**Comparison of dose between conventional radiography and EOS imaging**

### Introduction

EOS® imaging is a new technology developed with the goal to reduce radiation dose to patients while maintaining high image quality [1]. This modality creates simultaneous 2D lateral and posteroanterior (PA) images. It has the ability to examine patients in the weight-bearing position, as well as create 3D reconstructions from these images [2].

### Dose

Dose can be quantified in numerous ways including entrance skin dose, effective dose, organ dose, and cumulative radiation dose [3, 4]. However, a true comparison of dose between modalities is only valuable when also assessing image quality [5].

**EOS vs. Conventional Radiography**

- EOS images are created without magnification due to the slot-scanning technology, which creates a more accurate demonstration of anatomy [6].
- EOS images have been found to be comparable to conventional radiography, if not superior [7, 8].
- When Digital Radiography (DR) is contrasted with EOS imaging, TLD readings of entrance skin dose at all locations for EOS have been found to have significantly lower dose, as seen in Table 1 [9].
- Further testing shows that there are significant decreases in entrance skin dose, effective dose, and organ doses for EOS imaging when compared to DR (Figure 6) [10].
- The most significant reduction in dose was seen at the level of the symphysis pubis, which would indicate decreased dose to radiosensitive reproductive organs [2].

### Dose Reduction Strategies

- **Leg length discrepancies and scoliosis are diagnosed most commonly in pediatrics** [11].
- These patients have a high frequency of follow-up exams after initial imaging and potential corrective surgeries, which raises concerns for high cumulative dose [4].
- It is crucial that the principles of ALARA (As Low As Reasonably Achievable) is followed for EOS imaging [3].
- Pediatrics have a longer lifetime to manifest any negative radiation effects such as:
  - cancer [12]
  - iatrogeic diseases [13]
  - abdominal pregnancies [14]

**Dose Reduction Strategies**

- New Micro Dose copper filter and postprocessing algorithm reduces radiation exposure by fifty times compared to CR [6].
- Micro Dose has been shown to decrease exposure 5-7 times compared to the original Low Dose filter, as shown in Table 2 [6].
- The benefits of EOS imaging greatly outweigh the costs, especially for at risk populations such as pediatrics and patients with scoliosis. As EOS technology becomes more accessible to patients, it will greatly reduce the risk of negative ionizing radiation in the future, and soon become the gold standard for spinal imaging.

### Risk vs. Benefit

- **Benefits of EOS Imaging include:**
  - viewing pathologies that change when weight-bearing [4]
  - understanding rotational deformities [5]
  - reducing radiation exposure from diagnostic tests [6]
  - generating images without magnification for a more true representation of anatomy [7]
  - A major downfall of EOS imaging is a lack of options for those who cannot bear weight [8].
  - EOS imaging replaces radiation exposure by 6-9 times compared to CT scanning, and is a novel way to image the bony anatomy of pregnant patients while maintaining diagnostic quality images [9].
  - 3D remodeling from EOS images is beginning to reduce the need for CT scanning of patients with spinal deformities [10].
  - In the near future, it is predicted that CT will slowly be replaced with EOS imaging, especially for at risk populations such as pediatrics and pregnant patients [11].

### Disadvantages

- **Clinical effectiveness of EOS is limited to basic equipment in most studies; however, recent advancements such as copper filters and associated algorithms for Micro Dose [12].**
- **Require more studies on patient health outcomes to determine if this imaging modality leads to better diagnosis and treatment** [13].
- **Also challenging to determine if the reduction in dose found in EOS imaging would appear in the clinical setting when considering learning curves, wide variety of anatomy, and patient conditions** [14].
- **Require specific training for radiologists, radiological technologists to reconstruct the 3D model, and surgeons to implement data from these images and reconstructions** [15].
- **Major costs of the equipment, installation and training of these specialists** [16].

### Conclusion

EOS imaging has been found to significantly decrease patient dose while maintaining the standards of high diagnostic image quality [17, 18]. Compared to conventional radiography, obtaining simultaneous PA and lateral images with the option of 3D reconstructions allows for decreased dose with better visualization of anatomic deformities [19]. Micro Dose copper filters and algorithms will also aid in the diagnosis and progression of patient anatomy with the benefits of lowered dose [20]. These dose reduction strategies are vital to patient populations receiving high cumulative dose to decrease risk of further complications in their lifetime [21]. The benefits of EOS imaging greatly outweigh the costs, especially for at risk populations such as pediatrics and patients with scoliosis. As EOS technology becomes more accessible to patients, it will greatly reduce the risk of negative ionizing radiation in the future, and soon become the gold standard for spinal imaging.

### References