Technical Summary

Fluoroscopic Radiation to the Orthopedic Traumatologist's Hand & Efficacy of a Novel Radiation Attenuation Product

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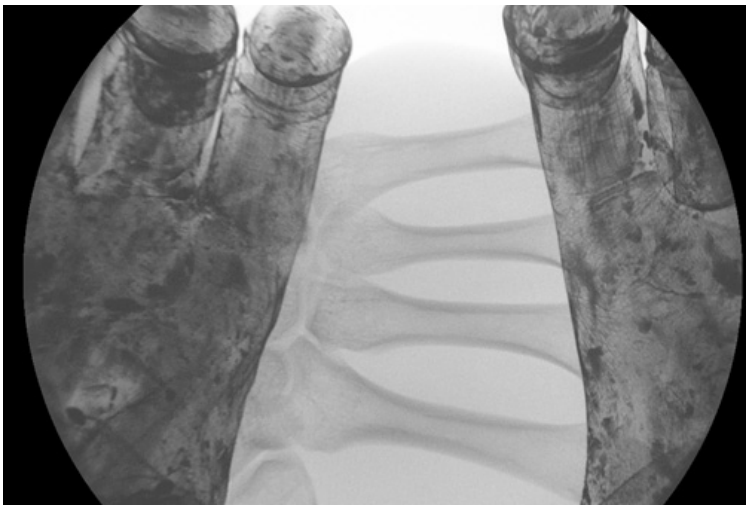
Clinical Relevance

The utilization of intraoperative fluoroscopy is vital in many specialties to minimize operative time, optimize implant placement, and improve patient outcomes. These advantages for the patient however come at a cost for the clinician, with greater radiation exposure to the surgeon's hands. UltraBLOX is a novel radioprotective cream that provides significant dose reduction without changing tactile feel or limiting dexterity during surgery. This cream allows the clinician to use fluoroscopy while performing within the operative field without compromising the safety of the surgeon.

Background

The utilization of fluoroscopy has aided the orthopaedic traumatologist by reducing operative times and soft tissue devitalization. However, these advantages must be weighed against the potential threat that fluoroscopic radiation poses to the surgeon's hands. Although surgeons can avoid direct irradiation by keeping hands out of the fluoroscopic field, working intimately around the field still exposes the hand to scatter radiation. Previous studies attempting to elucidate the amount of radiation exposure to the orthopaedic surgeon's hands during use of a large C-arm fluoroscope have lacked power and have been contradictory. Furthermore, attempting to limit this exposure through use of radiation-attenuating gloves can decrease the surgeon's tactile abilities, thus driving the surgeon to forego their use. The purpose of this study was to determine the amount of radiation that the hands of orthopaedic traumatologists experience during routine clinical practice and to evaluate the ability of a novel radiation attenuating product, only 0.2mm thick, to decrease this radiation.



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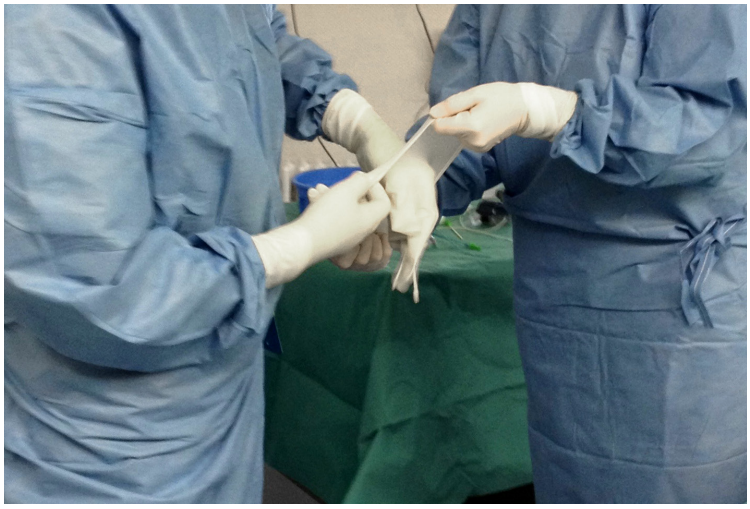
Materials and Methods

Three fellowship-trained orthopaedic trauma surgeons at a level I trauma center monitored radiation exposure to the dominant hand during 60 individual trauma cases (20 per surgeon) and 75 cumulative trauma cases (25 per surgeon) requiring the use of large C-arm fluoroscopy. Each surgeon wore two side-by-side dosimeters on the dorsum of their dominant hand for each case, one dosimeter covered with a thin layer (0.2mm) of a novel

radiation attenuating product and the other adjacent dosimeter without any protection. Both dosimeters were placed within a sterile package and affixed to the surgeon's hand under his or her surgical gloves prior to each case. The dosimeters, which were controlled for environmental exposure, had a minimum radiation detection of 5mrem. All dosimeters were returned to the manufacturer to determine overall radiation exposure (uncovered) and attenuated radiation exposure (covered).



Results

During cumulative exposure over 25 cases, the surgeons' hand was exposed to an average of 100 mrem (range 81-128), with the novel radiation attenuation product demonstrating the ability to attenuate ≥50% of this radiation exposure (Surgeon A – 58%, Surgeon B – 52%, Surgeon C – 50%). For individual cases, 77% of all dosimeters showed detectable levels of radiation (≥5mrem) to the dominant hand, ranging from 5-69 mrem (average of 16.8 mrem). Average attenuation amongst all individual cases was 33%. Of the cases that registered undetectable amounts of radiation (<5mrem) to the hand, >50% consisted of ORIF ankle, syndesmosis and distal fibula. All other case types routinely registered detectable radiation to the hand. Greatest exposure was noted with ORIF/IMN cases of the proximal femur and femoral shaft, which registered an average of 25mrem to the hand, and ORIF of distal femur and tibial plateau, which registered an average of 12mrem.

Conclusions

The orthopaedic surgeon's hand is frequently at risk to radiation when utilizing C-arm fluoroscopy. Though surgeons can easily reduce direct irradiation by keeping their hands out of the fluoroscopic field, scatter radiation still poses a danger. Hands are at greatest risk during femoral ORIF and IMN procedures. The novel radiation-attenuating product tested shows the ability to decrease the hand's exposure to scatter radiation by 33-58%. The orthopaedic traumatologist's hand is routinely exposed to fluoroscopic radiation scatter. This study outlines that risk and introduces a novel product that reduces radiation exposure to the hand.

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