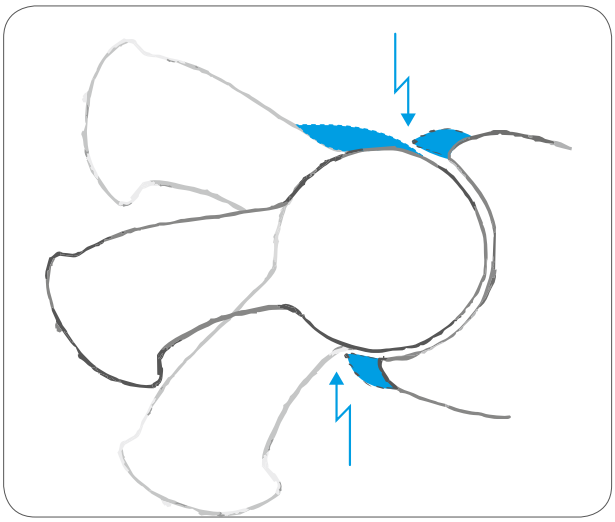
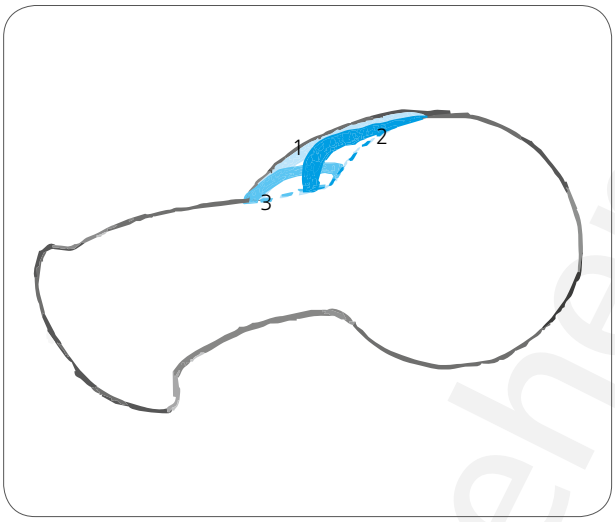
Femoroacetabular impingement (FAI)



Femoroacetabular impingement syndrome is characterised by a morphological disorder of the acetabulum and proximal femur which can lead to early osteoarthritis.

Fig. 4.4: How an osseous bump (blue) at the proximal femur and/or acetabular overcoverage (blue) can lead to a limited excursion and abnormal contact at the joint edges (arrows).

Cam type impingement morphology



There are two morphological variants of cam deformity.

Fig. 4.5: (1) Typical cam deformity is an insufficient offset of the femoral head-neck junction. (2) Variant morphology is a widening and extension of the femoral head at the lateral edge of the joint, so that the femoral head impresses with a rounded tip. This can be recognised due to the increased lateral radius on axial imaging. (3) The other variant is a well-circumscribed bony extrusion from the medial femoral neck, known as an osseous "bump".

Measurement of cam lesions

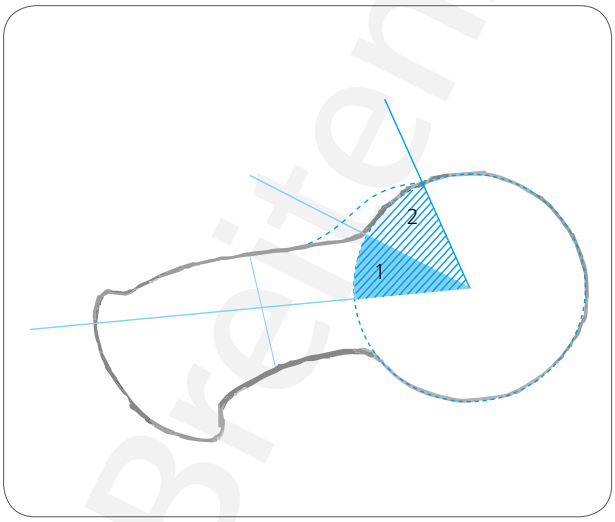
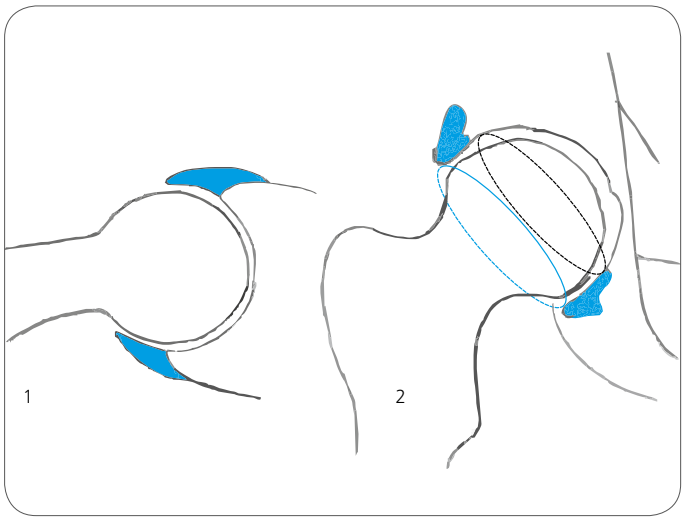


Fig. 4.6: Cam lesions can be quantified on MRI using the alpha angle. A best-fit circle is drawn following the contour of the femoral head and a line drawn from the centre of the circle to the point where the head-neck contour deviates from the circle. The alpha angle is the angle between this line and the femoral head-neck contour line. This is classically measured in the oblique axial plane although multiplanar reconstructions can be used to demonstrate the deformity in a different alignment. An alpha angle of (1) < 55° is considered normal and (2) > 55° abnormal. However, there is low inter- and intraobserver agreement when using this technique and the presence of a cam lesion nonetheless does not necessarily indicate clinical impingement syndrome.

Pincer type impingement morphology



In pincer type impingement, an excessively prominent acetabular rim impacts on the proximal femur. This may reflect global or focal overcoverage of the femoral head, leading to labral degeneration and tearing.

Fig. 4.7: Global developmental acetabular overcoverage of the femoral head (blue) with protrusio acetabuli in the (1) axial and (2) coronal planes. Pincer lesions can also be localised (with retroversion, localised hypertrophy, osteophytes or an ossified labrum).

Measurement of acetabular depth

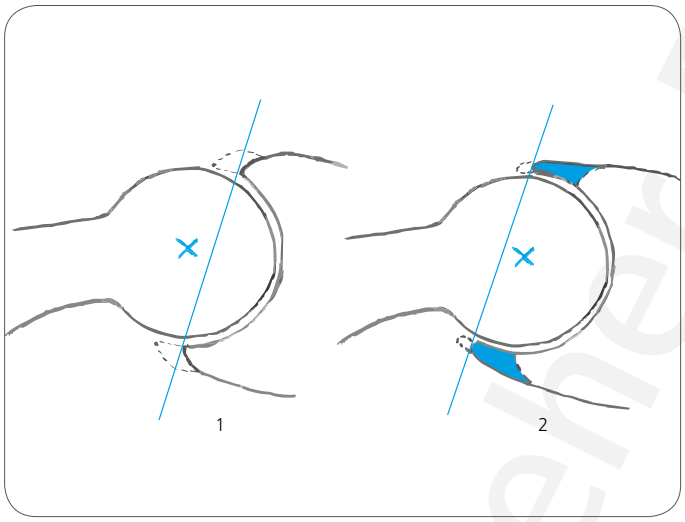
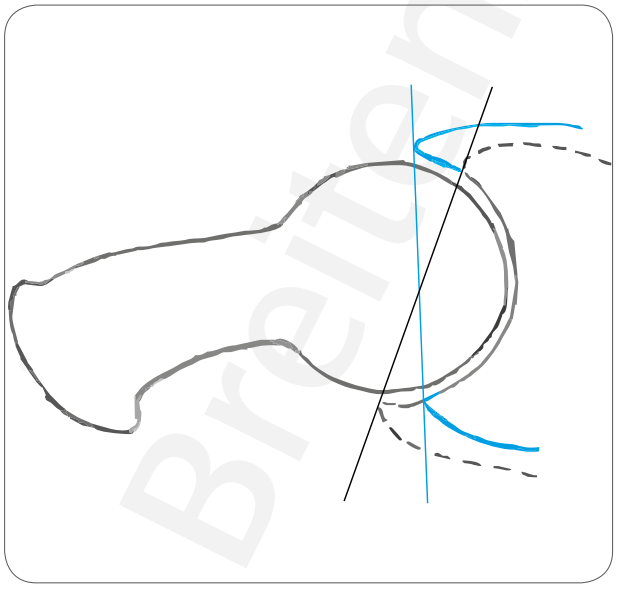


Fig. 4.8: Acetabular depth can be measured with the same image used to calculate the alpha angle. A line is drawn between the anterior and posterior or superior and inferior bony acetabular rims. (1) If the centre of the femoral head is lateral to the acetabular rim, the value is positive. (2) If the femoral head lies medially, the value is negative, indicating acetabular overcoverage and possible global pincer deformity. This is the equivalent to the posterior wall sign on plain X-ray.

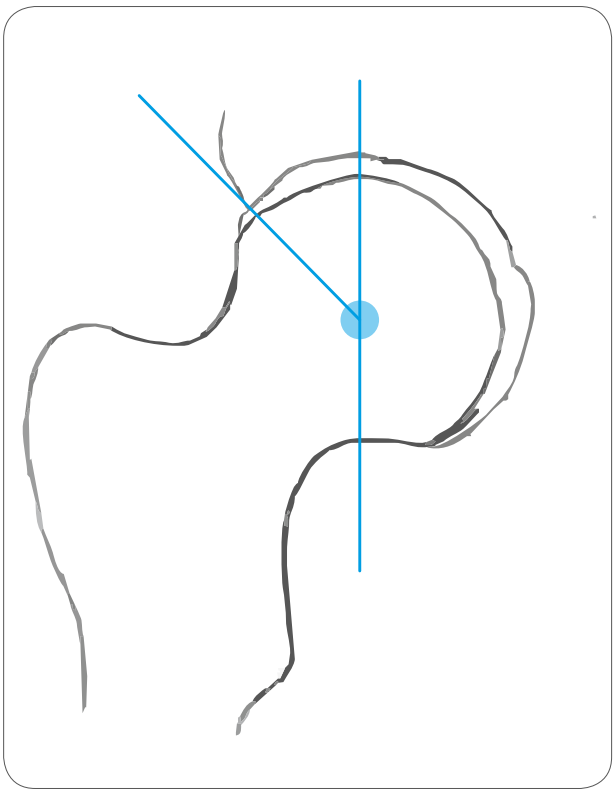
Measurement of acetabular retroversion



Acetabular retroversion may lead to pincer type FAI due to an anterolateral focal overcoverage of the acetabulum. This can be assessed on axial cross-sectional imaging by drawing a line between the anterior and posterior acetabular margins at various levels. If the anterior bony margin is level with or lateral to the posterior bony margin, this shows retroversion. Ideally, 3D imaging should be used so that correction can be made for anterior pelvic tilt in the sagittal plane.

Fig. 4.9: A line is drawn between the anterior and posterior bony margins of the acetabulum and intersected with a true vertical line. Slight anteversion of 5° to 15° is normal. This should be measured in the upper and middle zones of the acetabulum. Reduced anteversion or retroversion may be global or limited to the superior acetabulum.

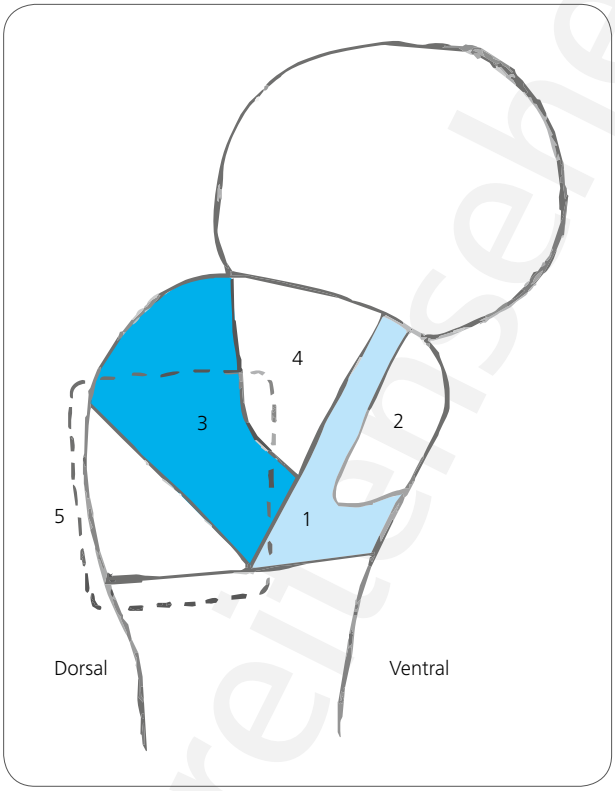
Measurement of the lateral centre edge angle (Wiberg)



Traditionally radiographic, this measurement is also valid on MRI. An angle is formed between a vertical line through the centre of the femoral head and a line between the centre of the femoral head and the lateral bony edge of the acetabulum. Values between 20° and 40° are considered normal. An increased angle indicates pincer type morphology, whereas a decreased angle indicates acetabular dysplasia.

Fig. 4.10: Measurement of the lateral centre edge angle (Wiberg), a value of less than 20° indicates acetabular dysplasia.

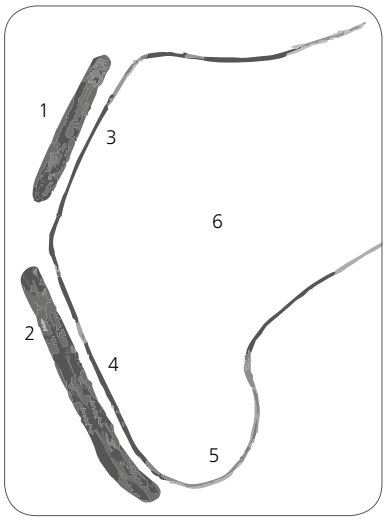
Lateral hip anatomy: abductors, entheses and the greater trochanter



The anatomy of the lateral hip includes the gluteal abductor tendons, their entheses, the different facets of the greater trochanter and the related bursae. Related pain is often termed greater trochanteric pain syndrome and may originate from any of these structures.

Fig. 4.11: The greater trochanter can be divided into anterior, lateral, superoposterior and posterior facets. (1) The gluteus minimus tendon inserts on the anterior facet with (2) the subgluteus minimus bursa at the anterior aspect. (3) The gluteus medius tendon inserts on to the lateral and superoposterior facets with (4) the subgluteus medius bursa at the anterior aspect of the lateral facet. The trochanteric bursa overlies the posterior facet. (5) Trochanteric bursa.

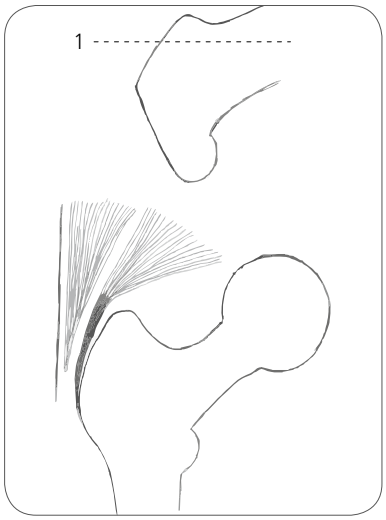
Axial cross-section of the greater trochanter



The relatively weak gluteus minimus tendon inserts anteriorly and the stronger gluteus medius tendon posteriorly at the greater trochanter.

Fig. 4.12: Axial view of the greater trochanter. The (1) gluteus minimus tendon has an average thickness of 4 mm and width of 17 mm at the insertion on the (3) anterior facet of the (6) greater trochanter. The (2) gluteus medius tendon has an average thickness of 7 mm and width of 19 mm at the insertion on the (4) lateral and (5) superoposterior facets. The subgluteal bursae are located deep to the respective tendons. The trochanteric bursa is the largest and covers the posterior facet and the distal lateral part of the gluteus medius tendon.

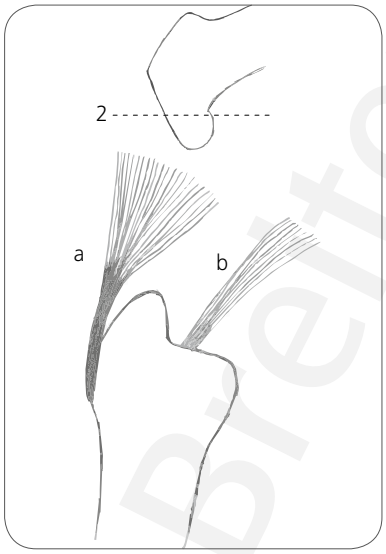
Gluteus minimus tendon and the anterior facet



The gluteus minimus tendon can be divided into two parts. The main tendon, from the superficial part of the muscle fascia, inserts on the anterior facet. The second part of the insertion is a muscular insertion on the anterior and superior capsule of the hip joint.

Fig. 4.13: Coronal view through the anterior facet of the greater trochanter, showing the gluteus minimus tendon deep to the gluteus medius muscle and iliotibial tract.

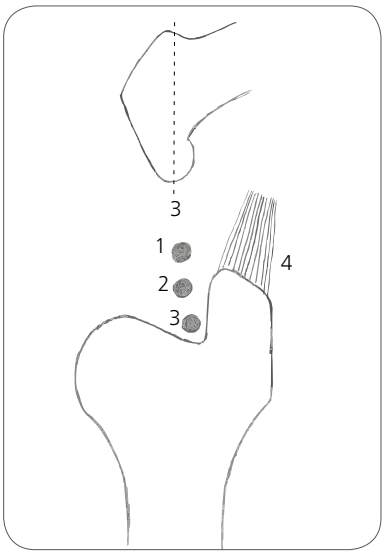
Lateral part of the gluteus medius tendon and the lateral facet



The gluteus medius tendon can be divided into two parts. The main part, from the central and posterior portion of the muscle, has a strong insertion on the superoposterior facet. The weaker lateral part, from the undersurface of the muscle, inserts onto the lateral facet.

Fig. 4.14: Coronal view through the posterior part of the greater trochanter, showing the lateral facet with the lateral part of the (a) gluteus medius tendon insertion. The anterior aspect of the tendon covers the posterior aspect of the (b) gluteus minimus tendon insertion. The femoral head is no longer visible in this relatively posterior section.

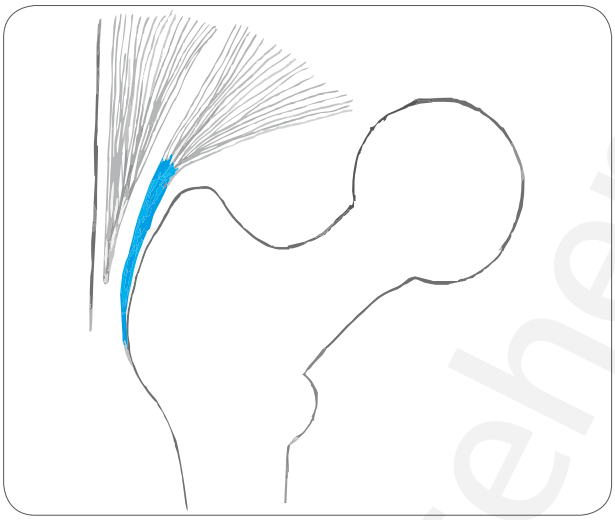
Main part of the gluteus medius tendon and the superoposterior facet



The superoposterior facet and the main part of the gluteus medius tendon insertion is seen in the coronal and sagittal planes. The superoposterior facet is a proximal projection of the posterior contour of the trochanter, forming the most proximal part of the enthesis.

Fig. 4.15: Coronal illustration of the greater trochanter showing the styloid-like projection of the superoposterior facet and the main part of the gluteus medius tendon insertion (4). The tendons of the (1) piriformis, (2) obturator internus and (3) obturator externus run perpendicular and anterior to this tendon insertion.

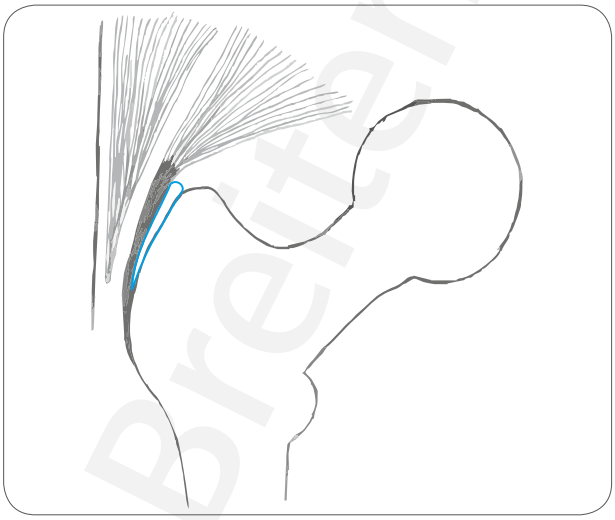
Tendinopathy of the gluteus minimus muscle tendon



Tendinopathies of the gluteal abductor tendons are common findings and frequent MRI diagnoses. They are most commonly seen in women over the age of 50 years (f : m / 4 : 1). The medius tendon is more commonly affected than the minimus tendon.

Fig. 4.16: Coronal view through the greater trochanter showing tendinosis of the gluteus minimus tendon at the anterior facet. The tendon is of regular width and continuity, but displays increased fluid signal.

Subgluteal bursitis



The subgluteus minimus and medius bursae are located deep to the gluteus minimus and medius tendons respectively and are easily seen on MRI when distended.

Fig. 4.17: Subgluteus medius and minimus bursitis presents as a well-circumscribed linear fluid collection between the respective tendon enthesis and the greater trochanter.