Technical Aspects and Image Quality in Mammography

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In mammograqphy, it is most important to consistently produce high-contrast, high-resolution images at the lowest radiation dose consistent with high image quality. In recent years, there have been many significant technological improvements in mammographic x-ray equipment, image recording systems, and viewing conditions. Some of the major technical development milestones in mammographic imaging are shown in Table 1. Until the mid 1980's, many x-ray units were used that were not dedicated to mammography. These x-ray units had tungsten target tubes that were designed originally for medical imaging procedures, such as chest radiography. Some of these units had compression devices that were home made; therefore, breast compression was less than optimal by today's standards. Many of these units had very large focal spots or short focal spot-to-breast surface distances that could result in significant geometric blur (unsharpness). Direct exposure (industrial type) x-ray films were being used, which often required long exposure times (causing blur by motion) and which resulted in high radiation exposure. In addition, viewing conditions were inadequate.

Today, mammography is performed with dedicated mammographic x-ray equipment. These units have specially designed tube targets, smaller focal spots, and significantly improved breast compression devices, among other features. Cassettes and screen-film combinations are designed specifically for mammography. Film processing and viewing conditions also have improved significantly over the years. In 2000, the first digital mammography system was approved by the Food and Drug Administration (FDA) for clinical use.

The American College of Radiology (ACR) Mammography Accreditation Program introduced in 1987, the ACR Quality Control Manuals introduced in 1992, and the Mammography Quality Standards Act which was implemented in 1994, have also had a significant impact on the improvement of the technical quality of mammographic images in the United States.

In summary, today it is possible to obtain mammograms with higher image quality that require significantly lower radiation doses compared with mammograms dating back to the 1970s and early 1980s. Some of the important technological improvements that have let to todays high quality mammographic images are discussed in this presentation.

Table 1. Technical Advances in Mammography

Year	Development
Prior to 1969	Conventional tungsten target x-ray tubes with direct exposure industrial type films were used
1969	Dedicated mammographic unit with molybdenum target tube and compression cone introduced (CGR Senographe)
1971	Xeroradiography system introduced for mammography (Xerox)
1972	Screen-film system introduced for mammography (Du Pont Lo-dose system)
1976	Rare earth screen-film system and special cassette introduced for mammography (Kodak Min-R system)
1977	Mammography x-ray unit for magnification with microfocal spot Introduced (Radiological Sciences Inc.)
1978	Mammography unit with grid introduced (Philips)
1987	American College of Radiology Mammography Accreditation Program (ACR MAP) begins
1992	American College of Radiology Mammography Quality Control Manual for Radiologists, Radiologic Technologists, and Medical Physicists, introduced
1994	The Food and Drug Administration (FDA) implements the Mammography Quality Standards Act (MQSA)
2000	Digital mammography system approved by the FDA for clinical use (GE Senographe 2000D)

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