



To assess the image quality and radiation dose of EOS 2D/3D imaging system compared to Digital radiography

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Introduction

- NICE guidelines recognises the benefits of EOS 2D/3D imaging system in terms of reduced radiation dose and increased throughput ¹.
- NICE does not recommend routine usage of EOS system in the NHS due to high costs and lack of patient benefits from other features like 3D reconstruction, weight bearing imaging and simultaneous PA and lateral view acquisition ¹.
- NICE encourages use of EOS system in specialist centres to collect data on patient benefits ¹.

Methods

Retrospective comparative study between EOS system and digital radiography DR at the Royal Devon and Exeter Hospital.

Timeline: Dec 2024 to April 2025

Data source: PACS

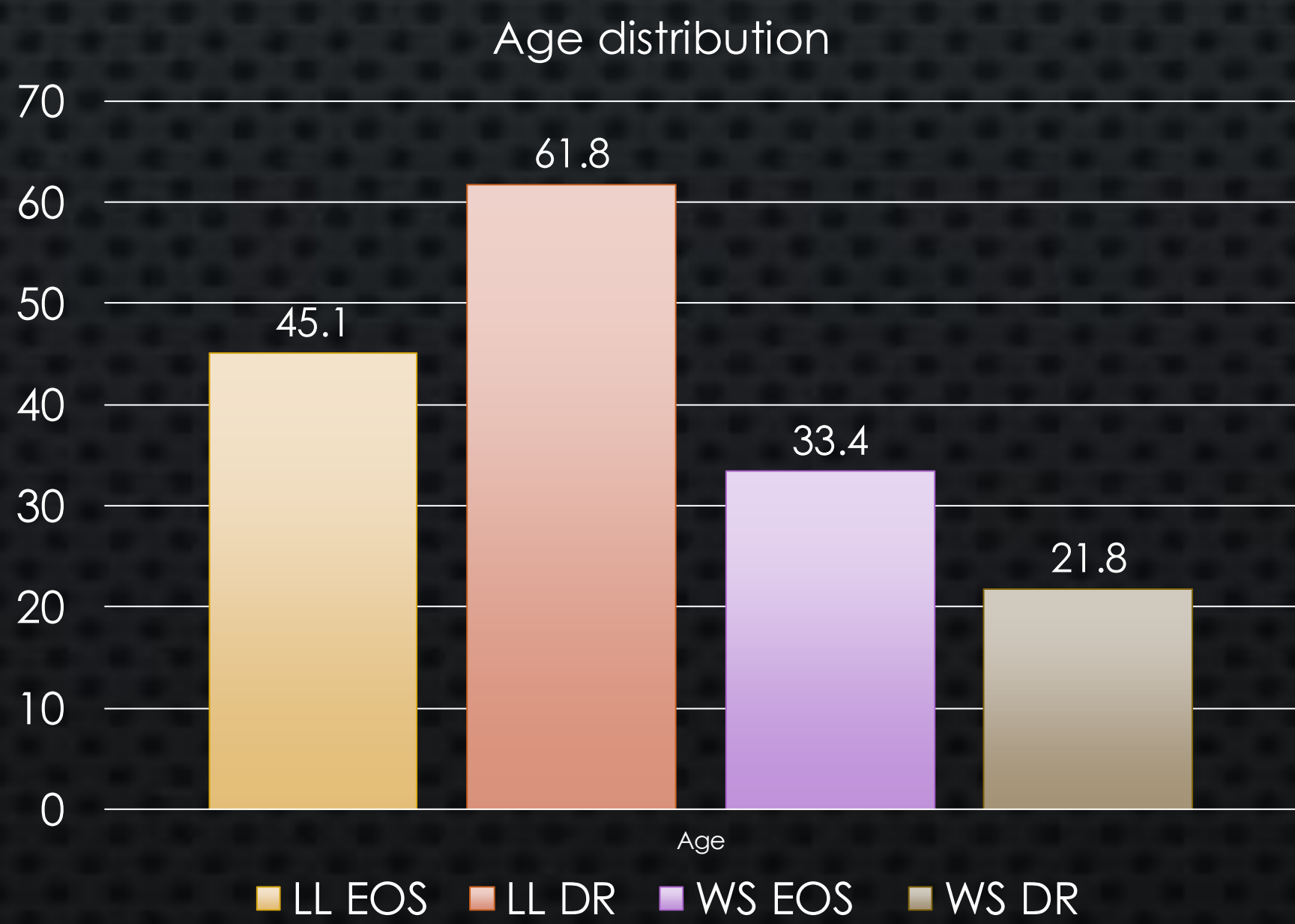
- Image quality- assessed by three independent assessors - orthopaedic registrar(OR), radiology ST5 registrar(RR) and superintendent radiographer(SR).
- Long leg alignment(LL) and whole spine imaging(WS)
- (1) Structure not detectable
- (2) Structure visible but features not perceptible
- (3) Features discernible but not clearly defined
- (4) Features clearly defined ².
- Radiation dose- assessed by trainee physicist.
- Mann-Whitney U test is used for p-values

Results

- 120 radiographs reviewed(EOS LL: 30, EOS WS: 30, DR LL: 30, DR WS: 30)
- EOS showed excellent image quality comparable to DR among for long leg (LL) and whole spine(WS) imaging.
- EOS had statistically better image quality (*p-value* <0.05) compared to DR for iliac crest, femoral head and thoracic spine as per a minimum of 2 assessors.
- EOS showed a significantly lower radiation dose compared to DR for long leg (~39% less) and whole spine(40%) imaging.

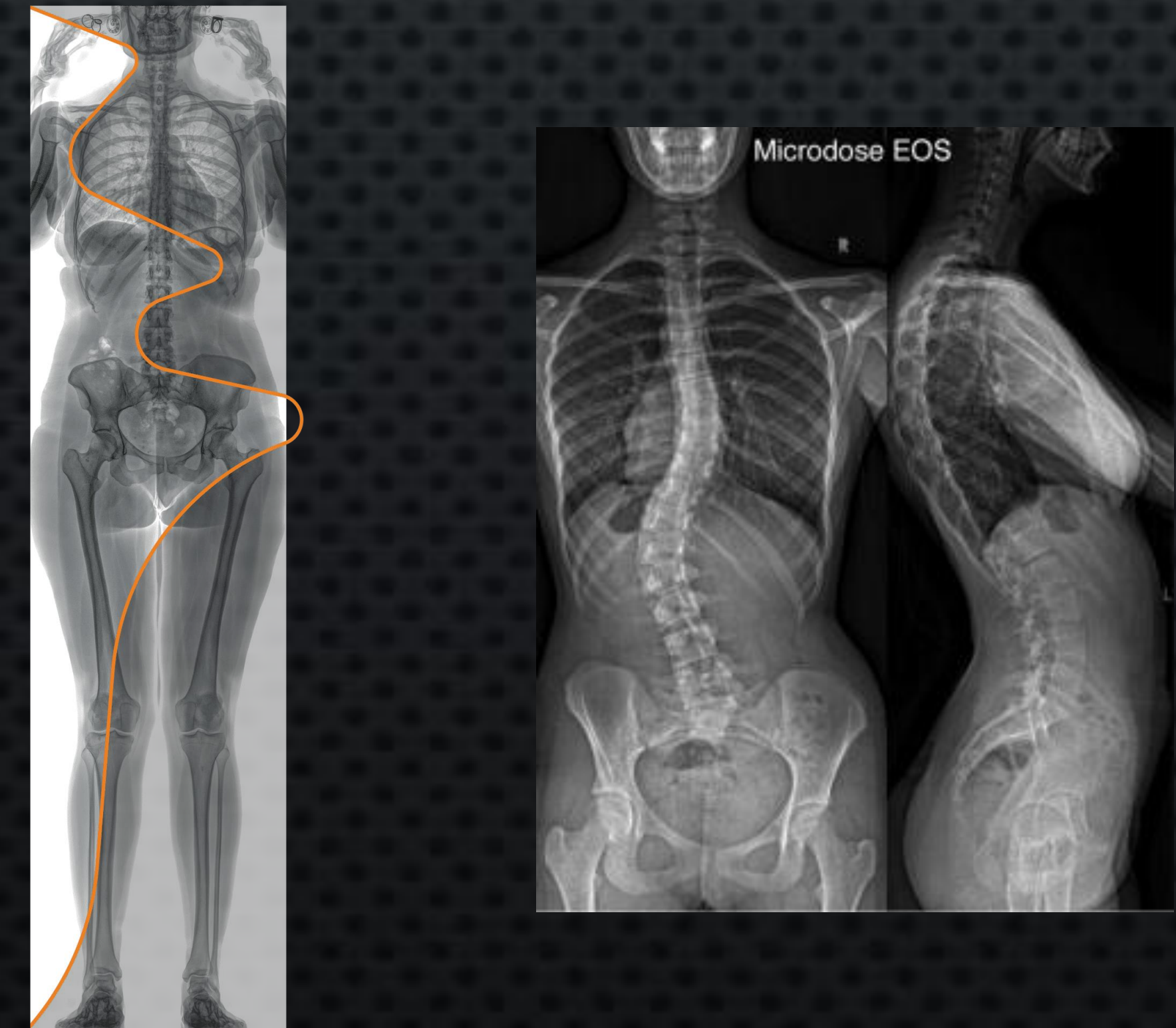
LL Image quality (mean)	OR EOS	OR DR	P-value
Iliac Crest	3.9	3	0.006
Femoral Heads	4	3.5	0.008
Femoral Condyles	4	4	1
Tibial condyles	4	4	1
Ankle Joints	4	3.9	0.831
WS image quality (mean)	OR EOS	OR DR	P-value
Thoracic spine	3.9	3.4	0.005
Lumbar spine	4	3.7	0.078
Pedicles	3.9	3.7	0.266
iliac crests	3.8	3.6	0.146

LL radiation dose	DR	EOS
Mean DAP (dGycm ²)	27.7	13.3
Range (dGycm ²)	132.9 (1.37-134.2)	56.8 (1.1-57.9)
Median DAP (dGycm ²)	17.5	6.8
P-value	0.04	

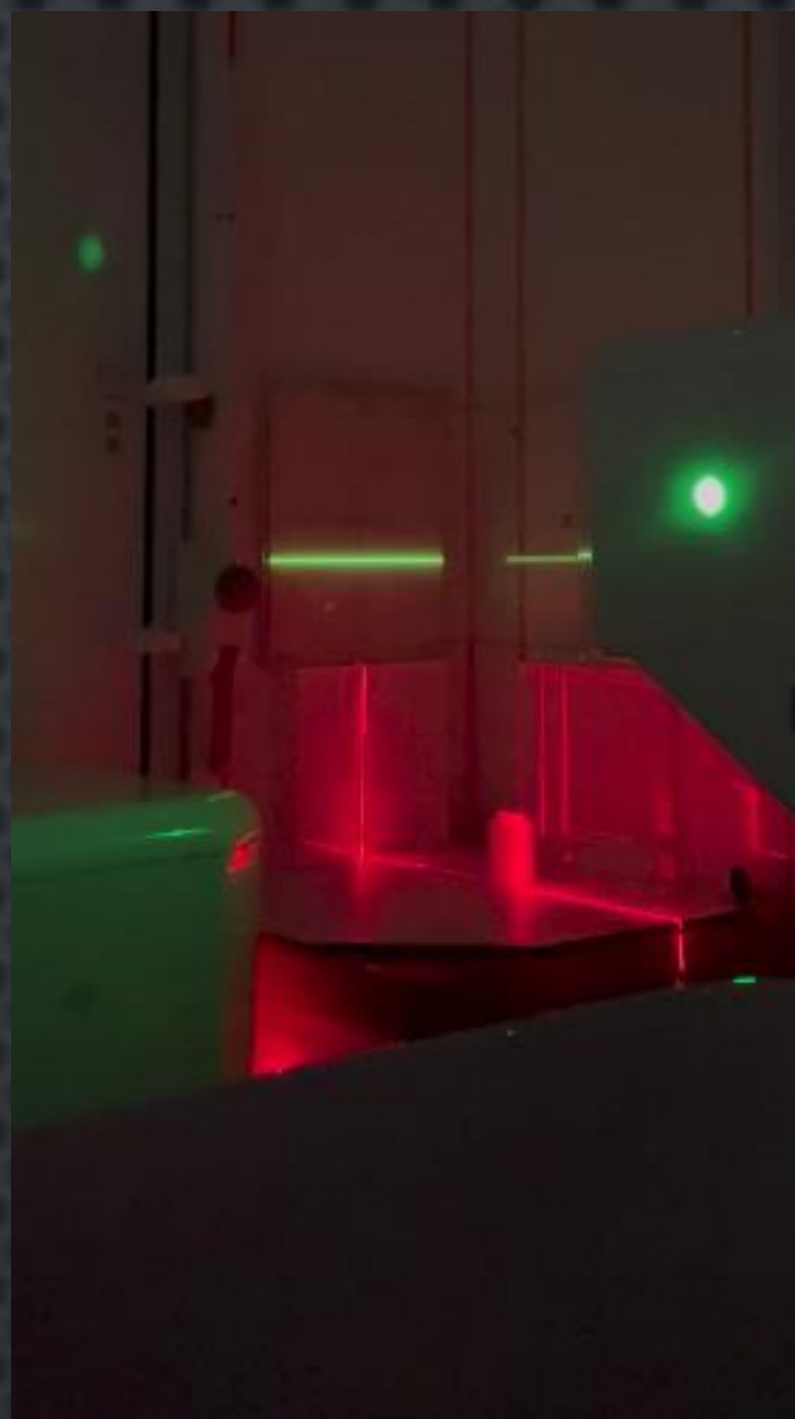


LL Image quality (mean)	RR EOS	RR DR	P-value
Iliac Crest	3.9	3.2	0.042
Femoral Heads	4	3.7	0.78
Femoral Condyles	4	3.9	0.831
Tibial condyles	4	3.9	0.831
Ankle Joints	4	3.9	0.295
WS image quality (mean)	RR EOS	RR DR	P-value
Thoracic spine	3.5	3.03	0.019
Lumbar spine	3.9	3.63	0.133
Pedicles	3.7	3.5	0.219
iliac crests	3.8	3.93	0.978

WS radiation dose	DR	EOS
Mean DAP (dGycm ²)	21.1	7.9
Range (dGycm ²)	76.2 (1.7-76.2)	18.5 (2.5-21)
Median DAP (dGycm ²)	15	6
P-value	0.06	



LL Image quality (mean)	SR EOS	SR DR	P-value
Iliac Crest	4	3.4	0.001
Femoral Heads	4	3.6	0.007
Femoral Condyles	4	3.8	0.369
Tibial condyles	4	3.8	0.369
Ankle Joints	3.7	3.9	0.501
WS image quality (mean)	SR EOS	SR DR	P-value
Thoracic spine	3.7	3.8	0.413
Lumbar spine	3.9	3.7	0.124
Pedicles	3.9	3.9	1
iliac crests	3.9	3.7	0.277



Discussion

Specialised detector

- EOS system uses multi-wire proportional detector(MWPC) a specialised detector system which detects individual x-ray photons to high precision.

Specialised beam

- EOS system uses a slot x-ray system which produces a thin cross-sectional x-ray beam in simultaneous biplane views.

Specialised algorithms

Micro dose: Low energy x-ray photons meets increased detector sensitivity. Ideal for paediatric scoliosis follow up imaging. Up to 80% reduction in radiation dose.

Flex dose: Dose modulation according to anatomy ³.

Conclusion

- EOS has similar or slightly better image quality
- Mean radiation dose EOS vs DR
 - Halved for LL imaging
 - 1/3rd for WS imaging

References

- <https://www.nice.org.uk/guidance/htg274/resources/the-eos-2d3d-imaging-system-pdf-1809590060805829>
- Wade R, Yang H, McKenna C, Faria R, Gummerson N, Woolacott N. A systematic review of the clinical effectiveness of EOS 2D/3D X-ray imaging system. European Spine Journal. 2013 Feb;22(2):296-304..
- <https://www.eos-imaging.com/our-expertise/imaging-solutions/eosedge>