

Brief Communication

Soft Tissue Balance of the Hip

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Abstract: Release of static and dynamic contractures around the hip provides significant immediate benefits for the patient and accelerates postoperative rehabilitation. Knee pain is decreased, groin pain is eliminated, range of motion of the hip is increased, and functional leg-length difference is reduced. This article emphasizes the importance of techniques used to ensure soft tissue balance. **Key words:** total hip replacement, soft tissue balance, pain relief, release of contractures, functional leg-length difference

Very little has been written about the necessity for muscle function to allow a hip arthroplasty to work correctly or soft tissue balance around the hip. With hip arthritis, prior to total hip arthroplasty, one of the operations done for relief of the pain was the "hanging hip" operation [1]. This operation involved relief of pain for the arthritic hip by elimination of the contractures around the hip that accentuated the pain from arthritis of the joint. We have previously described some of the muscle balancing procedures that we use to ensure soft tissue balance [2]. In this article, we explain the importance of these techniques.

Release of static and dynamic contractures around the hip provides significant immediate benefits for the patient and accelerates postoperative rehabilitation. The patient benefits by a decrease in knee pain, elimination of groin pain, increased range of motion of the hip, and, potentially of greatest benefit for the patient-doctor relationship, reduction of functional leg-length difference. A functional long leg occurs when the leg lengths are actually correct, but

because of contractures around the hip and a resultant pelvic obliquity, the patient feels like the leg is 1 or 2 inches longer. This functional leg-length difference can persist for many months until the tissues accommodate to the hip arthroplasty [3]. In some patients, this may never occur and a functional leg-length difference persists.

Soft tissue balancing of the hip requires release of muscles. There is little cost to the patient for the release of muscles except when the iliopsoas tendon is completely released from the lesser trochanter. This release can cause weakness with ascent of stairs and lifting the leg to get in and out of a car.

Indications

The surgeon can anticipate that soft tissue releases around the hip are necessary when a patient has contractures of the hip that are more than 20° in flexion, abduction, or external rotation. From the radiographs, soft tissue releases can be anticipated when the hip demonstrates shortening from collapse of the femoral head, particularly with superolateral migration and the presence of osteophytosis around the hip (Fig. 1). Contractures will be present when there are significant acetabular osteophytes and shortening of the hip on the radiograph. During surgery, tightness of the hip through the range of motion with the components in place indicates the

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Fig. 1. Anteroposterior radiograph of a left hip with shortening of the hip due to mild collapse and superolateral migration of the femoral head. Extensive osteophytes are present, especially in the medial acetabulum.

necessity for soft tissue release. Failure to bring the hip to full extension, failure to be able to abduct the hip beyond 20°, and failure to bend the knee beyond 90°–100° (without knee arthritis or previous total knee arthroplasty) are indications that there is an imbalance of the soft tissues. The test for full extension is that the leg can be extended 10° beyond a line between the anterosuperior spine and the patella. A tight tensor fascia muscle results in a positive Ober sign [4,5] so that the thigh does not settle easily against the other leg.

First, the surgeon must be certain that the leg has not been lengthened to create this tightness. We use the position of the lesser trochanter to the ischium to determine leg lengthening. On a radiograph, a line is drawn across the bottom of the ischia, and the relationship of that line to the lesser trochanters is used to determine the hip length. During surgery, by palpating the ischium and observing the position of the lesser trochanter, one can make a very accurate measurement (Fig. 2). When one is palpating the ischium, one must not be fooled by the tendons of the hamstrings that originate on the ischium.

Offset can also be determined by palpation of the interval between the greater trochanter and the pelvis during range of motion. In abduction and external rotation, the tip of the greater trochanter should clear the pelvis by 1 full fingerbreadth. In full

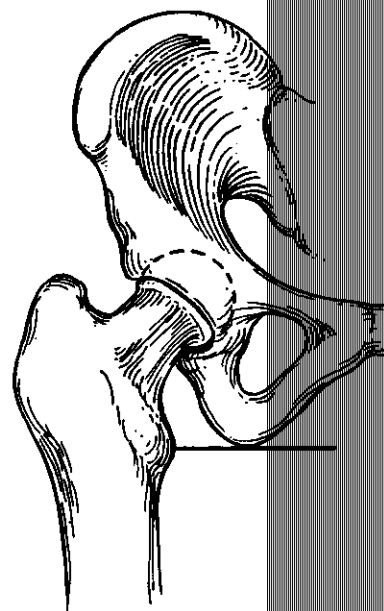


Fig. 2. During surgery, the relationship between the lesser trochanter and the ischium is a very accurate method of determining hip length.

extension and external rotation, the lesser trochanter should clear the ischium by one full fingerbreadth. In flexion to 90° and internal rotation, the anterior femoral neck should clear the pelvis by 1 fingerbreadth. These measurements are not accurate until the soft tissue balance has been corrected so that the full range of motion is available.

Surgical Technique

Inability to Extend the Hip

If the hip does not extend beyond neutral, which is a line from the anterior spine to the patella, the surgeon must palpate the iliopsoas tendon. This tendon likely will be very tight and can be felt to cross the anterior acetabulum like a "banjo string." The iliopsoas tendon must be recessed or completely released until it is elastic, as it is palpated in extension and as it crosses the anterior acetabulum. Leaving the iliopsoas tendon tight like a banjo string can cause groin pain after surgery from irritation of the tendon as it crosses the anterior acetabulum. It may also be true that the anterior capsule is very tight and prevents extension of the hip. This static structure must be released by excision or incision of the anterior capsule sufficiently to allow the hip to extend 10°.

Inability to Abduct and Externally Rotate the Hip More Than 20° or Positive Ober Sign

The primary internal rotator of the hip is the tensor fascia muscle and its extension as the ilio-

tibial band. If the hip is very tight in abduction and external rotation or if there is tightness in the thigh as it lays against the other leg (positive Ober sign), release of the tensor fascia is necessary. This is done by grasping the tensor fascia with 2 Kocher clamps just distal to the fascial band to the gluteus medius muscle. The vastus lateralis fascia should be retracted with 1 hand while the assistant lifts the tensor fascia anteriorly. Division with an electrocautery device includes the muscle fibers so that the muscle and the fascia will give (Fig. 3). The tensor fascia can be divided completely to the rectus femoris muscle. The division of the tensor fascia muscle will allow improved abduction and external rotation of the hip. One finger should be able to be placed between the tip of the trochanter and the pelvis with complete abduction and external rotation. If this cannot be done, the offset is not correct and 1 more modular head length for the femoral component may be necessary. If leg length is correct and the tip of the trochanter abuts against the pelvis, then a decision either to increase the leg length or to transfer the trochanter must be made.

Knee Flexion

If the tensor fascia has been divided and the knee will still not flex beyond 90°-100°, then division of the rectus muscle must be done. The rectus muscle can be brought into direct view by again lifting the cut edges of the tensor fascia and placing opposite retraction on the vastus lateralis tendon. The rectus muscle can then be grasped and pulled into the wound and divided as necessary to allow the knee to fully flex without resistance (Fig. 4). By release of

the tensor fascia muscle and iliotibial band (which inserts at Gerdy's tubercle) and release of the rectus tendon as necessary, postoperative knee pain is significantly reduced.

Discussion

We emphasize by writing this article that surgeons must think about soft tissue balance of the hip just as they think about soft tissue balance in the knee when doing an arthroplasty. With a painful hip, the surgeon initially evaluates the fixation of the components to determine if there is any indication of looseness. We are emphasizing that most postoperative pain in hip arthroplasties that are well positioned and well fixed radiographically is caused by soft tissues. The two primary reasons for soft tissue pain after total hip arthroplasty are poor function of the abductor muscles of the hip [6] and failure to achieve soft tissue balance.

Hip pain after arthroplasty that is caused by poor function of the abductor musculature is reflected by the patient complaining of pain in the lateral trochanteric and buttock area. This is almost always caused by poor function of the gluteus medius muscle or the upper head of the gluteus maximus muscle (usually from denervation) [6]. This is best tested with a side-lying abduction test. The patient lies on his or her side with the operated hip up and is asked to abduct the leg with the knee in extension. If this cannot be done against manual resistance the abductor musculature grade is poor or fair. We believe 1 reason this occurs is because of too vigorous a manual splitting of the gluteus maximus

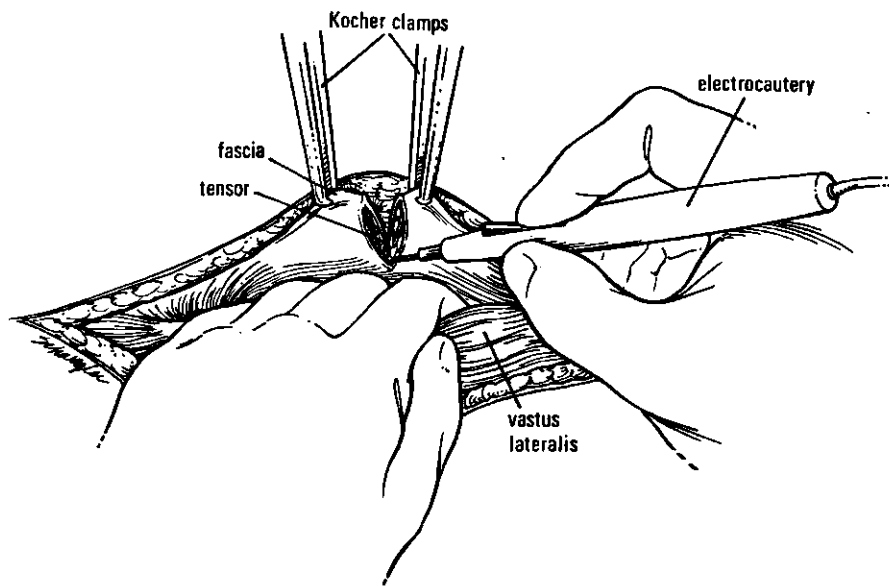
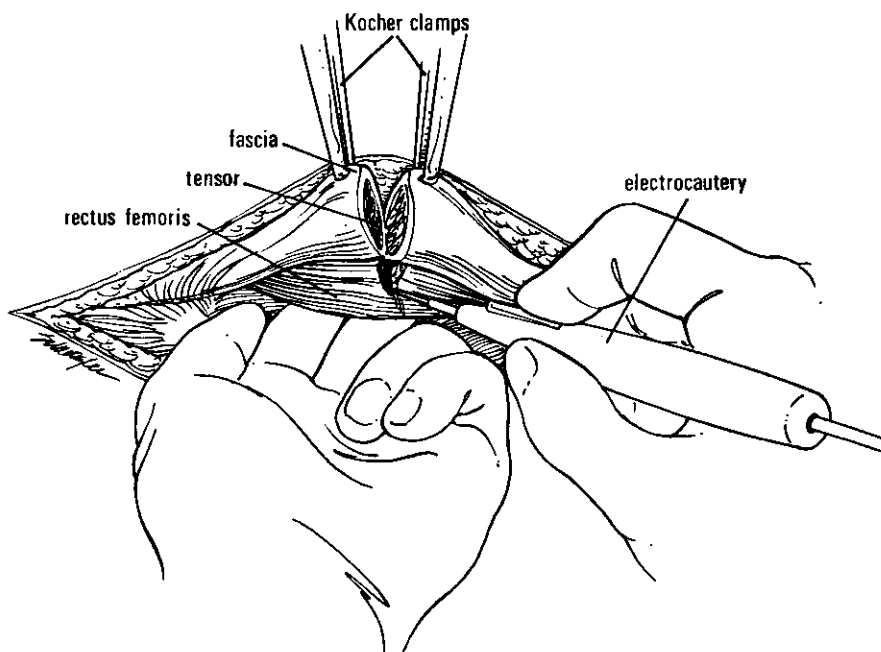


Fig. 3. Release of the tensor fascia. An assistant lifts the anterior edge of the fascial incision with 2 Kocher clamps while the surgeon retracts the vastus lateralis with 1 hand and releases the tensor fascia and muscle fibers as necessary to obtain an adequate release. The release is performed with electrocautery to minimize bleeding and is done distal to the fascial attachment to the gluteus medius.

Fig. 4. Release of the rectus femoris. After release of the tensor, the surgeon reaches into the wound with the hand retracting the vastus lateralis and elevates the rectus muscle into view with the index and long fingers. As the assistant continues to lift the tensor fascia with the Kocher clamps, the surgeon can now safely release the rectus muscle as necessary until the knee can be flexed beyond 90° with the hip in extension. Again this is done with electrocautery to decrease bleeding.



muscle that denervates the upper head. We suggest that the gluteus maximus muscle must be divided with an electrocautery device that allows the surgeon to recognize if she or he is near the nerve for the upper head of the maximus.

A second reason for pain after surgery is poor soft tissue balance with contractures of the iliotibial band, the iliopsoas muscle, the rectus femoris muscle, or the anterior capsule. Pain at the lateral knee is common from tightness of the iliotibial band. Pain in the anterior knee is usually from tightness of the rectus femoris muscle. If the iliopsoas tendon is tight across the anterior acetabulum, the patient can have groin pain. Lastly, any of these contractures can cause a decrease in the range of motion of the hip, resulting in functional deficiencies, such as inability to put on shoes and stockings, or even dislocation from struggling in functional activities against limited motion.

Perhaps the most disturbing postoperative complaint for both the patient and the surgeon is functional leg-length difference. This occurs when on radiographs the hip length and offset have been reestablished within 5–10 mm, but the patient feels as if the leg is 1 or 2 inches too long. This functional leg-length difference is caused by contractures around the hip that create a pelvic obliquity. Commonly, this is caused by tightness of the gluteus medius muscle in a hip that has been short and has had a decreased offset and then is corrected to the normal hip length and offset. This abductor stretch is accentuated by failure to perform soft tissue

balance of the hip. The abductor stretch will require time for adaptation of the gluteus medius muscle to its correct length; however, patients will feel a minimal leg-length difference during this period of adaptation if correct soft tissue balance has been performed for the hip. Release of the tensor fascia muscle is the most important part of this soft tissue balance. When the conditions described are present before surgery, the surgeon must tell the patient that his or her leg will feel long after surgery so that the patient is not worried that something was done incorrectly during surgery.

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