off in front. Medially in height corresponding to lower edge of acetabulum, irregular stratifications, which are separated from a stratification on the corresponding place on the edge of the acetabulum by a fissure of a couple of mm. in breadth.

Point of the angle formed by the distal fragment.

Position of the angle in central position. See above. Upper side of angle runs parallel with the pelvis in corresponding parts.

Position and appearance of collum and caput. Both well developed. Collum short. Caput hat-shaped, with a ridged stratification medially at the edge. It rests in a shallow oblong extra socket at the back of ala ossis ilii, immediately above and behind the acetabulum, which nearly coincides with it.

Extra socket. See above.

Acetabulum. See above. Acetabulum small and shallow.

Position of angle with inward and outward rotation. With rotation movements of the leg small glide movements between side of angle and lower edge of acetabulum.

Position of collum and caput. In the main unchanged.

Centre of movement. See above.

Standing position. Inconsiderable pushing up of femur.

Left hip:

Angle of osteotomy c. 125° in central position directed obliquely backwards and outwards.

Distance of angle from apex of trochanter 11 cm. (reduced measure c. 9½ cm.).

Appearance: rounded off. The corresponding distal fragment somewhat swollen.

Point of the angle formed by the distal fragment.

Position of the angle in central position lies immediately in front of and below anterior edge of acetabulum. Upper side of angle runs mainly parallel with pelvis, below anterior edge of acetabulum.

Position and appearance of collum and caput. Collum and caput somewhat atrophic. Collum directed vertically and slightly medially. Caput lies immediately behind crista iliaca anterior sup., and with its lateral part rises to the level of the lateral edge of pelvis. Distance of caput from acetabulum, about 8 cm.

Extra socket is indicated immediately above acetabulum.

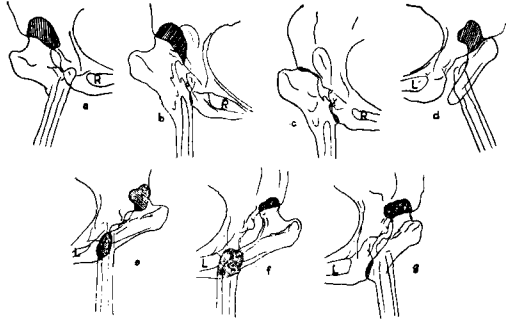
Acetabulum filled up, with tumidly intensified edges.

Position of angle with inward and outward rotation. With attempt at inward r., as in central position. With outward r. the angle is directed more to the back.

Position of collum and caput. With outward rotation collum and caput shift medially; with inward r. they shift in the opposite direction.

Centre of movement is about in the middle of the upper side of angle.

Standing position: the whole of the upper side of the angle is moved upwards, thus approaching the lateral part of the pelvis.



27 R. 27 a = Middle position op. — 27 b = Middle position, lying. — 27 c = After extirpation of caput.
 27 L. 27 d = Middle position op. — 27 e = Middle position, lying. — 27 f = Lying, internal r. —
 27 g = Lying, external r.

No. 27. — SUMMARY. — On the right side, the angle of osteotomy is straightened out from 120° to 150° . The angle is open obliquely backwards and outwards. The point is formed by the distal fragment, rounded off in front. It lies at the lower edge of the acetabulum, and on the top there are irregular layers, separated from similar ones on the corresponding spot on the edge of the acetabulum by a fissure two mm. in breadth. Caput is well developed, hat-shaped. It lies in a shallow, oblong extra cavity at the back of ala ossis ilii just above and behind acetabulum. The caput is so fixed in this extra cavity that all movements are practically lost and the leg is firm in a flexion-adduction contracture. In March 1934, the caput was extirpated, whereupon movement returned. After-treatment continues at the time of writing. Left side: Angle of osteotomy unchanged 125° . Point of angle, formed by the distal fragment, lies just in front of and below the anterior edge of the acetabulum. Centre of movement is about in the middle of the upper side of the angle. On this side, the pelvis is supported in the middle position and with internal rotation, not with external. In a standing position, the upper side of the angle is pushed somewhat upwards. Walking capacity and bearing before extirpation of caput were poor.

No. 28 (12652). Female; aet. 11. E. J. K.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. dex. Lordosis increased. Trendelenburg +	Lordosis Trendelenburg	
Patient has always had a limp, which has increased. No other troubles. Right leg 4 cm. short.	Anamnesis Walking capacity pains shortening before op.	<i>Final condition on 20/11 33.</i>
Bifurcation. Right side on 30. 3. 31. Angle of osteotomy 130°.	Operation angle of osteotomy in degrees	
About three years.	Time since op.	
Moves about indoors all day without any trouble. Goes out walking for 2 or 3 miles. Is then rather tired, but without pain. With raised heel the limp is very slight.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Shortening 6 cm. Heel raised 3 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 30. 11. 1933.

Right hip:

Angle of osteotomy 140° , directed obliquely backwards and outwards.

Distance of angle from apex of trochanter c. 9 cm. (reduced measure c. $7\frac{1}{2}$ cm.).

Appearance. Rounded off with slightly spool-shaped thickening. The different fragments can scarcely be distinguished from each other any longer.

Point of the angle formed by lower fragment (see above).

Position of the angle in central position. Point of angle lies on a level with anterior edge of acetabulum, c. 1 cm. below its middle part. Upper side of angle lies parallel with and below upper part of acetabulum, and above and at the side of these parts.

Position and appearance of collum and caput. Collum directed vertically. Caput lies luxated upwards c. 8 cm. above middle part of acetabulum, laterally and immediately behind lateral edge of os ilium.

Extra socket. A small extra socket, immediately above acetabulum, directed laterally and backwards.

Acetabulum. Fairly blocked up.

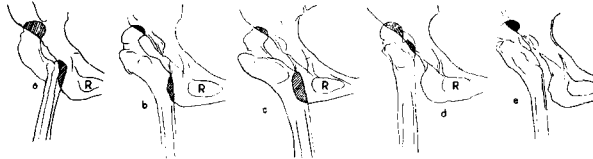
Position of angle with inward and outward rotation. With inward r. the angle lies slightly medially; with outward r. it is directed straight backwards.

Position of collum and caput. With outward and inward rotation: typical glide movements, medially and laterally, respectively.

Centre of movement lies round a point immediately above acetabulum.

Standing position. Upper side of angle approaches adjoining parts of os ilium.

Notes. Left hip: normal findings.



28 R. 28 a - Middle position op. - 28 b - Middle position, lying. - 28 c = Lying, internal r. - 28 d = Lying, external r. - 28 e = Middle position, standing.

No. 28. — SUMMARY. — Angle of osteotomy increased from 130° to 140° . It opens obliquely backwards and outwards. Both fragments are fused together, but the point is formed by the lower fragment. It lies on a level with the anterior edge of acetabulum, 1 cm. below the middle. Centre of movement lies round a point immediately above acetabulum. Pelvis supported in middle position and internal rotation, but not external rotation. In a standing position, the upper side of the angle approaches adjoining parts of os ilium. Walking capacity indoors normal, out of doors reduced. Bearing normal. Very slight limp. Shortening of right leg increased 4 to 6 cm.

No. 29 (12798). Female; aet. 23. A. D. M. O.	No. Name	Data before final condition.
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
Though patient has limped since birth, she was not troubled until a year before op. Now she tires very soon and gets pain in the back. Right leg c 2 cm. short. X rays show that on the right side the caput is in a shallow extra socket.	Anamnesis Walking capacity pains shortening before op.	
Bifurcation. Right side on 9. 12. 31. Angle of osteotomy only 155°, owing to position of caput in an extra socket. Left side on 9. 3. 32. Angle of osteotomy 150°.	Operation angle of osteotomy in degrees	Final condition on 4/12 33.
About two years.	Time since op.	
Goes about indoors without much trouble, but waddles. Walks out for 2 miles at the utmost. Does not tire so fast and has no pains.	Type of walk and time	
Lordosis +. Trendelenburg on left side negative; on right side positive.	Lordosis Trendelenburg	
On right side a relapse has taken place. Right leg is 3 cm. short. Movements in all directions too great, save with abduction, when it is 5° at the utmost.	Shortening in cm Elevation of heel	
Left side normal.	Stretching	
Left side active and passive 70°.	Inflexion	
Left side normal.	Abduction	
Left side 10°.	Adduction	
Left side: inward r. considerably reduced. About half outward r.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 4. 12. 1933.

Angle of osteotomy. Right hip: only an indicated angle of osteotomy, directed backwards. At the place of the osteotomy the upper and lower fragments are closely grown together at an area of c. 9 cm., resulting in a shortening of the corresponding length. Left hip: angle c. 150°.

Distance of angle from apex of trochanter. Left side, c. 9 cm. Right side, see above.

Appearance. Right side: see above. Left side: see below.

Point of the angle formed by lower fragment on left side, its medial part forming a projecting blunt point.

Position of the angle in central position. Left side: point of angle lies immediately below upper edge of acetabulum; upper side of angle parallel with lateral edge of pelvis.

Position and appearance of collum and caput. Left side: both directed vertically. Collum lies at the back of the lateral edge of ala ossis ilii, caput c. 10 cm. above middle part of acetabulum. Right side: caput, collum and trochanter lie back of ala ossis ilii, collum directed medially backwards, and caput lying c. 10 cm. above middle of acetabulum.

Extra socket. On both sides a small extra socket, just above acetabulum, directed obliquely backwards and outwards.

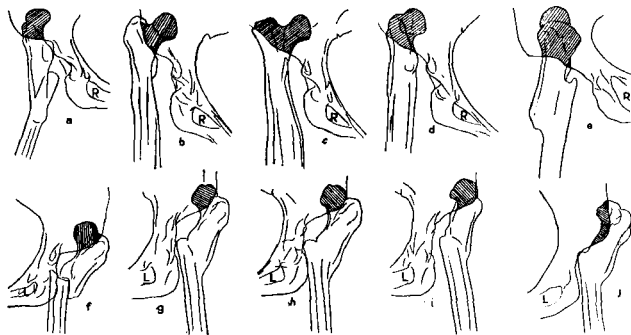
Acetabulum blocked up with slightly tumid edges.

Position of angle with inward and outward rotation. Left side: with inward r. mainly the same position as with central position. With outward r. the angle is directed more backwards. Right side: with outward r. femur revolves chiefly round caput part; likewise with inward r.

Position of collum and caput. Left side: both swing slightly with inward and outward rotation. Right side: movement chiefly round caput.

Centre of movement on left side lies at the medial edge of middle part of upper side of angle. On right side the movements are chiefly round the caput.

Standing position. Left side: upper side of angle approaches pelvis. Right side: caput and collum are pushed up to the back of ala ossis ilii.



29 R. 29 a = Middle position op — 29 b = Middle position, lying. — 29 c = Lying, internal r. —
29 d = Lying, external r — 29 e = Standing, external r.
29 L. 29 f Middle position op. — 29 g = Middle position, lying. — 29 h = Lying, internal r. —
29 i = Lying, external r. — 29 j = Middle position, standing.

No. 29. — SUMMARY. — Angle of osteotomy on right side is practically straightened out, and centre of movement here lies round caput. Relapse. Angle of osteotomy on left side unchanged 150°. The point is formed by the lower fragment, the medial part of which forms a projecting, blunt point lying immediately below the upper edge of acetabulum. The centre of the movement, on this side, lies at the medial edge of the middle part of the upper side of the angle. The pelvis is supported in all positions except with external rotation. In a standing position, the upper part of the angle approaches the pelvis. Walking capacity and bearing are poor, owing to the relapse on the right side. Shortening on the right side increased by 1 cm.

B. Cases of »Low Osteotomy«.

No. 8 (8593). Female; aet. 37. B. J.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. bil. — Polyarthrit, chron. Lordosis increased. Trendelenburg +.	Lordosis Trendelenburg	
Walks badly, waddles, and soon tires. Complains of continual pains in the back. As there is no stability, it is impossible to measure any certain difference in the length of the legs.	Anamnesis Walking capacity Pains shortening before op	<i>Final condition on 20/11 33.</i>
Bilateral low osteotomy, Schanz's method. Right side on 10. 8. 27. Angle of osteotomy 135°. Left side on 10. 12. 27. Angle of osteotomy 140°. A fistula formed on the left side from Schanz's screw. It healed after c. 4 months.	Operation angle of osteotomy in degrees	
About eight years.	Time since op.	
Walks with a slight waddle, but says she feels strong. Can go for a walk of about an hour and a half, and never has pains.	Type of walk and time	
Lordosis additionally increased. Trendelenburg neg. on right side, pos. on left.	Lordosis Trendelenburg	
Left side 1 cm. short.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Patient has normal passive inflexion on both sides, but no active do.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Palpable on both sides in Scarpa's triangle.	Angle of osteotomy stretched to	

X-rays on 20. 11. 1933.

Angle of osteotomy. Right side, c. 135°. Left side, c. 145°.

Distance of angle from apex of trochanter. Right side, c. 10 cm. Left side, c. 14 cm.

Appearance. Rounded off on both sides.

Point of the angle formed by lower fragment on both sides.

Position of the angle in central position. Right side: angle directed obliquely backwards and outwards. Angle of osteotomy lies immediately below and in front of edge of acetabulum. In central position the upper side of angle is parallel with lateral edge of pelvis. Left side: angle of osteotomy in central position is directed straight backwards. Upper side of angle forms a pointed angle with lateral edge of pelvis.

Position and appearance of collum and caput. Right side: collum directed vertically, and like caput is rather atrophied. Caput lies, at back of crista iliaca lateral edge, c. 10 cm. from acetabulum. Left side: collum and caput and trochanter part pushed up to back of os ilium.

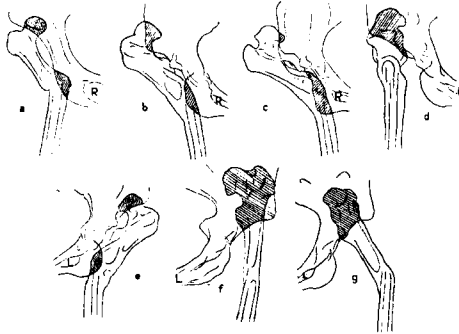
Acetabulum blocked up with tumid edges.

Position of angle with inward and outward rotation. Right side: with outward rotation the angle is directed right backwards. Left side: the angle is directed backwards medially.

Position of collum and caput. Right side: with outward rotation collum and caput shift medially. Left side: rotation round caput and trochanter part.

Centre of movement. Right side: middle part of upper side of angle. Left side: see above.

Notes. Patient only photographed in standing position. X-ray-examined in lying position, but not photographed.



8 R. 8 a = Middle position, op. — 8 b = Middle position, standing. — 8 c = Standing, internal rotation. — 8 d = Standing, external rotation.
8 L. 8 e = Middle position, op. — 8 f = Middle position, standing. — 8 g = Standing, external rotation.

No. 8. — SUMMARY. — Angle of osteotomy on right side unchanged 135°. In a middle position, the angle opens obliquely backwards and sideways. Point of angle lies just in front of and below the lower edge of acetabulum. It is rounded off. The centre of the movement lies in the middle part of the upper side of the angle. The pelvis is supported in the middle and with internal rotation, but not with external rotation. On the left side, an angle of osteotomy which has been increased from 140° to 145°, but this angle is directed straight backwards in a lying middle position. The pelvis is therefore well supported only with internal rotation. Here, too, the centre of movement lies in the middle part of the upper side of the angle. Walking capacity is increased, but not satisfactory. Bearing poor. No definite shortening.

No. 10 (8817). Male; aet. 9. A. K.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased. Trendelenburg +	Lordosis Trendelenburg	
Has limped since birth, and limp has increased. No other trouble. Left leg 4 cm. short.	Anamnesis Walking capacity pains shortening before op.	
Low osteotomy, Schanz's method. Left side on 1. 10. 27. Angle of osteotomy 130.	Operation angle of osteotomy in degrees	<i>Final condition on 14/2 33.</i>
About six years.	Time since op.	
Walks without difficulty for 2 or 3 hours at a stretch without tiring. Moves about the house quite normally.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Left leg 4 cm. short. Heel raised 3 cm.	Shortening in cm. Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 14. 12. 1933.

Left hip: osteotomy by Schanz's method.

Angle of osteotomy. Almost straightened out, and replaced by a soft curve of femur (c. 145°) c. 12 cm. from point of trochanter.

Trochanter minor part somewhat enlarged, and lies with its point in the centre of the plane of the edges of the shallow socket.

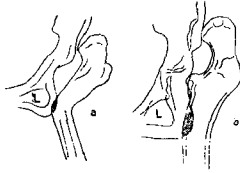
The upper arch of femur continues direct into the well developed, vertically placed collum, and the somewhat atrophic caput, which with its medial edge rests in a flat and rather large extra socket, which is directed backwards laterally.

Appearance of hip after the op. is that it is considerably straightened out and rounded off. The moderately increased trochanter minor part is in the centre of the shallow socket, and movements take place in the main with this as centre.

Position of angle with inward and outward rotation. With attempts at inward r. there was no change compared with central position. With outward r. the angle is directed backwards.

Standing position. Position the same as with lying position.

Notes. Right side: normal finds.



10 L. 10 a = Middle position, op. — 10 b = Middle position, lying.

No. 10. — SUMMARY. — The angle of osteotomy is straightened out so that only a flat convexity remains. The trochanter minor section is enlarged. Its point stands on a level with the shallow middle part of the acetabulum. Caput rests with its medial edge in a shallow extra cavity. All movements take place with caput as centre. In the middle position, the caput stands only just outside the extra cavity, but in this position the trochanter minor section is pressed against the soft parts which cover acetabulum. In this position, the pelvis has a support partly against the trochanter-section, partly thanks to the stretched soft parts. The upper fragment is pointed almost vertically. The place of the osteotomy therefore slides to and fro past the acetabulum. Walking capacity and bearing good. The shortening has not increased.

No. 11 (9067). Female; aet. 10. M. J.	No. Name	Data before final condition.
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg + both sides.	Lordosis Trendelenburg	
Walks with a limp and a waddle for short distances, and complains of tiredness. Both legs of same length.	Anamnesis Walking capacity pains shortening before op.	Final condition on 1/12 33.
Low osteotomy on both sides, Schanz's method. Right side on 3. 12. 33. Angle of osteotomy 115°. Left side on 18. 4. 31. Angle of osteotomy 125°.	Operation angle of osteotomy in degrees	
About three years.	Time since op.	
Can walk for an hour and a half. Never has pains, but waddles.	Type of walk and time	
Lordosis normal, Trendelenburg negative on both sides.	Lordosis Trendelenburg	
Left leg 3½ cm. short. Heel raised 2 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 1. 12. 1933.

Angle of osteotomy. Right side 145°, directed obliquely backwards and outwards. Left side 140°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter. Right side 10 cm. (red. meas. c. 8½). Left side 10 cm. (red. meas. c. 8½).

Appearance. On both sides the angle is rounded off to a soft arch.

Point of the angle formed by the fragments on both left and right side, which are so well joined that it is impossible to say which of them forms the point.

Position of the angle in central position. On the right side the punct. max. for the convexity lies just below ant. edge of acetabulum. Upper side of angle runs parallel with ant. edge of same. The well developed troch. minor part lies in different situations just below upper acetabular roof and has a slightly irregular upper surface. On left side same, save that troch. min. is not so well developed and lies further back.

Position and appearance of collum and caput. On both sides collum and caput are atrophic and in central position directed vertically outwards. Caput lies on both sides laterally of and behind lateral edge of os ilium.

Extra socket. Lacking on both sides.

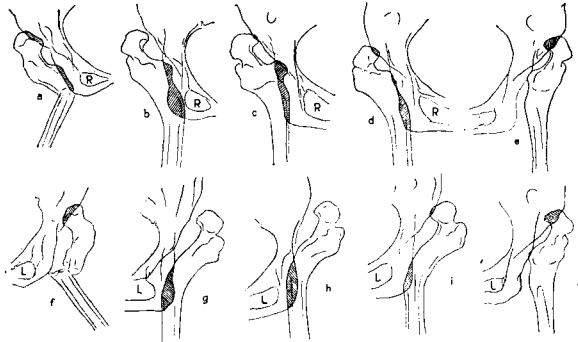
Acetabulum blocked up on both sides.

Position of angle with inward and outward rotation. With attempt at inward r. on both sides mainly unchanged as in central position. With outward r. the angle is directed further backwards, especially on left side.

Position of collum and caput. With inward rotation collum and caput shift inconsiderably to the side; with outward r. the shift is in the opposite direction. Same conditions on both sides.

Centre of movement. With rotation movements the upper sides of the angles move to some extent with the place for trochanter minor as middle-point.

Standing position. On right side the femur is pressed somewhat nearer the lateral edge of pelvis. On left side the femur is moved upwards about 1 cm., the upper side of angle then approaching the lateral edge of pelvis.



11 R. 11 a = Middle position, op. — 11 b = Middle position, lying. — 11 c = Middle position, standing. — 11 d = Lying, internal rotation. — 11 e Lying, external rotation. (Inversed in reproduction).

11 L. 11 f = Middle position, op. — 11 g = Middle position, lying. — 11 h = Middle position, standing. — 11 i = Lying, internal rotation. — 11 j = Lying, external rotation.

No. 11. — SUMMARY. — The right angle of osteotomy straightened out from 115° to 145°, the left from 135° to 140°. On both sides, there is an even convexity. The angle openings on both sides point obliquely backwards and outwards. On the right side, the upper fragment runs parallel with the anterior edge of the acetabulum, and the trochanter minor section lies in different positions immediately below the roof of acetabulum. On the left side, the conditions are similar, save that trochanter minor is not so well developed, and lies further back. Centre of movement: region of the trochanter minor on both sides. In a middle position and with internal rotation, the pelvis is supported, but with external rotation the support is lost. Similar on both sides. On the right side, the upper fragment is pressed nearer the lateral edge of the pelvis. On the left side, the femur is moved up about 1 cm. in a standing position. Walking ability improved. Bearing good. On the left side, the operation has caused a shortening of 3¼ cm.

No. 12 (9675). Female; aet. 5. K. H.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. dex. Lordosis increased, Trendelenburg +.	Lordosis Trendelenburg	
On admission 6 months before op. there was a bilateral hip-joint luxation. The left side was replaced in the usual manner. The caput remained in the socket, but in a subluxated position. The right side was relaxed four times. At the time of the op. this side was 2½ cm. shortened.	Anamnesis Walking capacity pains shortening before op.	
Low osteotomy, Schanz's method. Right side on 12. 8. 31. Angle of osteotomy 140°.	Operation angle of osteotomy in degrees	
About 2½ years.	Time since op.	<i>Final condition on 27/11 33.</i>
Walks with a slight waddle. Has half-an-hour's walk to school, which she performs four times a day without trouble.	Type of walk and time	
Lordosis normal, Trendelenburg weakly positive.	Lordosis Trendelenburg	
2½ cm. Heel raised 2 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 27. 11. 1933.

Right hip:

Angle of osteotomy practically straightened out. Corresponding soft flexion of femur with a curvature of c. 160° . Punktum max. situated 9 cm. from point of trochanter (red. measure $7\frac{1}{2}$ cm.).

Distance of angle from apex of trochanter. See above. Angle directed backwards and outwards.

Appearance. Slight curve of femur.

Point of the angle formed by. See above.

Position of the angle in central position. The place of the angle of osteotomy lies c. 10 cm. below and just in front of acetabulum. The unchanged trochanter minor lies on a level with the edges of the socket.

Position and appearance of collum and caput. Both slightly hypotrophic. The collum is directed vertically.

Extra socket. A well developed extra socket directed obliquely backwards directly above acetabulum.

Acetabulum. Blocked up with tumid edges.

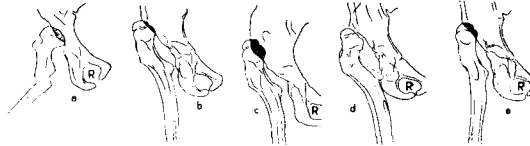
Position of angle with inward and outward rotation. With attempt at inward r. the position was unchanged in the main. With outward r. the angle is directed further back.

Position of collum and caput. With outward rotation collum and caput shift somewhat medially.

Centre of movement corresponds mainly to the middle part of the upper side of angle.

Standing position. The femur is pushed up a good 1 cm., and the upper side of angle approaches the lateral edge of the pelvis.

Notes. Left hip: subluxation position of caput, which lies in the upper part of a large shallow socket.



12 R. 12 a = Middle position, op. — 12 b = Middle position, lying. — 12 c = Middle position, standing. — 12 d = Lying, internal rotation. — 12 e = Lying, external rotation.

No. 12. — SUMMARY. — Angle of osteotomy almost straightened out. Only a flat arch remains corresponding to an angle of c. 160° . The concavity is directed backwards and outwards. The highest vaulting lies below and immediately in front of acetabulum. Centre of movement corresponds mainly to the middle part of the upper side of the angle. In a middle position and internal rotation the pelvis is supported, but the support is lost with external rotation. In a standing position the femur is displaced 1 cm. upwards, and the upper side of the angle approaches the lateral edge of the pelvis. Walking capacity improved, and bearing good. Shortening $2\frac{1}{2}$ cm.

No. 13 (9698), Female; aet. 14. J. K. A.	No. Name	Data before final condition.
Lux. cox. cong. bilat. Lordosis increased, Trendelenburg + on both sides.	Lordosis Trendelenburg	
Walks very badly with knees rotating considerably inwards. Legs probably of equal length.	Anamnesis Walking capacity pains shortening before op.	
Low osteotomy, Schanz's method, on both sides. Right side on 23. 2. 29. Angle of osteotomy 135°. Left side on 23. 1. 29. Angle of osteotomy 130°.	Operation angle of osteotomy in degrees	
About five years.	Time since op.	Final condition on 9/12 33.
Walks stiffly, but can cover up to 3 miles. Untroubled indoors.	Type of walk and time	
Lordosis slightly increased, Trendelenburg negative on both sides.	Lordosis Trendelenburg	
Left leg 1 cm. short.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 9. 12. 1933.

Angle of osteotomy. Right side: 150°, directed obliquely backwards and outwards. Left side: 130°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter: Right side: c. 13 cm. (red., meas. c. 11 cm.). Left side: c. 11 cm. (red. meas. c. 9¼ cm.).

Appearance. Place for point of angle rounded off with slightly spoon-shaped thickening.

Point of the angle formed on both side by the two fragments, which meet in the rounded-off point.

Position of the angle in central position: Right side: the rounded-off point lies about 3 cm. below anterior lower edge of acetabulum. The upper side of angle runs parallel with it. Left side, the same in the main.

Position and appearance of collum and caput. Right side: both well developed. Collum directed vertically. Caput lies c. 10 cm. above acetabulum, immediately lateral of ilium in central position. Same on left side.

Extra socket. Indication of one immediately above acetabulum.

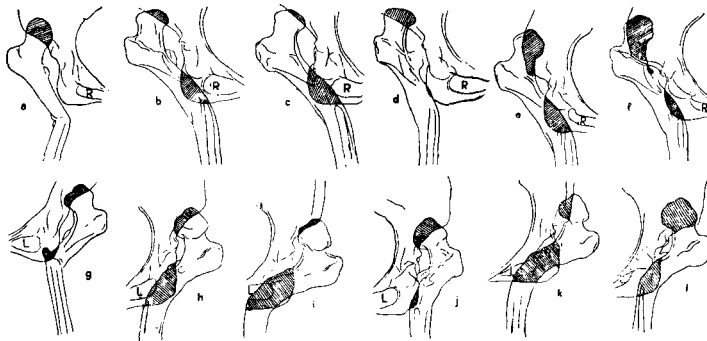
Acetabulum slightly filled up on both sides.

Position of angle with inward and outward rotation. Right side: At attempt with inward rotation, mainly unchanged position. With outward r. the angle was directed further backwards. Same on left side.

Position of collum and caput. Collum directed vertically on both sides. With outward rotation glide-movements of caput and collum medially.

Centre of movement lies on the upper side of angle near the trochanter.

Standing position. Right side: the caput is shifted upwards a few cm., the upper side of angle then approaching the lateral edge of the pelvis. Same on left side. No difference with outward and inward rotation.



13 R. 13 a = Middle position, op. — 13 b = Middle position, lying. — 13 c = Lying, internal rotation. — 13 d = Lying, external rotation. — 13 e = Standing, internal rotation. — 13 f = Standing, external rotation. — 13 L = Middle position, op. — 13 g = Middle position, lying. — 13 h = Lying, internal rotation. — 13 i = Lying, external rotation. — 13 j = Standing, internal rotation. — 13 k = Standing, external rotation.

No. 13. — SUMMARY. — Both angles of osteotomy straightened out from 135° and 130°, respectively, to 150°, and form rounded-off convexities, with the concavities open backwards and outwards. On both sides, the place for the point of the angle of osteotomy lies c. 3 cm. below the anterior, lower edge of acetabulum. The upper sides of the angle run parallel with it. Centre of movement lies in the upper side of the angle, near the trochanter major. The pelvis is supported on both sides in the middle position and with internal rotation, but not with external rotation. In a standing position, the caput is pushed on both sides a few cm. upwards, the upper side of the angle then approaching the lateral edge of the pelvis. Walking capacity increased. Bearing almost normal. Shortening on left side c. 1 cm.

No. 14 (9905). Female; aet. 30. E. B.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. dex. Lordosis increased, Trendelenburg +.	Lordosis Trendelenburg	
Walks with a considerable limp and gets pains after as little as 10 minutes. Right leg 7 cm. short.	Anamnesis Walking ca-pacity pains shortening before op.	
Low osteotomy, Schanz's method. Right side on 20. 4. 29. Angle of osteotomy 130°.	Operation angle of osteotomy in degrees	<i>Final condition on 13/11 33.</i>
About 4½ years.	Time since op.	
Walks with a slight limp after raising of heel. She is satisfied, and moves about freely indoors. No pain at all.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Shortening 11 cm. Heel raised 8 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Inflects passively and normally in a standing position, but in a lying position lacks all active power of inflection.	Inflexion	
Normal.	Abduction	
Almost lost.	Adduction	
External rotation normal, internal lacking.	Rotation	
Palpable in Scarpa's triangle.	Angle of osteotomy stretched to	

X-rays on 13. 11. 1933.

Right hip:

Angle of osteotomy 140°, directed obliquely backwards and outwards with central position of foot.

Distance of angle from apex of trochanter: on the film 14 cm. (reduced measure c. 11½ cm.).

Appearance: rounded off, with slight spool-shaped embossment round the point of the angle.

Point of the angle formed by both fragments.

Position of the angle in central position. The point lies c. 3 cm. below the anterior lower edge of socket. Upper side of angle runs chiefly parallel with the anterior upper edge of socket underneath it.

Position and appearance of collum and caput. Collum slightly atrophic, is directed vertically. Caput lies with its lateral edge c. 9 cm. above acetabulum immediately behind crista iliaca anterior sup.

Extra socket is indicated.

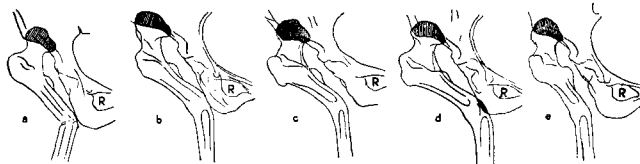
Acetabulum filled up, with tumidly increased edges.

Position of angle with inward and outward rotation. With inward r. the angle is slightly medial, with outward r. there is a moderate lateral shift.

Position of collum and caput is in the main unchanged with these movements in relation to the pelvis.

Centre of movement lies in region of caput.

Standing position. The femur is pushed a cm. or so upwards in relation to the pelvis.



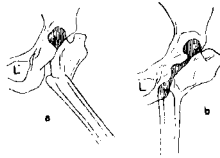
14 R. 14 a = Middle position, op. — 14 b = Middle position, lying. — 14 c = Middle position, standing. — 14 d = Lying, internal rotation. — 14 e = Lying, external rotation.

No. 14. — SUMMARY. — Angle of osteotomy increased from 130° to 140°. The femur forms an even convexity, with the concavity directed backwards and outwards in the middle position. The highest point of the convexity lies c. 3 cm. below the anterior, lower edge of the cavity. Centre of movement lies in the region of caput. The pelvis is supported in all positions except with external rotation. In a standing position, the femur is pushed a cm. or so upwards in relation to the pelvis. Walking capacity good. Bearing good. Limps. Shortening has increased from 7 to 11 cm.

No. 17 (10699). Female; aet. 35. G. C. J.	No. Name	<i>Data before final condition.</i>
Insuff. cox. sin. post osteomyelit. Lordosis increased, Trendelenburg +	Lordosis Trendelenburg	
At age of 7 had aches and pains in left hip. Hospital treatment for some months, then well until 10 years old, when same symptoms reappeared. Lay up for 3 years in extension. Was then only troubled by a bad limp till a year ago, when she began to feel stiff in the hip, grew tired and got pains with exertion. Shortening 9 cm. Moderate pes equinus. With weight thrown on it, the knee-joint has marked genu recurvatum. X-rays show that only a small, finger-sized rest of collum and caput remains. It is c. 2 cm. long and freely mobile in the wide acetabulum.	Anamnesis Walking capably pains shortening before op.	<i>Final condition on 8/12 33.</i>
Low osteotomy, Schanz's method. Left side on 29. 1. 30. Angle of osteotomy 110°.	Operation angle of osteotomy in degrees	
Angle of abduction was not suited to the fixation that was prescribed, owing to the collum remnant, and it took 6 months before there was sufficient adduction of the leg.	Notes	
About four years.	Time since op.	
Patient runs a large boarding-house on the West Coast. She is busy all day long, manages the stairs without difficulty, does not tire, never has pain, but limps.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Left leg 11 cm. short. Heel raised 7 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Active inflexion in lying position c. 40°. Passive inflexion normal.	Inflexion	
25°.	Abduction	
Scarcely 5°.	Adduction	
Both inward and outward r. reduced by about half.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 8. 12. 1933.

Left hip: of collum there remains a good 2 cm.-long vertically directed peg, the rounded-off thumb-end sized end leads into the acetabulum, which is enlarged upwards and has a slightly irregular bottom with some sclerosis around it. Nearly a cm.-wide »joint fissure«. In a standing position the collum end is slightly pressed closer to the roof of the acetabulum. Osteotomy has been performed on the femur *c.* 9 cm. below the top of the trochanter. The angle amounts to *c.* 120°, directed obliquely backwards laterally, and lies immediately laterally of and below the lower edge of the acetabulum. Trochanter minor therefore lies in the immediate proximity of the lower edge of the socket. The point of the angle is formed by the lower fragment of the femur. The point is slightly rounded off. On attempt at outward-inward rotation no change of position between femur and pelvis.



17 L. 17 a -- Middle position, op. -- 17 b -- Lying, internal rotation.

No. 17. — SUMMARY. — Angle of osteotomy straightened out from 110° to 120°. It is open obliquely backwards and sidwards and the point is formed by the lower fragment which lies immediately under and laterally of the lower edge of acetabulum. A remainder of the collum of 2 cm. is within the acetabulum, and all movements take place round it. The pelvis is supported in all positions. Walking capacity and bearing good, even though the shortening has caused the shoulders to be aslope. Limbs. Shortening has increased from 9 to 11 cm.

No. 19 (10836). Female; aet. 21. I. V. S.	No. Name	Data before final condition.
Lux. cox. cong. dex. Lordosis almost normal. Trendelenburg +.	Lordosis Trendelenburg	
Patient has always limped. Grows tired and gets pains after only 10 minutes' walk. Right leg 4 cm. short. A radiogram shows that caput is fixed in a shallow extra socket.	Anamnesis Walking caput pains shortening before op.	
Low osteotomy, Schanz's method. Angle of osteotomy 115°. It had been intended to perform an ordinary Bifurcation op., but the osteotomy was performed too low, so that op. became more of the Schanz type.	Operation angle of osteotomy in degrees	
About 3½ years.	Time since op.	
Patient walks about indoors all day long without tiring, but off and on she has sciatic-like pain in the right side and especially in the calf. The limp with raised heel is almost unnoticeable. Can walk out of doors for an hour at most.	Type of walk and time	
Lordosis normal. Trendelenburg negative.	Lordosis Trendelenburg	
Shortening 6 cm. Heel raised 4 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
25°.	Abduction	
None.	Adduction	
Inward rotation lost, outward normal.	Rotation	
Palpable in Scarpa's triangle.	Angle of osteotomy stretched to	Final condition on 23/11 33.

X-rays on 23. 11. 1933.

Right hip:

Angle of osteotomy 125°, directed obliquely backwards and outwards.

Distance of angle from apex of trochanter 12 cm. (red. meas. c. 10 cm.)

Appearance. Point of angle well marked, slightly rounded off. Considerable callus on lower side.

Point of the angle formed by lower fragment.

Position of the angle in central position. Point of angle lies a few cm. below and in front of lower anterior edge of acetabulum. Upper side of angle runs parallel with it. Trochanter minor slightly enlarged with a few irregularities on surface. It is directed towards middle of acetabulum.

Position and appearance of collum and caput: Both well developed. Collum directed vertically. Caput lies with its medial edge in a shallow extra socket just above acetabulum, at back of lateral edge of os ilium.

Extra socket. See above.

Acetabulum filled up.

Position of angle with inward and outward rotation; no great difference noticeable.

Position of collum and caput. Caput moves in the socket.

Centre of movement. See above.

Standing position. Upper side of angle approaches lateral edge of pelvis.



19 R. 19 a = Middle position, op. — 19 b = Middle position, lying.

No. 19. — SUMMARY. — Angle of osteotomy straightened out from 115° to 125°. It is open obliquely backwards and outwards, and its point is formed by the lower fragment. The point is situated a couple of cm. below and somewhat in front of the anterior, lower edge of the acetabulum. Caput is freely movable in a shallow extra cavity. It rests with its medial part against this cavity. All movements take place round the head lying in the extra cavity. The pelvis is supported in the middle position and with internal rotation, not with external. Walking capacity normal indoors, reduced out of doors. Bearing good, slight limp. Shortening increased from 4 to 6 cm.

No. 21 (1800). Female; aet. 35. E. K.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. sin. Lordosis increased. Trendelenburg +.	Lordosis Trendelenburg	
Was little troubled by her limp until last year. She can now only walk a few steps without having pains in the hip and back. Shortening 6 cm.	Anamnesis Walking capacity pains shortening before op.	
Low osteotomy, Schanz's method. Left side on 18. 3. 31. Angle of osteotomy 130°.	Operation angle of osteotomy in degrees	
About 2¾ years.	Time since op.	<i>Final condition on 9/11 33.</i>
The patient is an elementary school teacher. Since the op. she can move freely indoors, on the stairs, and out of doors. With raised heel her walk is normal.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Left leg 6 cm. short. Heel raised 5 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal, though in lying position the actual strength is very slight.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
External r. normal. Internal r. somewhat restricted.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 9. 11. 1933.

Angle of osteotomy, left side, c. 130° , open backwards and outwards.

Distance of angle from apex of trochanter, 11 cm.

Appearance: rounded off.

Point of the angle formed by lower fragment.

Position of the angle in central position a few cm. below lower part of acetabulum.

Position and appearance of collum and caput. Both moderately atrophic. Collum directed vertically and backwards. Caput lies in the soft parts immediately outside the lateral edge of pelvis.

Extra socket is indicated.

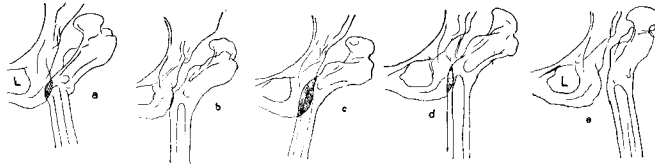
Acetabulum slightly filled up.

Position of angle with inward and outward rotation. With inward rotation the angle points somewhat medially. With outward rotation it is directed more towards the back.

Collum and caput perform pendulous movements in opposite direction.

Centre of movement lies in lower half of upper side of angle.

Standing position: the upper side of angle approaches the lateral edge of the pelvis.



21 L. 21 a = Middle position, op. — 21 b = Middle position, lying. — 21 c = Middle position, standing. — 21 d = Lying, internal rotation. — 21 e = Lying, external rotation.

No. 21. — SUMMARY. — Angle of osteotomy unchanged 130° . Point of angle is formed by the now rounded-off lower fragment. The angle is open obliquely backwards and outwards. The point lies a couple of cm. below the lower part of acetabulum. Centre of movement lies in the lower part of the upper side of the angle. The pelvis is supported in the middle position and with internal rotation, but with external rotation. In a standing position, the upper side of the angle approaches the lateral edge of the pelvis. Walking capacity, bearing and mobility practically normal. Shortening unchanged 6 cm.

No. 30 (13177). Female; aet. 16. A. M. A.	No. Name	<i>Data before final condition.</i>
Lux. cox. cong. dex. Lordosis increased. Trendelenburg +.	Lordosis Trendelenburg	
Patient can walk for short distance without difficulty, but must go slowly and soon tires. Right leg 4 cm. short.	Anamnesis Walking capacity pains shortening before op.	
Low osteotomy, Schanz's method. Right side on 6. 4. 32. Angle of osteotomy 140°. The osteotomy was intended to come opposite the socket, but was somewhat too low, so that trochanter minor came to be opposite the acetabulum.	Operation angle of osteotomy in degrees	
A year and three-quarters.	Time since op.	<i>Final condition on 14/12 33.</i>
Walks without difficulty indoors all day long. Can walk out of doors for 1½ hours without difficulty, but then grows tired very quickly. Limp, but never has any pain.	Type of walk and time	
Lordosis normal, Trendelenburg negative.	Lordosis Trendelenburg	
Shortening 5 cm. Heel raised 3 cm.	Shortening in cm Elevation of heel	
Normal.	Stretching	
Normal.	Inflexion	
Normal.	Abduction	
Normal.	Adduction	
Normal.	Rotation	
Not palpable.	Angle of osteotomy stretched to	

X-rays on 14. 12. 1933.

Right hip:

Angle of osteotomy 140° in central position obliquely backwards and outwards.

Distance of angle from apex of trochanter c. 11 cm. (red. measure c. 9 cm.).

Appearance: rounded off, with slight spool-shaped embossment.

Point of the angle formed by the two fragments, which meet.

Position of the angle in central position. Point of angle lies immediately in front of and c. 1 cm. below lower edge of socket. Upper side of angle runs parallel a couple of cm. below anterior edge of socket. Trochanter minor well developed, directed medially, and lies in lower part of acetabulum. Planed off at its upper surface.

Position and appearance of collum and caput. Both atrophic. Collum directed vertically and slightly medially. Caput lies in a little extra socket, immediately above the back part of the acetabulum (in lying position).

Extra socket: a small one.

Acetabulum filled up with tumidly intensified edges.

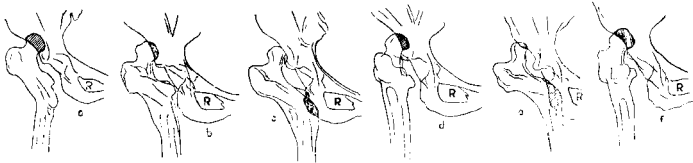
Position of angle with inward and outward rotation. With inward r. inconsiderable shift medially of point of angle; with outward r. the angle is directed backwards.

Position of collum and caput. With outward and inward rotation typical glide movement of caput and collum medially and laterally.

Centre of movement corresponds to middle part of upper side of angle.

Standing position. Caput is pushed upwards a few cm. and is luxated from the little extra socket. No difference in height with outward and inward rotation.

Notes. Left hip: normal findings.



30 R. 30 a Middle position, op. — 30 b — Middle position, lying. — 30 c — Lying, internal rotation. — 30 d — Lying, external rotation. — 30 e — Standing, internal rotation. — 30 f — Standing, external rotation.

No. 30. — SUMMARY. — Angle of osteotomy unchanged 140°. In the middle position, the opening of the angle is directed obliquely backwards and outwards. The point of angle is formed by both fragments. It lies just in front of and 1 cm. below the lower edge of the cavity. Trochanter minor is directed medially, and is just outside the lower part of acetabulum. At its upper surface it is effaced. Centre of movement corresponds to the middle part of the upper side of the angle. The pelvis is supported in the middle position and with internal rotation, but not with external rotation. Walking capacity and bearing improved. Limps. Shortening increased from 4 to 5 cm.

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