# Chapter 32

1. What “across-the-board” adjustment in radiographic techniques is recommended to allow for

CR operation at the 400-speed class, reduce patient exposure, and avoid image mottle?

a. double all mAs values

b. cut all mAs values in half

c. increase all kVp levels by 15 per cent

d. reduce all kVp levels by 15 per cent

2. If a department chooses to operate their CR or DR system at the 200-speed class, what general

adjustment in techniques must be made in changing from 400-speed rare earth screens:

a. an overall doubling

b. a four-fold increase overall

c. a reduction to one-half

d. no change is required

3. For all digital imaging systems, a lower limit for exposure to the receptor is imposed by:

a. the appearance of mottle

b. images turning out too light

c. the appearance of image fog

d. images turning out with excessive contrast

4. Which of the following are essential considerations when using automatic exposure control with a DR or CR system?

a. the use of high kVp techniques

b. exact centering of the anatomy

c. correct selection of activated detectors

d. all of the above

5. Mottle in a CR or DR image can result from: a. insufficient kVp

b. insufficient mAs

c. improperly calibrated AEC

d. all of the above

e. b and c only

6. On a lateral cervical spine, to darken the shoulder area without darkening the entire image,

use:

1. Tissue impression
2. Equalization
3. Brightness correction by region of interest (ROI)
4. Contrast (window width)

7. For digital imaging, if a grid is not used:

1. the fog caused by scatter radiation will be transmitted through to the final image
2. the final digital image will always turn out dark
3. the final digital image will always turn out light
4. the reduced signal-to-noise ratio from poor input data can contribute to digital processing errors

8. Just as in conventional radiography, it is essential in digital radiography that the original

must have a high signal-to-noise ratio:

a. laser beam

b. light emission from the phosphor plate

c. primary x-ray beam

d. remnant x-ray beam

9. The contrast appearing in a digital image is related to the:

*1. total amount of acquired data*

*2. subject contrast of the anatomy*

*3. noise level in the image*

a. 1 only

b. 2 only

c. 2 & 3 only

d. 1, 2 & 3

10. Which of the following is true for the chest and for mid-sized and small extremities:

a. High kVp levels produce excessive scatter radiation

b. Very little scatter radiation is produced, even at high kVp’s

c. High kVp levels generate excessive gray scale

d. High kVp levels cause excessive contrast in the final image

11. The advent of digital imaging has:

a. rendered the use of “manual” technique obsolete

b. rendered the use of “proportional anatomy” systems for technique obsolete

c. rendered the “4-cm” rule obsolete

d. all of the above

e. none of the above

12. Specific fog patterns in the latent image can be “cleaned up” by digital:

a. rescaling

b. gradation processing

c. frequency processing

d. windowing

13. The largest “structures” in the digital image, such as background densities and fog patterns,

correspond to \_\_\_\_\_\_\_\_\_ layers of the image.

1. Darker
2. Lighter
3. High-frequency
4. Low-frequency

14. A lumbar fog density that extends about 1/4 of the way across the image has a lateral

frequency of:

1. 1 hertz
2. 2 hertz
3. 4 hertz
4. 8 hertz

15. How much over-exposure is required before a digital imaging system becomes overwhelmed

with data, causing *saturation* to occur:

a. 2 times

b. 4 times

c. 6 times

d. 10 times

e. 20 times

16. Misunderstandings about radiographic technique and the nature of digital imaging, combined

with the extremely broad exposure latitude of digital imaging systems, has led to what

problem:

a. increased repeat rates

b. poor quality images

c. dose creep

d. histogram analysis failures

17. Which of the following statements is true regarding CR systems:

a. They are “mAs-driven,” adjust only the mAs

b. Never use less than 70 kVp

c. Collimation of the field smaller than the phosphor plate size cannot be used

d. Grids cannot be used

e. Digital processing is usually able to compensate for scatter caused during the exposure

18. Which of the following statements is *false:*

a. Digital processing cannot compensate for insufficient penetration of the original

remnant x-ray beam

b. Digital processing cannot always compensate for very extreme (10 times) overexposure in the original remnant x-ray beam

c. Scatter radiation in the original remnant x-ray beam always results in a dark image

after digital processing

d. Digital processing cannot always compensate for inadequate signal-to-noise ratio

(SNR) in the original remnant x-ray beam

19. In the digital age, anatomy smaller than \_\_\_ cm should no longer be radiographed using

conventional grids.

1. 20
2. 13
3. 10
4. 7

20. In the digital age, patient dose can be minimized and positioning flexibility increased by:

1. Using lower grid ratios
2. Using virtual grid software
3. Not using grids on knees
4. All of the above

21. On DR equipment, when the grid is left in place for small extremities such as the forearm or

ankle:

1. Patient dose will be 3 to 4 times that of non-grid technique, but necessary
2. Unnecessary patient dose will be 3 to 4 times that of non-grid technique
3. The same technique can be used, resulting in equal patient dose
4. Patient dose will be reduced after technique is compensated

22. When a conventional stationary grid is used, and its grid lines run parallel to the scanning

lines of a CR reader, which of the following is likely to result unless the grid is a high-frequency grid:

1. Moire artifact
2. Halo artifact
3. Grid cut-off
4. Mottle

23. Which of the following grids has its grid lines running crosswise rather than lengthwise:

a. Virtual grid

b. Crosshatch grid

c. Short-dimension (SD) grid

d. Focused grid

24. Aliasing artifacts are essentially a type of:

a. Mottle

b. Interference pattern

c. Fog pattern

d. Plate storage artifact

25. Using a non-grid approach for mobile and trauma procedures helps prevent:

a. Unnecessary patient dose

b. Grid cut-off

c. Problems adapting positions

d. All of the above

26. In the digital age, especially for mobile procedures, where conventional grids continue to be

used the recommended grid ratio is now:

1. 6:1
2. 8:1
3. 10:1
4. 12:1

27. A reduction in the probability of mottle and a reduction in patient dose can BOTH be

achieved by:

a. Adding a conventional grid and fully compensating the mAs

b. Adding a conventional grid and only partially compensating the mAs

c. Removing a conventional grid and only partially reducing the mAs

d. Removing a conventional grid and fully reducing the mAs to compensate

28. All of the following are steps listed in Fuji’s *Virtual Grid* software EXCEPT:

a. Scattered x-ray estimation

b. Grid effect calculation

c. Unsharp mask subtraction

d. Granularity improvement

29. All virtual grid software applies variations of which *two* basic digital processing operations:

1. Edge enhancement

2. Contrast enhancement

3. Noise reduction

4. Dynamic range control

a. 1 and 2 only

b. 2 and 3 only

c. 1 and 3 only

d. 2 and 4 only

30. “Selecting the grid ratio” in a virtual grid program actually:

a. changes the ratio of the grid used during exposure

b. changes the degree of scatter clean-up during exposure

c. changes the intensity with which the algorithms are applied

d. changes the image parameters applied at the display monitor

31. Virtual grid software has been clinically demonstrated to:

a. Reduce the occurrence of artifacts from grid misalignment

b. Allow flexibility in angling and centering the CR for trauma procedures

c. Reduce patient dose by 50-70%

d. All of the above

32. For the lateral cervical spine projection, several manufacturers now provide an image control

settings menu where the “underpenetrated area” area of the image (C7-T2) can be defined

and corrected as a default setting for that procedure. This is actually an adjustment to the:

1. Penetration level of the x-ray beam
2. Intensity of the x-ray beam
3. Brightness of a targeted area of the image
4. Penetration of a targeted area of the image

33. The need for compensating filters on various projections has now been largely eliminated by:

a. The *inherent* ability of digital processing to balance brightness across the image

b. *Targeted area brightness correction* algorithms added to specific procedure protocols

c. The power of frequency detail processing

d. *A* and *B*

e. *A, B,* and *C*

34. With CR systems, the use of *left* and *right* lead markers on the original exposure:

a. is only needed for extremity radiographs

b. is no longer needed

c. continues to be recommended

d. is only needed for torso and head procedures

35. After exposure, the stored image on a photostimulable phosphor plate will fade at a rate of

about:

a. 10% per hour

b. 25% per hour

c. 10% within 8 hours

d. 25% within 8 hours

36. For CR, substantial fog density between two projections on the same plate can cause:

a. unsharp borders on the collimated fields

b. improper windowing

c. smoothing failure

d. segmentation failure

37. When exposing multiple fields on a single CR receptor plate, which of the following assists

the computer in avoiding exposure field recognition errors:

a. keep the anatomy centered within each field

b. keep the fields parallel to each other

c. keep the fields equidistant from each other

d. all of the above

38 Experimentation with CR shows that an unprocessed, latent image will have completely

faded from the plate after:

a. 24 hours

b. 3 days

c. 10 days

d. There is no practical time that can be stated

39. For CR, as a rule-of-thumb, at least per cent of the receptor plate must be exposed to

avoid histogram errors:

a. 25%

b. 30%

c. 50%

d. 75%

40. In any CR system, underexposure causes visible in the displayed image:

a. loss of density

b. loss of brightness

c. electronic noise or “snowflakes”

d. quantum mottle

41. When comparing CR and DR, which of the following best describes DR:

a. DR scans the entire image receptor plate from the center outward

b. DR scans only the exposed area of the plate from the center outward

c. DR scans the entire image receptor plate line-by-line

d. DR scans only the exposed area of the plate line-by-line

42. For digital imaging systems, which of the following presents the greatest risk to image

quality when performing a *bilateral* projection of both knees:

a. mottle from not positioning both knees directly over activated detector cells

b. exposure field recognition error

c. histogram analysis error resulting in too dark an image

d. histogram analysis error resulting in too light an image

43. CR phosphor plates are especially vulnerable to:

a. overexposure

b. underexposure

c. scatter radiation

d. background radiation

e. c and d only

44. In the digital age, displayed image brightness is:

a. controlled by mAs

b. decoupled from image acquisition

c. controlled by kVp

d. best adjusted by using monitor settings

45. In the digital age, the main role of radiographic technique is to:

a. control contrast

b. ensure that enough radiation is emitted from the x-ray tube

c. ensure that adequate signal reaches the detector

d. ensure that data clipping does not occur

46. Which of the following has the least dramatic effect on scatter radiation:

a. large body parts

b. large field sizes

c. grids

d. kVp

47. Studies demonstrate that in the displayed digital image, at higher kVp’s, contrast is:

a. very slightly reduced

b. substantially reduced

c. very slightly increased

d. substantially increased

48. When a single 15% step increase in kVp is accompanied by a halving of the mAs, the

*absorbed dose* to the patient is:

1. reduced even more than the skin exposure (ESE)
2. reduced less than the skin exposure
3. increased even more than the skin exposure (ESE)
4. increased less than the skin exposure

49. When a substantial change in approach to technique is made, which of the following will

need to be changed:

1. DI (deviation index)
2. EI (exposure indicator)
3. EIT (target exposure indicator)
4. SNR (signal-noise ratio)

50. Which of the following affects the *displayed* image contrast for a digital image:

a. windowing

b. gradation processing

c. detail processing

d. rescaling

e. all of the above

51. Which of the following is digital processing *least* capable of correcting for:

a. a localized lumbar fog pattern

b. pre-fogging an entire CR plate from scatter radiation

c. overexposure

d. grid lines

52. The increased exposure latitude afforded by digital imaging includes all of the following

options *except:*

1. Using high kVp levels
2. Performing more procedures non-grid
3. Not using compensating filters except for the most extreme cases
4. Using low kVp levels

53. Which of the following statements about CR imaging is true:

a. CR is mAs-driven, only change the mAs

b. CR is kVp-driven, never use more than 90 kVp

c. CR does not allow collimation smaller than the IR

d. At least 1/3 of the CR plate should be exposed

54. For CR, when multiple views are taken on a single receptor plate, which of the following

could result in a dark digital image?

a. photomultiplier tube failure

b. anti-aliasing failure

c. insufficient reading of the phosphor plate

d. segmentation failure

55. When the AEC is used on a DR unit, off-centering of the anatomy that allows increased

“raw” x-ray beam exposure to the detectors will most likely cause \_\_\_\_\_\_\_\_ in the final

displayed image:

1. Mottle
2. Excessive density
3. Reduced contrast
4. Halo effect

56. When a department changes a particular room from film/screen to CR, the AEC for that x-ray

unit must be recalibrated according to the:

1. final density of the image
2. final brightness of the image
3. exposure indicator readings
4. measured primary beam radiation

57. In the digital age, for final displayed image contrast, the kVp is best described as:

a. the only controlling factor

b. the primary controlling factor

c. one contributing factor among many

d. not related at all

58. A digital imaging system cannot compensate for:

a. too much mA

b. too long exposure time

c. too small a body part

d. too low kVp

59. To minimize patient dose in the digital age, the radiographer’s goal should be to produce a

digital image that presents:

1. barely perceptible mottle
2. no mottle at all
3. saturation
4. a high exposure indicator

60. Computer software can now target specific portions of the image for brightness correction.

This has reduced the need for using \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ except in the most extreme cases.

1. AEC
2. Compensating filtration
3. Protective filtration
4. High-frequency generators
5. High kVp

61. When considering the *primary* x-ray beam, to provide sufficient signal reaching the IR, the

primary concern for setting radiographic *technique* in the digital age is:

* 1. Adequate intensity of x-rays from the tube
  2. Adequate penetration of x-rays through the patient
  3. Adequate contrast in the primary x-ray beam
  4. Adequate brightness in the primary x-ray beam

1. From the standpoint of the image receptor detecting x-rays, all that really matters is the:
   1. Total exposure level in the remnant beam
   2. Original set kVp
   3. Original set mAs
   4. Total exposure rate in the primary beam
2. Total exposure at the IR is dependent upon:
   1. Set kVp
   2. Set mAs
   3. Absorption by the patient
   4. All of the above
3. If a higher kVp resulted in twice the penetration, then \_\_\_\_\_\_\_\_ mAs could be used to achieve equal dose to the IR:
   1. The same
   2. One-half
   3. Twice
   4. One-quarter
4. The margin for error in radiographic techniques that can produce an acceptable image defines:
   1. Dynamic range
   2. SNR
   3. Contrast
   4. Exposure latitude
5. All technical aspects of the original exposure become *less* critical with:
   1. Increased SNR
   2. Increased intensity
   3. Increased exposure latitude
   4. Increased subject contrast
6. Compared to film technology, the greatly increased *exposure latitude* of digital imaging makes \_\_\_\_\_\_\_\_\_\_\_\_\_\_ less critical:
   1. All technical aspects of the initial exposure
   2. Setting of kVp only
   3. Use of grids only
   4. Use of compensating filters only
7. When it comes to setting radiographic technique, the increased exposure latitude of digital systems extends:
   1. Primarily in a downward direction
   2. Primarily in an upward direction
   3. Equally upward and downward
   4. The same as for film technology
8. For *increases* in technique using digital equipment, which of the following is a restricting factor:
   1. Image brightness
   2. Patient dose
   3. Image contrast
   4. Image sharpness
9. Because removing grids or using lower grid ratios allow less mAs to be used, we are empowered to reduce:
   1. Patient dose
   2. Image noise
   3. Scatter fog
   4. Image brightness
10. Changing form a 10:1 or 12:1 grid ratio to a 6:1 grid ratio allows:
    1. kVp to be cut in half
    2. kVp to be cut by 1/3
    3. mAs to be cut in half
    4. mAs to be cut by 1/3
11. Because it allows more radiation to reach the IR, removing a grid reduces the probability of noise appearing from:
    1. Quantum mottle
    2. Scatter radiation
    3. Both of the above
    4. Neither of the above
12. *Virtual grid* software is about \_\_\_\_ as effective as conventional grids:
    1. 50%
    2. 75%
    3. 85%
    4. 98%
13. Where conventional grids continue to be used with digital equipment, which of the following is strongly recommended:
    1. Use conventional grids only for mobile procedures
    2. Use conventional grids consistently for all procedures
    3. Increase radiographic techniques
    4. Reduce grid ratios
14. Which of the following is true regarding the use of grids with digital equipment:
    1. All grid use should be eliminated
    2. Grid use is equally important as it was for film technology
    3. Grid use is much more important than it was for film technology
    4. Grids should only be used when necessary
15. Experiments demonstrate that for digital images processed by a computer, reducing the mAs to one-quarter the original without any compensation:
    1. will result in lighter image
    2. will result in an image with increased contrast
    3. will result in an image with decreased contrast
    4. may result in the appearance of mottle
16. Experiments demonstrate that for digital images processed by a computer, increasing the kVp by 30 percent will result in a(n) \_\_\_\_\_\_\_\_\_\_\_\_ image:
    1. severely fogged
    2. severely darkened
    3. higher contrast
    4. none of the above
17. Experiments demonstrate that with digital equipment, a four-fold increase in mAs causes::
    1. No notable change in the image
    2. A notable increase in brightness
    3. A notable decrease in brightness
    4. A notable decrease in contrast
18. Which of the following problems has arisen because of the extensive *upward* exposure latitude of digital imaging:
    1. dose creep
    2. frequent fogging
    3. frequent mottle
    4. none of the above
19. The postprocessing capabilities of leveling and windowing provided by digital technology make the modern digital image a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ image:
    1. latent
    2. interactive
    3. unalterable
    4. permanent
20. When the mAs is cut in half, increasing the kVp by 15% restores exposure *to the IR* because of:
    1. Increased penetration through the anatomy
    2. Increased production of bremsstrahlung x-rays in the tube
    3. Both of these effects
    4. Neither of these effects
21. When kVp is increased by 15%, which of the following effects impacts entrance exposure at the surface of the patient:
    1. Increased penetration through the anatomy
    2. Increased production of bremsstrahlung x-rays in the tube
    3. Both of these effects
    4. Neither of these effects
22. Each time the 15% rule is applied (cutting mAs in half while increasing kVp by 15%), patient skin dose is:
    1. Reduced by 1/3
    2. Reduced to 1/3
    3. Reduced to 1/2
    4. Increased 35%
23. At the *image receptor,* the end result of applying the 15% rule (cutting the mAs in half while increasing kVp by 15%) is:
    1. The original exposure level is maintained
    2. Exposure is reduced by the same ratio as patient dose
    3. Exposure is reduced even more than patient dose
    4. Exposure is increased
24. For digital systems generally, a single step application of the 15% rule to increase kVp while cutting mAs in half has what impact on visible image *contrast:*
    1. It is visibly increased
    2. It is visibly reduced, but by an acceptable level
    3. Any change is visibly negligible
    4. It is unacceptably reduced
25. For digital systems, studies demonstrate that even a *52-kVp increase* demonstrates NO:
    1. Visible change at all in the image
    2. Visible reduction in gray scale
    3. Visible reduction in brightness
    4. Apparent fog patterns
26. With digital imaging, most expected fog patterns (such as those encountered on the lateral lumbar spine projection):
    1. Can be corrected by digital processing
    2. Are passed right through to the displayed image
    3. Are only slightly improved by digital processing
27. Studies of nine manufacturers demonstrate that for a *single step* application of the 15% rule, *mottle* was:
    1. *Never* significant
    2. Significant for some manufacturers
    3. Always significant
28. In terms of the final displayed image, a digital imaging system may not be able to

compensate for:

a. too much mA

b. too long exposure time

c. too small a body part

d. too low kVp