

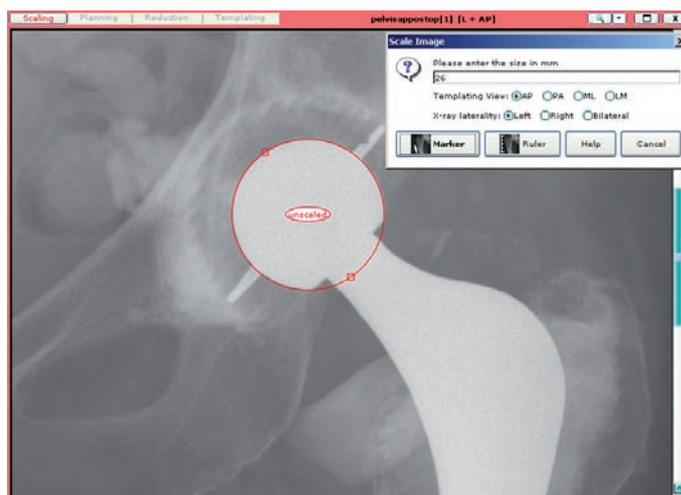
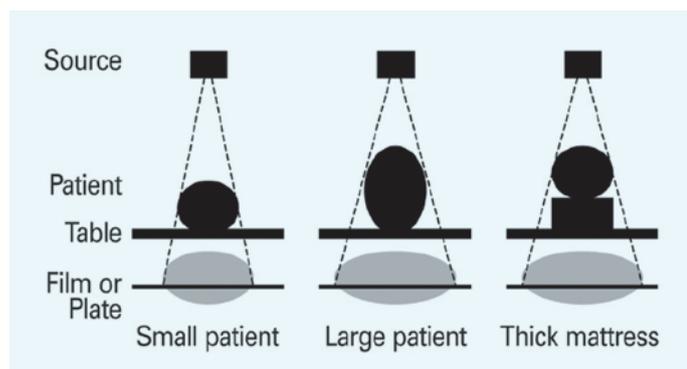
Scaling digital x-ray images of the hip

written by Dr Grant Shaw, Portsmouth, UK

Turning on full beam headlights when driving along a dark country road improves range, detail and confidence in what you can see. This in turn improves speed and avoids unexpected potholes and obstacles. It is possible to drive safely along the same road using dipped beam or even on sidelights alone but progress is slower and more difficult.

It is possible to do hip replacements without pre-operative planning but templating helps us anticipate and avoid problems. Scaling x-rays for digital hip templating is like turning on the full beam in that it adds clarity and confidence to the measurements used for planning.

It is well known that the pelvic x-rays we use for planning hip replacements vary in magnification (115% -130%). This degree of variation occurs partly because of differences in radiographers' techniques but mainly due to patients' obesity. The hip joint of a thin patient lying on an x-ray cassette is only a few centimetres above the plate giving little distance for the x-rays to diverge. In an over weight patient, the hip joint can be twice as far from the plate, allowing the divergent beam to spread more before it hits the plate.



Using the femoral head of an existing implant is a convenient way of calibrating the image.

The solution to this problem is to introduce an object of known size into the plane we are interested in measuring. If the patient has already had a hip replacement on the other side, the metal femoral head provides the ideal scaling marker. When using OrthoView in this situation it is possible to draw a circle around the metal head on the image and enter the diameter. The software then scales the image so that we can take measurements on the x-ray with confidence that they are accurate.

Not all our patients come so conveniently fitted with a built-in marker and so the radiographer has to introduce a marker at the time of taking the image. The marker is placed on the patient in the plane of the hip joint.

Type of marker

Markers of many shapes and sizes have been used.

Ruler

Radio-opaque rulers have been used but they need to be placed in the plane of the hip joint and also held perpendicular to the x-ray beam. The advantage of rulers is that a scale of 50, 100 or even 150mm can be used which reduces the end error. The disadvantage is fixing and ensuring the ruler stays in the correct position while the image is taken.

Sphere

Metal spheres can be used. The main advantage is that orientation is not important as they are entirely symmetrical. The disadvantage is that spheres can be quite heavy and difficult to hold in the correct plane, even using adhesive strips to hold them. Spheres mounted on adjustable 'arms' and attached to a stand are now available and make it much easier to position correctly.

Markers with flexible 'arms' enable easy positioning of the sphere.



Disc

A coin or disc makes a very good marker, creating an elliptical shadow on the x-ray. The maximum diameter of the ellipse is always the diameter of the disc, whatever orientation it is lying at. The main advantage of a disc is that it is light and easy to handle even when quite large and can easily be introduced into the correct plane.



OrthoView QuickScale™ tool makes scaling the digital image quick, easy and accurate.

All these markers can be measured using specially developed scaling tools in OrthoView. A disc or a sphere shaped object can be scaled by simply clicking anywhere on the marker, using the QuickScale tool. This tool automatically detects the edge of the marker and measures the maximum diameter of the ellipse or circle.

Positioning of marker

Trochanter

For scaling pelvic x-rays, the greater trochanter provides a good palpable bone landmark in the plane of the hip joint. Positioning the marker on the skin over the greater trochanter should work well. However, we like to have a whole pelvic view for templating hips so that leg length inequality can be recognised and also because it is often helpful to template the contralateral side. If a pelvic view is taken, the largest plates are only just large enough to include the bones and often miss the soft tissues overlying the greater trochanters. In practice markers fixed to the skin overlying the greater trochanters are often missing from pelvic views.

Between legs

In Portsmouth we evaluated a scaling disc positioned between the legs. It used an adjustable height disc encased in plastic. This provided the best solution for us as the correct vertical height of the marker can be assessed by resting it against the greater trochanter. The device can then be positioned as high as possible between the legs. The only compromise required is that the radiographers have to centre the x-rays lower, which actually gives a better planning image because more femoral shaft is seen.

The scaling device used in Portsmouth.



The disc is set at the correct height against the greater trochanter.



The device is then placed between the patient's legs.

Using a stand device with an adjustable arm holding the marker also makes it easy to position at the correct height between the legs.

Summary

The QuickScale tool in OrthoView has brought quick simple repeatable and accurate scaling with a single click. All our hip replacement patients have their pre-operative images taken with the disc scaler placed between the legs. This combination inspires confidence in the templating results, improving the clarity of the plan and reducing unexpected problems.

OrthoViewTM
Orthopaedic Digital Templating

info@orthoview.com
www.orthoview.com