

2016

Moving from Computed Radiography to Digital Radiography, a Collaborative Approach to Improve Image Quality

Daniel Sandoval

Denise Valenti

Tammie Bateman

Vannessa Norris

Gary Mlady

See next page for additional authors

Follow this and additional works at: https://digitalrepository.unm.edu/rad_pubs

Recommended Citation

Sandoval, Daniel; Denise Valenti; Tammie Bateman; Vannessa Norris; Gary Mlady; and Reed Selwyn. "Moving from Computed Radiography to Digital Radiography, a Collaborative Approach to Improve Image Quality." (2016).
https://digitalrepository.unm.edu/rad_pubs/4

This Poster is brought to you for free and open access by the Radiology at UNM Digital Repository. It has been accepted for inclusion in Radiology Research and Scholarship by an authorized administrator of UNM Digital Repository. For more information, please contact disc@unm.edu.

Authors

Daniel Sandoval, Denise Valenti, Tammie Bateman, Vanessa Norris, Gary Mlady, and Reed Selwyn

Moving from Computed Radiography to Digital Radiography, a Collaborative Approach to Improve Image Quality

Daniel Sandoval¹ ♦ Denise Valenti² ♦ Tammie Bateman² ♦ Vanessa Norris² ♦ Gary Mlady¹ ♦ Reed Selwyn¹
¹ University of New Mexico School of Medicine, Albuquerque, NM ♦ ² University of New Mexico Hospital, Albuquerque, New Mexico

Background

The University of New Mexico School of Medicine (UNM SOM) and the University of New Mexico Hospital (UNMH) have long worked together to deliver high quality patient care to the citizens of New Mexico and the surrounding region. One of the key ways that the Department of Radiology has worked to deliver the highest quality care to the patients of UNMH is by establishing a Quality Assurance Committee. The committee is composed of radiologists, technologists, medical physicists and support staff who all lend their expertise to review and help solve any quality assurance issues for the department. This poster is one example of how a "team" within the Quality Assurance Committee helped solve an important image quality issue within our department, and improved patient care.

Purpose

This project is an example of how to form a team (triad) comprised of radiologists, technologists, and physicists to utilize post-processing techniques in digital radiography (DR) in order to optimize image acquisition and improve image quality.

The Issue

After the installation of a new GE Discovery XR656 Digital Radiographic room, our radiologists began to identify images with "quality issues." The issues ranged from images appearing under penetrated, to images with soft tissue that resembled "a plastic phantom." It was readily apparent that all of the images identified as having quality issues were being produced from the new GE Discovery room.

The issue was brought up at a monthly Quality Assurance meeting, and a team composed of the quality assurance technologist, a medical physicist, and a radiologist was formed to carry out the investigation and to find a solution.



FIGURE 1: Image showing both "under penetration" in the shoulder as well as "plastic looking" soft tissue (arrow).

Investigation

The investigation proceeded by determining the common causes for image quality complaints:

- ♦ The Quality Assurance manager and technologist supervisors ruled out technologist error.
- ♦ The medical physicist ensured that the imaging system was functioning properly.
- ♦ Radiologists were interviewed for more information regarding exactly what the image quality issues were.

With the radiologist interview, a major clue was finally discovered. The lead markers on some of the images appeared to have a subtle shading in the center. See Figure 2. A quick test then was performed by reprocessing the image with a slightly different algorithm. Figure 3 shows the reprocessed image with a notable difference in the appearance of the lead marker and the patients anatomy.

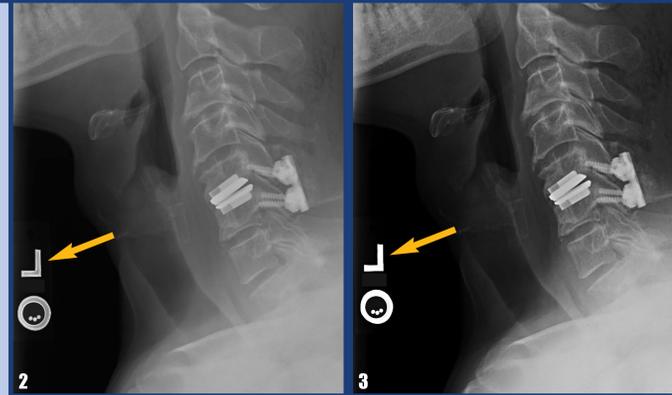


FIGURE 2: It was noted that some of the lead markers "did not look right" to the radiologists. Note the odd shading in the middle of what should be a highly attenuating object.

FIGURE 3: After reprocessing the image with a different algorithm, the appearance of the lead marker noticeably changed. Notice also the difference in the appearance of the anatomy in the image.

Methods

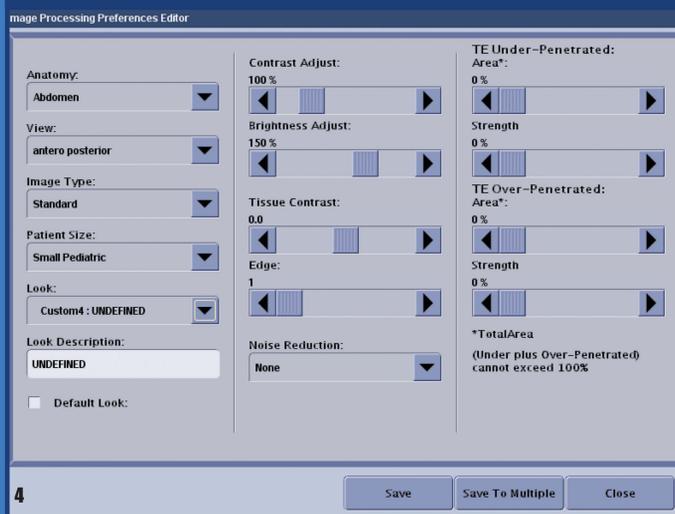


FIGURE 4: GE Image Processing Preferences Editor interface. This interface allows for the granular customization of each processing algorithm that is anatomy, view, and patient size specific. TE stands for tissue equalization which "improves contrast and visibility in over- and under-penetrated regions of an image without compromising the contrast in other regions of interest." (GE, 2015)

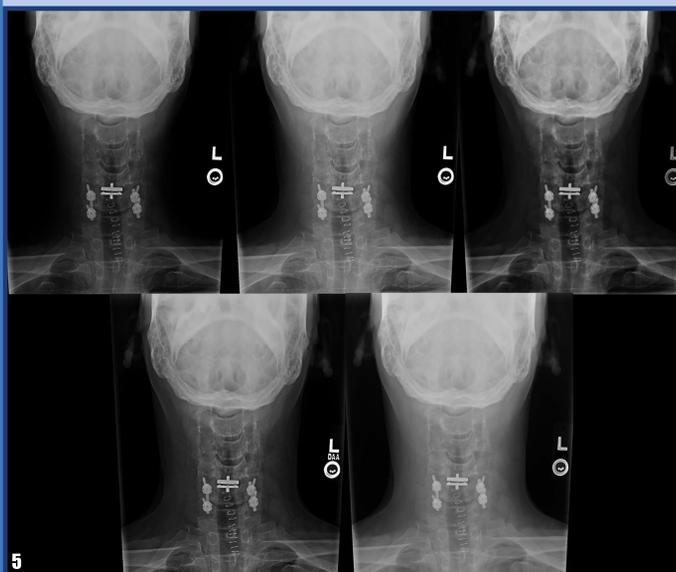


FIGURE 5: One view of the "c-spine with hardware" exam that was reprocessed with all 5 algorithms.

After further review of the vendor supplied documentation, it was determined that there were many image processing settings that could be adjusted to create hundreds of different custom image processing algorithms. Figure 4 shows the GE Image Processing Preferences Editor interface. This interface not only allows the adjustment of typical image values, such as "Contrast" and "Edge" enhancement, but also vendor specific values such as "Tissue Contrast" and "TE-under/over Penetrated."

- ♦ Various exam types from adult musculoskeletal (n=35), adult chest (n=4), and pediatric (n=7) were chosen for review.
- ♦ All the images in each exam type were reprocessed using five customized algorithms. In total, 673 images were reprocessed for review by the radiologists. Figure 5 shows an example of one group of reprocessed images.
- ♦ An image score sheet was created (Figure 6) allowing the radiologist to assign a numeric score to each of the processed images.
- ♦ Each image was scored based on seven properties: 1) overall image look, 2) soft tissue contrast, 3) high contrast, 4) latitude, 5) tissue equalization, 6) edge enhancement, 7) visualization of structures. Additional space allowed for additional comments not captured in scoring categories.
- ♦ Scores for each custom algorithm for each image set were summed. The algorithm with the highest score for each image set was then set as the default for each exam type.

Medical Physicist Data	Adult GE Room Image Quality Improvement Project					PACS Presentation State: RM 1 QIP
Exam: Lateral C-Spine	Patient Name: Test Adult C-Spine W/ Hardware	Factory 1 (F1)	Factory 2 (F2)	Factory 3 (F3)	Factory 4 (F4)	Custom 3 (C3)
Image Look Score	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Notes: Amongst the 5 looks how do you rate this look?						
Soft Tissue Contrast	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Notes: Do you like the presentation of the soft tissue?						
High Contrast	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Notes: How do you like the contrast between bone and tissue?						
Latitude	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Notes: Are you able to window level and visualize all anatomy?						
Tissue Equalization	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Notes: Are the images too black and white, do you prefer more gray?						
Edge Enhancement	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Notes: Are the edges "fuzzy" for are they too bright?						
Visualization of Fine Structures	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Notes: Are you able to visualize fine structures?						
Total						

FIGURE 6: Image score sheet used by the radiologists as they reviewed the images in each of their sections.

Results

Default processing for each type of image study was changed to the algorithm with the highest score. Some elements of the custom algorithms were further adjusted upon request by the radiologists.

Due to this quality assurance project, the department of radiology can produce better quality images from the GE XR656 Digital Radiographic System. Soon after this project was completed, an additional GE XR656 system was purchased and installed at an offsite clinic. The custom processing algorithms were copied onto this new system to ensure image quality consistency between the two facilities.

Images taken on the GE systems and placed into the PACS "QC folder" for image processing reasons decreased. Feedback from radiologists was, overall, that image quality for these studies had improved.

Conclusion

This work is an example of the collaboration between radiologists, technologists, and physicists at the University of New Mexico to add value to the radiology department. The significant amount of work required to prepare the processing algorithms, reprocessing and scoring of the images was eagerly taken on by all team members in order to produce better quality images and improve patient care.

This process of team image optimization will now be implemented at the time of install for each new radiographic system at our facility.

References

Operator's Manual for GE Discovery XR656 Digital Radiographic System. 5402340-1EN Rev. 12. General Electric Company, 2015.