STANDARDISATION OF HAND X-RAYS FOR ARTHRITIS: THE RELEVANCE OF HAND POSITIONING


Background: Joint space width has become an important outcome measure in rheumatoid arthritis. The quality of routine hand x-rays is varying, and hand positioning may affect the projection of the JSW on the image (Angwin 2001). The impact of the position of a hand relative to the X-ray tube on JSW is not known precisely. Standard positions may improve sensitivity to detect differences over time.

Objectives: To analyse the sensitivity of JSW to positioning of the hand relative to the X-ray tube. To design and test a mould to standardise positioning and thus facilitate automated segmentation of digitised images.

Methods: Micro-CT scans (resolution 66mm) of MCP joints were used to generate projections of a joint under varying angles of rotation. With a semi-automated analysis the JSW was measured for each projection. We designed a mould with X-ray opaque markers that assists the patient to place his left or right hand in a standard position. Furthermore, we added markers to determine the angle of the X-ray tube and the projection's magnification factor.

Results: Rotation of the micro-CT images between −15 and +15 degrees over the axis through the MCP joint resulted in variation of the projected JSW between 1.4 and 2.4 mm, or 5 to 54 mm per degree rotation. Since JSW may decrease at an annual rate of up to 50 mm, these differences are clinically significant. Preliminary steps to measure the degree of malpositioning in 2D images by statistical methods proved to be limited. To standardise for rotational deviation and to enable assessment of the actual angle by which an image was made, we introduced a mould. Personnel of the X-ray department appreciated this tool immediately. The results of the first series indicate adequate quality, while the images are easier to recognise for an automated segmentation system. Further results comparing the methods with conventional unguided imaging will be presented.

Conclusion: Accurate positioning of the X-ray tube is of clinically significant relevance for computerised assessment of the JSW. The quality and precision of JSW measurements can be improved with the use of a mould to standardise and calibrate hand X-rays. The markers on the radiographs support rheumatologists and radiologists to assess the quality of the X-rays.