RECENTLY APPROVED GE FFDM DBT TESTING PROCEDURES.

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History of mammography

* During early 70’s a balloon the size of basket ball was attached to a long cone.
* The balloon was used as a compression mechanism
* Conventional X-ray machine was used
* Ready pack films were used like the one used for therapy localization
History

* The next improvement was the use of zero gram.
* An exposed charged plate was run through a processor.
* The processor sprinkled a blue powder.
* The images were printed in a large format.
* Shades of blue.
History

* Introduction of film screen mammography
* Used films which were designed for mammography was used
* High contrast
* Single emulsion screen of the casettes
* Many manufactures were approved for selling their mammo machines by FDA
ACR

- ACR got involved in developing a set of standards for the equipment
- Dose reduction and image quality was their priority
- Institution participation was voluntary
- Institutions meeting ACR standards were issued a sticker for display.
- Feather in the cap of institutions
- Participation was not 100%
Betty Ford was diagnosed with breast cancer and went public.
Congress got involved in regulating standards early 90’s
Mandated that all screening facilities must be approved by MQSA
Standards were published in 10 CFR part 21
Standards were analogous to ACR guide lines.
ACR manual was used as a bible by MQSA
Sites were inspected annually for compliance
INTRODUCTION OF DIGITAL MAMMOGRAPHY

• Digital mammography was introduced in 18x24 format.
• Hard copy of the images were printed for interpretation
• Radiologists were ramping up with their familiarity of the digital systems
• Viewing monitors were not of adequate quality for complete on screen interpretation
• Limitation and bad width of PACS system.
Proliferation of digital units

* Many manufactures got into this business
* GE, Siemens and Selenia were major players. There were also many others besides them
* Viewing monitors of adequate resolution were available.
* Full Field Digital Mammography FFDM was gaining grounds.
* Presently most of them are FFDM units
* Film Screen units have become extinct
Great advantage of FFDM was one’s ability to adjust window and level.

Viewing rooms with low light intensity were specially designed.

Gained universal acceptance.

Still lacked the ability to differentiate overlying objects.

Testing was very prescriptive by the manufacturer. There was no single set of instructions.

Navy under the leadership of Capt Thomas was exploring tomographic concept.
GE FFDM and DBT

* GE DBT has extensive testing to be performed before initially using on patients.
* Not all screening procedures are approved on all units
* Requires FFDM testing be performed as stand alone system
* DBT 2D testing to be performed.
* 3 D testing has to be performed.
* Three times the work
Physicist Qualifications

* ABR certified in diagnostic radiology physics
* Had initial 8 hours of training in specific modality
* Acquire 15 hours of CEU every three years
* Have at least 3 units every year under the belt.
DBT IN UPRIGHT POSITION
DBT IN ANGULAR STARTING POSITION

STARTING POSITION OF GANTRY
DBT PADDLES

BLUE IS FOR 3D OPERATION
MTD

MOTORIZED TOMO DEVICE
TRANSPORT CADDY FOR MTD
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<th>Test Number</th>
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<td>SYSTEM RESOLUTION AND MTF</td>
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GE SIMPLIFIED APPROACH

- MOST OF THE QC TESTS ARE AUTOMATED
- QAP ICON ON THE MAIN SCREEN
- KVP AND HVL ASSESSES LIKE FILM SCREEN BUT WITH THE DETECTOR ADEQUATELY PROTECTED WITH LEAD
- IMAGE QUALITY OF THE PHANTOM ASSESSED ON BOTH ACQUISITION AND REVIEW WORK STATIONS
- ARTIFACT ASSESSED ON HARD COPY DEVICE IN ADDITION TO MONITORS
- AOP ASSESSED FOR 2.5, 5 AND 6 cm BREAST EQUIVALENT PHANTOM
DBT TESTS UNDER 2D MODE

QAP ICON BRINGS ONE TO THIS SCREEN. 2D AND 3D CAN BE SELECTED HERE
TESTS WITH MTD 2D

THE TESTS INDICATED IN THE PREVIOUS SLIDE IS REPAEDED WITH MTD MOUNTED.
KVP AND HVL NEED NOT BE REPEATED
3D TESTS UNDER TOMO MODE

THE FOLLOWING TESTS ARE PERFORMED WITH MTD ON UNDER TOMO MODE.
TOMO IS ACTIVATED BY SELECTED 3D OPTION.
GANTRY HAS TO BE POSITIONED IN THE START POSITION
3D OPTION HAS TO CHOSEN AND DISPLATED ON MTD.

FOOT PEDAL HAS TO ENGAGED DURING THE ENTIRE 3D EXPOSURE
3D TESTS

- FLAT FIELD TEST
- PHANTOM IQ TEST
- CNT AND MTF
- ARTIFACT EVALUATION AND FLAT FIELD UNIFORMITY
- SUB SYSTEM MTF AND FOCAL SPOT
- MGD AND AEC REPRODUCIBILITY
- KVP ACCURACY AND REPRODUCIBILITY
- HVL
- UNIT ASSEMBLY
- GRID TEXTURE
- COMPRESSION PADDLE BORDER TO CW ALIGNMENT
- VOLUME COVERAGE
- ACR IMAGE ASSESSMENT
3D TESTS UNDER TOMO MODE CONTINUED

- ALL THESE TESTS ARE PERFORMED UNDER TOMO MODE EXCEPT
  - KVP
  - HVL
  - ARTIFACT EVALUATION
  - SYSTEM RESOLUTION
VOLUME TEST

- Images are reconstructed at 1 mm interval.
- It can be displayed at 1 mm interval or
- It can be displayed at 5 mm slabs.
- It is important to ensure that the location of reconstructed plane corresponds to actual location.
- It is tested for 2.5 and 6 cm thickness.
- 1 mm Al filters are placed at the bottom and the top of the phantom.
- Reconstructed image must display sharp images of the filters both at the surface and top of the phantom.
TIME REQUIRED TO PERFORM THESE TESTS AND FREQUENCY

- It takes a total of two full days of painstaking measurement.
- It takes an additional day to analyze the measured data.
- GE has provided a template for data submission.
- I have developed an Excel spreadsheet for data analysis and production of the report.
- Frequency of each of these tests are specified by GE.
SUMMARY OF MAMMOGRAPHY EQUIPMENT EVALUATION
FOR G.E. BREAST TOMOSYNTHESIS

FACILITY NAME: AVERA ST. LUKES HOSPITAL IMAGING CENTER

FACILITY NAME: 305 S STATE STREET
ABERDEEN SD 57401

INSTALLATION DATE: 4/2/2015
UNIT SERIAL #: 1-RP-37

DATE OF SURVEY: 4/2/2015
ROOM #: 1-HP-37

MEDICAL PHYSICIST: S Guru Prasad
SIGNATURE:

TEST RESULTS

1. GRID TEXTURE TEST
   PASS
   FAIL
   "TEXTURE LEVEL" MUST NOT > 0.002

2. FLAT FIELD 3D & PHANTOM IQ 2D WITH MTD & 3D
   PHANTOM IQ 2D WITH MTD
   AOP PASS/Fail
   # OF FIBERS: PASS
   # OF SPECK GROUPS: PASS
   # OF Masses: PASS
   # OF LARGEST FIBERS 3 LARGEST SPECK GROUPS AND 3 LARGEST Masses MUST BE DETECTED
   FLAT FIELD 3D
   PASS
   FAIL
   "BRIGHTNESS NON UNIFORMITY" MUST NOT > 0.14
   "SNR NON UNIFORMITY" MUST NOT > 0.34

3. CNR & MTF MEASUREMENT
   MTF PARALLEL AT 2 lp/mm: 62.89
   MTF PARALLEL AT 4 lp/mm: 28.32
   MTF PERPENDICULAR AT 2 lp/mm: 60.36
   MTF PERPENDICULAR AT 4 lp/mm: 34.89
   "SNR NON UNIFORMITY" MUST NOT > 10

4. AOP 2D & 3D CHECK WITH MTD
   EXP. PARAMETERS
   ACRYLIC THICKNESS: 37.41
   TRACK/UNIT:
   kV:
   mAs:
   "SNR NON UNIFORMITY" MUST NOT > 8

5. AOP 3D CHECK
   EXP. PARAMETERS
   ACRYLIC THICKNESS: 37.41
   TRACK/UNIT:
   kV:
   mAs:
   "SNR NON UNIFORMITY" MUST NOT > 8

6. COMPRESSION PADDLE TO MTD C.W. ALIGNMENT
   PASS
   FAIL
   C.W. EDGE OF COMPRESSION PADDLE NOT VISIBLE IN IMAGE > 1% OF SIDE

7. BREAST ENTRANCE EXPOSURE & MGD
   PASS
   FAIL
   "MGD TO THE STANDARD BREAST MUST NOT EXCEED 3 mGy (0.3 rad) PER VIEW"

8. ARTIFACT EVALUATION
   PASS
   FAIL
   "ARTIFACTS ARE NOT APPARENT OR ARE NOT EXPECTED TO MIMIC OR OBSCURE CLINICAL INFORMATION"

9. VOLUME COVERAGE
   PASS
   FAIL
   "THE FOCAL PLANE OF TOP AI SHALL BE WITHIN THE RECONSTRUCTED VOLUME"

VOLUME COVERAGE MUST PASS
INFORMATION AND QUESTIONS

YOU CAN CONTACT ME AT air_n2847j@yahoo.com or 847-921-3462

THANK YOU