Scoliosis

Oral presentation

Arm positioning and postural sagittal variation: are kyphosis and lordosis measurements using x-ray reliable?

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Objective
To verify how changing the position of the arms, done during standard radiographs to allow visualization of the spine, can change the spinal sagittal angles.

Background
X-rays are the gold standard evaluation in scoliosis, and this is considered true also for sagittal plane deformities. While it is very well known that posture can change scoliosis curves, this has never been verified for the sagittal plane. In the case of sagittal alignment, it is even more important because to see the spine, there is the need to move the arms from the resting physiological position to a forward position, which may change spinal posture. Today there is not a universally accepted standard for arm positioning during radiographs, nor is it known how it influences spinal measurements. Surface devices may possibly be more reliable measurement instruments than radiographs because they allow the patient to maintain the normal position of their arms. Comparing the two methods is difficult because it would not be ethical to expose patients to repeated doses of x-ray. Surface methods may be tested using these methods, however.

Methods
Study Design: transversal study. Population: 85 subjects (50 hyperkyphosis, 33 scoliosis, 2 normals). Hardware: 4-D Formetric. Methods: each subject has been consecutively evaluated in normal standing, then with progressive extension of the shoulders with extended arms (45°, 90°, 135°, 180°), then with arm crossing on the chest (CROSS) and with flexion of the shoulders and elbow to let the hands rest on the shoulders (REST). All sagittal parameters given by Formetric have been considered. Statistics: ANOVA for total and sub-groups.

Results
The absolute differences from the standing position of kyphosis angles ranged from 4.8 to 13.3° and were statistically significantly different with rare exceptions. For lordosis the differences were always statistically significant and ranged from 4.6 to 10.4°. The biggest differences have been found with REST and 180°; the lowest with 45°, and CROSS in some cases. The variation of angles measured depended on changes of spinal condition, with displacements of the spine in both the sagittal and horizontal axis.

Conclusion
According to these results, x-rays should be used to determine bone deformities and for diagnosis, while monitoring spinal position can be more reliably and safely done using non-invasive, surface measurements.