



Q&A: EMERGING TOPICS

Hands-Free Radiography

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Abstract

Hands-free radiography, which uses nonmanual restraint techniques, is becoming more common among veterinary clinics. Veterinary professionals recognize the need for safer radiography practices that more closely align with those of human medicine. Nonmanual restraint techniques complement low-stress practices that reduce patient anxiety and support the acquisition of quality diagnostic images while improving workflow efficiency within the clinic.



Take-Home Points

- Radiographs are produced by high-energy ionizing rays passing through the body; these rays cause stochastic effects to the body such as cell mutation, cell death, and DNA alteration.
- No amount of radiation is safe.
- Hands-free radiography techniques enable veterinary professionals to distance themselves from the primary radiation beam, which significantly reduces their radiation exposure.
- Adhering to the principles of ALARA (as low as reasonably achievable)—which consider time, distance, and shielding—reduces radiation exposure.
- The adoption of hands-free radiography techniques involves the entire veterinary team and supports improved safety protocols.

The implementation and cultural shift toward the adoption of hands-free radiography represent significant advancement in occupational safety and patient care within veterinary medicine. By employing nonmanual restraint techniques, veterinary professionals can minimize exposure to ionizing radiation while simultaneously improving diagnostic image quality. This approach aligns with the principles of ALARA (as low as reasonably achievable) and parallels safety standards long established in human medicine. Furthermore, hands-free radiography promotes compassionate handling, reducing patient stress and improving efficiency and team morale.

Q What is hands-free radiography and why is it valuable?

Hands-free radiography incorporates techniques and

tools that enable veterinary professionals to distance themselves from the primary radiation beam and patient during radiograph acquisition, thus reducing exposure to primary and secondary, or scatter, radiation.

In most medical settings (e.g., hospitals, dentistry clinics), veterinary nurses/technicians minimize their exposure by stepping behind a lead wall or shield rather than standing beside a patient. Nevertheless, most countries do not have parity of radiation safety standards between human and veterinary medicine.¹ Furthermore, industry standards in the United States for veterinary radiography are severely outdated.² Continuous occupational exposure to radiation is not safe.³ Thus, each veterinary clinic should implement safety measures to reduce radiation exposure for the health of the team.

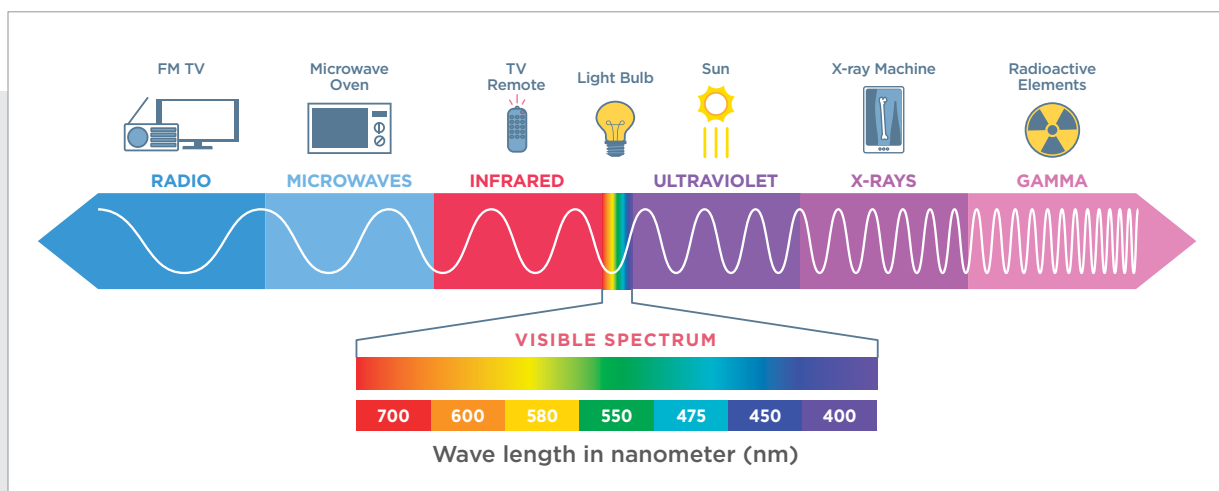


FIGURE 1. Electromagnetic spectrum.



Q What is an x-ray and radiation exposure?

The electromagnetic spectrum of radiation ranges from low-energy nonionizing waves (e.g., radio waves, microwaves) to high-energy ionizing waves (e.g., x-rays, gamma rays) (FIGURE 1). High-energy ionizing waves are required to penetrate tissues and bones and, ultimately, make a radiograph. The stochastic effects of ionizing radiation alter and/or damage DNA, causing molecular mutations and potentially cell death. These effects of occupational radiation exposure are cumulative, and there is most likely a latent period between the time of exposure and detection of its effects (e.g., cancer, hereditary genetic mutations). No amount of radiation is safe.⁴

Q How can radiation exposure be reduced?

One of the most effective ways to reduce radiation exposure is to increase the distance from the primary beam of radiation—a principle known as the inverse square law (FIGURE 2). This law states that “the intensity of radiation emitted by a point source is inversely proportional to the square of the distance from the source.”⁵ This means that if the distance from the radiation source is doubled, radiation exposure decreases by a factor of 4, or one-quarter of the dose. This continues exponentially—tripling the distance reduces exposure by one-ninth, and so on.⁶

ALARA Principles

To reduce radiation exposure, the 3 principles of ALARA should be incorporated.⁷

1. Time: Reduce the amount of time in the radiology suite.

- Rotate duties between team members if someone must remain in the suite.
- Ensure proper collimation, technique, and positioning to reduce the need for radiograph retakes.
- Use positioning devices rather than team members whenever possible.
- Provide sedative and/or analgesic drugs for squirmy, fearful, or painful patients.

2. Distance: Increase the distance from the primary radiation beam.

- Per the inverse square law, every step away from the beam exponentially reduces exposure.
- Positioning devices, along with sedative/analgesic drugs as needed, enable effective distancing from the primary radiation beam.

3. Shielding: Minimize exposure to scatter radiation.

- Personal protective equipment (PPE), including gown, gloves, goggles, and thyroid protector, is mandatory and should always be worn in the radiology suite.
- Lead PPE is not meant to be within the primary radiation beam and only protects from scatter radiation.

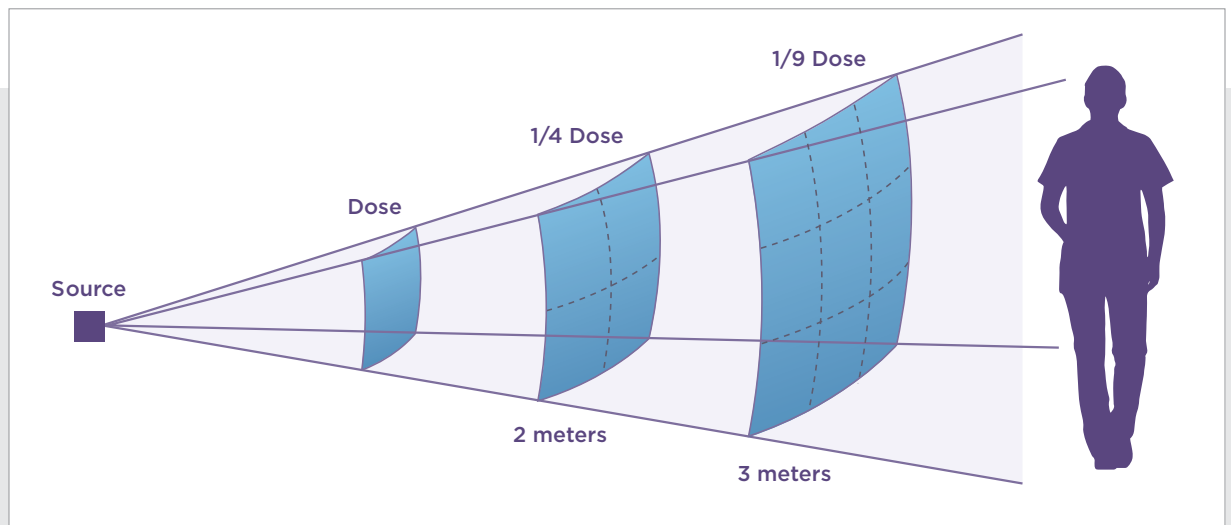


FIGURE 2. The inverse square law: Radiation exposure exponentially reduces as distance increases from the primary beam and the source of scatter radiation (patient).



- c. PPE should be well-maintained and assessed twice annually by radiographing the equipment to check for damage that is not visible by manual inspection. Scratches and tears to the fabric can result in radiation exposure, warranting immediate replacement.
- d. Movable lead doors and/or curtains can be used for additional shielding.

Beyond incorporating the 3 principles of ALARA to reduce radiation exposure, monitoring radiation exposure levels is mandatory. Dosimeters should be worn during radiograph acquisition to provide continuous measured feedback about exposure.⁸

Q How can hands-free radiography be implemented in practice?

Similar to all new skills, hands-free radiography takes time to master. When the entire team recognizes the importance of minimizing radiation exposure, then hands-free radiography can be smoothly integrated into the practice's methodologies. Proper training and equipment are paramount to successfully obtain radiographs using nonmanual restraint techniques.

Fortunately, many resources and tools are relatively low cost and readily available.

Begin with simple cases and cooperative patients. Be patient with the veterinary team and patients; patient comfort and safety are top priorities. Use positioning devices as needed for different types of studies. Administer sedative/analgesic drugs whenever necessary.

Positioning Devices for Nonmanual Restraint Techniques

Various positioning devices are available to gently restrain and secure patients to the radiography table, which enable team members to step away from the primary radiation beam. These devices are nontraumatic and comfortably immobilize the patient in a secure position, replacing the need for hands and arms to stabilize the patient during radiograph acquisition.

Sandbags

Sandbags are partially filled to enable sand to shift and conform to a patient's body without compression or constriction (**FIGURE 3**). These bags are radiopaque



FIGURE 3. An unsedated canine patient is positioned for lateral abdominal and thoracic views by using sandbags that keep the patient secure and comfortable on the x-ray table.



FIGURE 4. A sedated canine patient is positioned for a craniocaudal elbow or antebrachium view by utilizing positioning aids such as sandbags, a foam wedge, straps, and a v-trough.



and are not meant to overlay the anatomic area of interest. They are easy to clean, do not slip on the table, and can be used for all types of studies.

Straps

Straps can be applied to hold extremities in place (**FIGURE 4**). They are soft, comfortable, and mostly radiolucent (some versions have radiopaque buckles). They can be removed quickly and used for all studies.

Towels

Towels can be used to secure patients in a variety of positions. They can be placed under and/or alongside anatomic areas that need lifting and/or aligning to ensure correct orientation. Towels are typically radiolucent unless they are thick or have heavy embroidering.

Foam Wedges and Troughs

Foam wedges and troughs ensure the patient is positioned comfortably (**FIGURE 5**). They are soft and radiolucent; many have covers that are easy to clean. With correct placement, foam wedges and troughs can be used for many types of studies.

Q When is sedation/analgesia warranted?

The administration of a mild sedative drug is sometimes necessary to calm patients during radiograph acquisition. Sedative drugs may be used more frequently when the veterinary team is learning hands-free radiography techniques. Overall, sedative drugs should not be avoided as they facilitate quality diagnostic radiographs. If pain is a concern, analgesic drugs should be administered. Sedative and analgesic drugs are indicated for orthopedic studies; these patients are painful, and correct positioning requires significant torque and extension of extremities/joints. Drug protocols should be tailored to each patient.

Q What are some tips for success?

To master hands-free radiography, practice and perseverance are needed. Gentle, calm patient handling is recommended; often, this can enable the acquisition of thoracic and abdominal radiographs without sedation, especially if a patient is unwell or lethargic. Nonetheless, sedative and analgesic drugs are likely

indicated to ensure a patient is comfortable while being positioned.

Q What client communication is needed?

Educating clients about the need for hands-free radiography to reduce occupational radiation exposure is necessary. It may be helpful to compare these practices to those used in human medicine, then explain that hands-free radiography abides by the practice's policy to promote the veterinary team's safety. In addition, clients should be informed that a mild sedative and/or analgesic drug will likely be necessary to ensure their pet is stress- and pain-free during



FIGURE 5. A sedated canine patient is positioned for an orthogonal pelvic view by utilizing a v-trough, a foam wedge, straps, and tape.



radiograph acquisition.⁹ Clearly communicating these concerns and objectives is essential.

Q What are the benefits of hands-free radiography?

- Reduces radiation exposure
- Encourages better-quality radiographs
- Improves workflow efficiency (i.e., a team member can use positioning devices rather than another team member)
- Decreases stress for the patient and veterinary team, resulting in a calmer experience **TVN**

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Into Practice

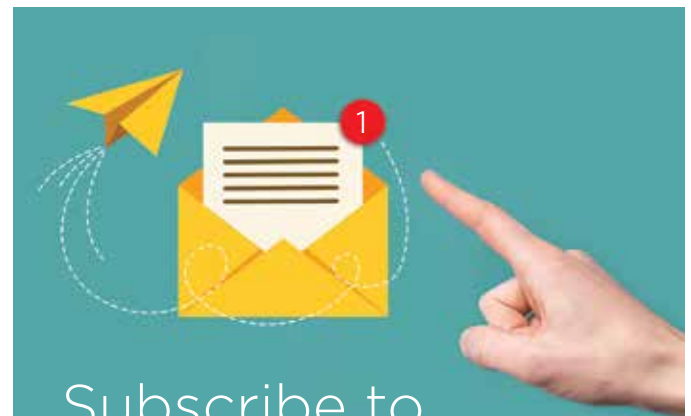
- ☒ Form a plan for the veterinary team to introduce hands-free radiography.
- ☒ Assess the radiology suite to identify positioning devices that are needed.
- ☒ Seek hands-free radiography training opportunities (e.g., in-person conferences, virtual workshops).¹⁰

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Antonia Laoutaris

Antonia began her career as a registered veterinary technician in Ontario after graduating with honors from Georgian College. Following years of work at primary care and emergency/referral clinics, Antonia successfully completed accreditation as a veterinary technician specialist with the Academy of Veterinary Technicians in Anesthesia and Analgesia. She currently works for VCA Canada as Director of Learning and Development. Additionally, as a proponent of hands-free radiology, Antonia joined the team at Hands-Free X-Rays in 2017, offering on-site and virtual workshops teaching veterinary teams how to implement nonmanual restraint techniques within their practices. She has written articles for various publications and has spoken at conferences across North America.



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