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### Evaluating the Effects of Contraceptive Use on Breast Pathology and Tissue Density Using Digital Breast Tomosynthesis

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## Introduction to Digital Breast Tomosynthesis (DBT)

- It is also known as 3D mammography.
- Similar to 2D digital mammographic imaging, DBT uses x-rays to acquire digital images of the breast.
- However, unlike 2D digital mammography, DBT is able to scan through the many layers of dense breast tissues.
- Images are obtained by the x-ray tube moving in an arc around a compressed breast on a stationary detector, while delivering a continuous beam.
- Images are then reconstructed into thin layers that can be viewed individually or scrolled through to reduce overlap of tissues.

(Dense Breast Info, 2020)

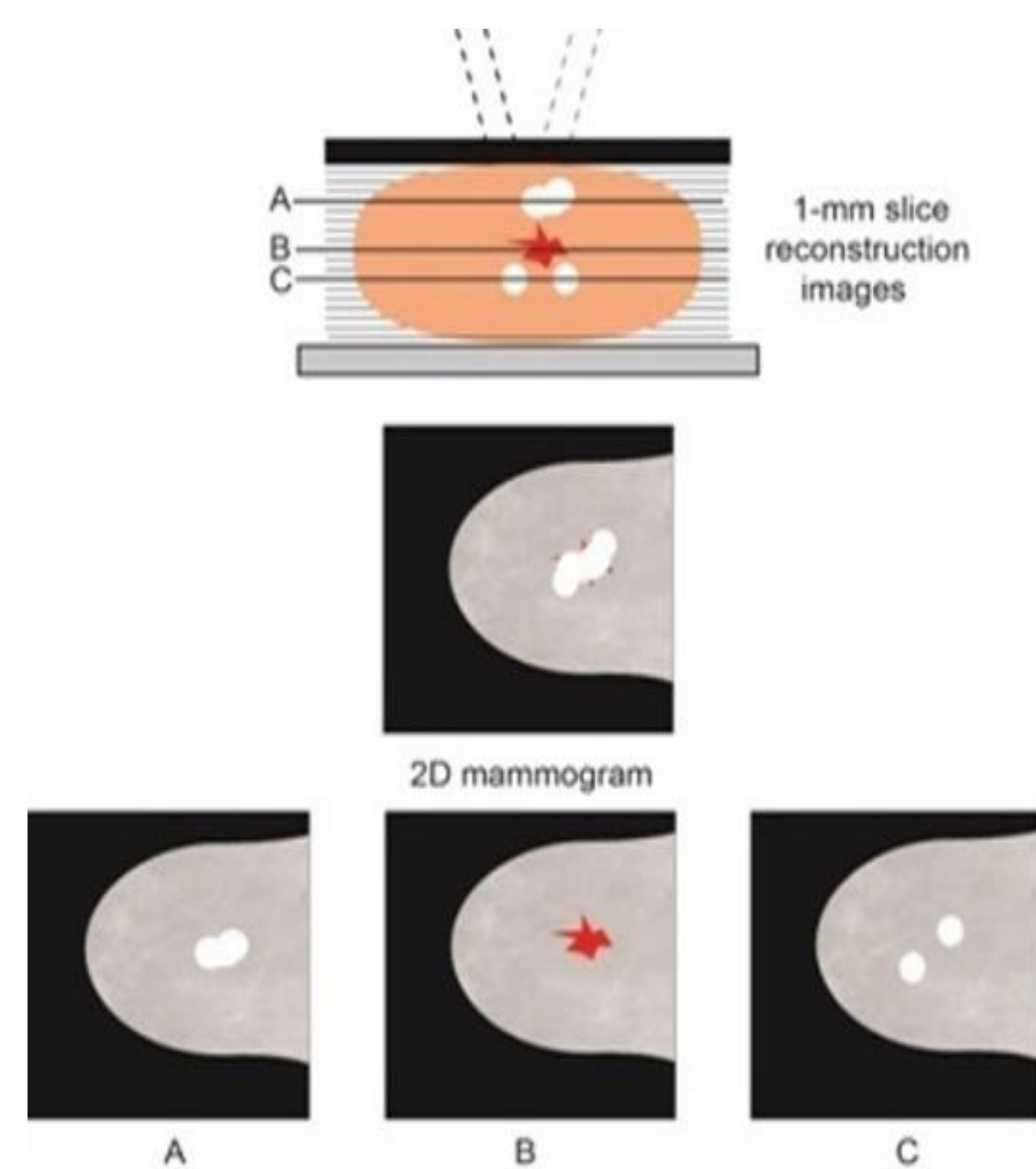


Figure 1: 2D vs 3D screenings (Dense Breast Info, 2020)

- Dense breast tissue appears white on mammograms.
- Using 2D instead of 3D mammography on dense breasts can obscure pathology because breasts structures can overlap each another.
- Overlapping tissues on 2D mammography can also make normal tissue appear abnormal.

(Aragon, 2017)

## Hormonal Contraceptives

- Contain estrogen and/or progesterin, two female sex hormones that are used to prevent ovulation  
(American Society of Health-System Pharmacists, 2020)
- The Centers for Disease Control and Prevention (CDC) reported that between 2015 and 2017, 64.9% of the 72 million women aged 15-49 in the U.S. were using contraception, and 22.9% of those were hormonal in nature.  
(Daniels & Abma, 2018)
- The use of birth control has been associated with increased risk of breast cancer.  
(Dorchak et al., 2018; Morch et al., 2017)
- Morch et al., found that risk of breast cancer among all current or recent (discontinuation within previous six months) users of hormonal contraception was higher than among women who had never used them, and the risk increased with longer duration of use. (See table below.)

Duration of Use of Hormonal Contraceptive	Relative Risk of Breast Cancer (95% CI)		
	<1 Yr since Recent Use	1 to <5 Yr since Recent Use	5 to 10 Yr since Recent Use
<1 yr	0.96 (0.78-1.19)	0.96 (0.85-1.09)	1.01 (0.88-1.15)
1 to <5 yr	1.04 (0.88-1.23)	1.06 (0.96-1.18)	1.07 (0.94-1.20)
5 to 10 yr	1.33 (1.11-1.59)	1.16 (1.02-1.33)	1.30 (1.06-1.58)
>10 yr	1.52 (1.17-1.98)	1.16 (0.89-1.49)	NA†

Table 1: Relative Risk of Breast Cancer According to Time since Use and Duration of Use of Any Type of Hormonal Contraception (Morch et al., 2017)

## Breast Density Factors

- Breast density has a significant inverse association with the age at which women start using hormonal contraceptives, and a positive association with the duration of contraceptive hormone use.  
(Dorgan et al., 2013)
- Increased breast density is directly related to the risk of breast cancer.  
(Houssami, 2016)
- Increased tumor size and worsened prognosis are associated with increased breast density.

(Rafferty et al., 2016)

## Using DBT to Screen Dense Breasts

- In 2016, Houssami noted that DBT “could provide a much more sensitive screening mammogram in women with dense breasts” (p. 516).
- The same year, a large study by Rafferty et al. (2016) comparing over 270,000 2D digital mammograms to more than 170,000 DBT exams reported “an increase in cancer detection of 1.6 per 1000 in women with heterogeneously dense breasts, but no improvement in cancer detection with extremely dense breasts.” (DenseBreast Info, 2020)
- Results of another large more recent study of DBT compared with 2D digital mammography revealed an increase in cancer detection of more than 2.5 per 1000 women aged 40-49 with dense breasts  
(Conant et al., 2019)
- DBT was also shown to be associated with decreased false-positive test results and increased breast cancer detection in the Conant et al. (2019) study.

## Case Study #1

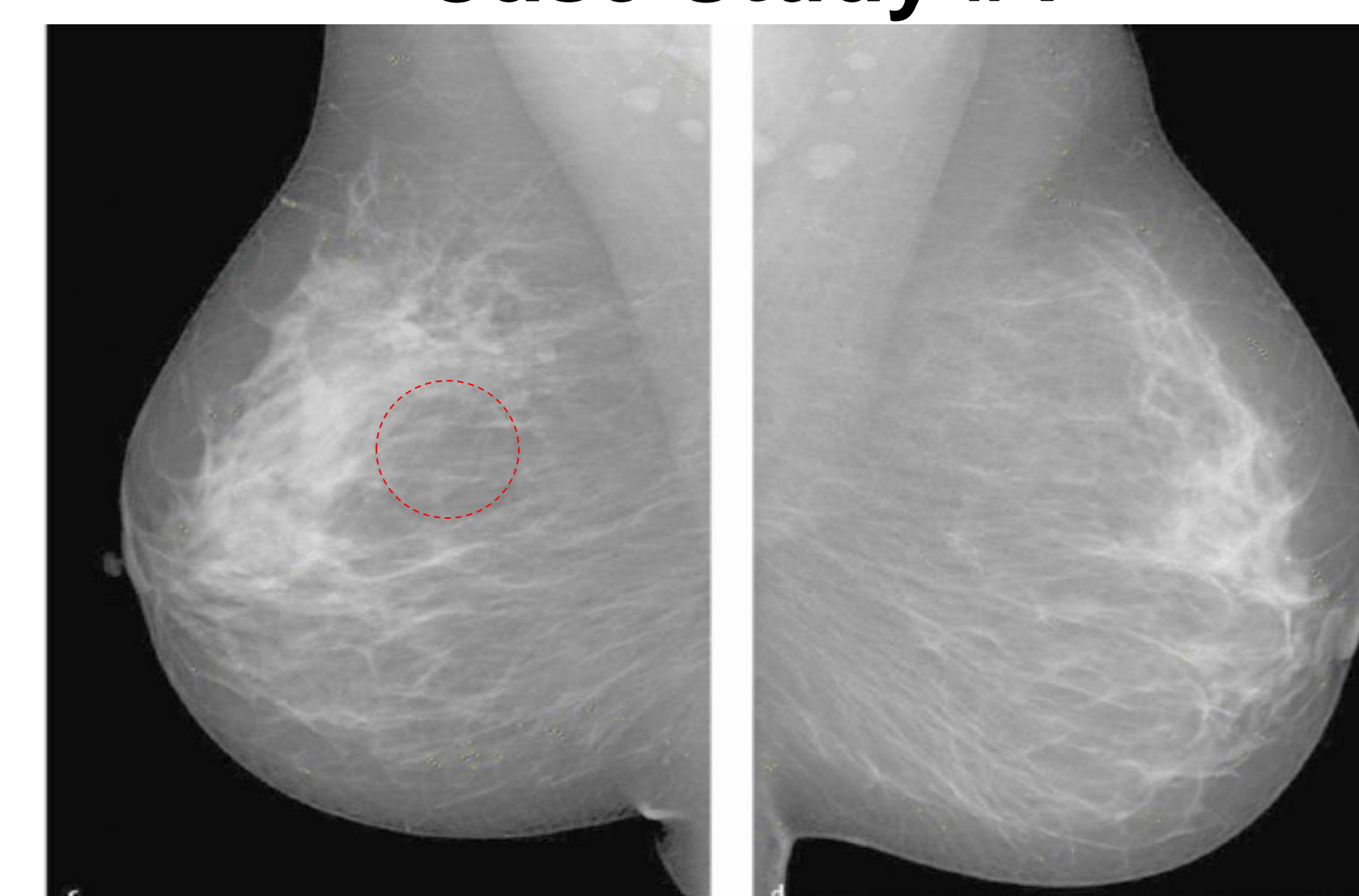


Figure 2: Digital MLO Projections of Breasts

- Female, 32 years of age, palpable mass in the upper outer quadrant of the right breast:
  - On hormonal contraception
  - Scattered fibroglandular density
  - Maternal history of breast cancer
- 2-D mammogram confirmed asymmetry and architectural distortion
  - Classified as BIRADS-5
- 3-D mammogram showed more detail: Spiculated density with 3.2 cm. x 2.8 cm. measurements
- Final Diagnosis: Ductal hyperplasia, fibrocystic changes, metaplasia and adenosis. No malignancy  
(Barkhausen, Rody, & Schaefer, 2015)

## Case Study #2



Figure 3: Digital MLO Projections of Breasts

- Female, 48 years of age:
  - Took hormonal contraceptives until age 42
  - Homogeneously dense breasts
  - No family history of breast cancer
- 2D mammogram showed a microcalcification cluster in the medial half of the left breast
  - Classified as BIRADS 4
- 3D mammogram of the left breast showed architectural distortion and multiple clusters of microcalcifications 9 cm. away from the nipple
- Final diagnosis: Fibrocystic changes with no evidence of malignancy

(Barkhausen et al., 2015)

## Breast Imaging Reporting and Data System (BI-RADS) Assessment Categories

Category 0:	Incomplete - Needs additional imaging evaluation and/or prior mammograms for comparison.
Category 1:	Negative.
Category 2:	Benign.
Category 3:	Probably benign.
Category 4:	Suspicious.
Category 5:	Highly suggestive of malignancy.
Category 6:	Known biopsy – proven malignancy.

Table 2: BI-RADS Scoring (Zubia & Ramirez-Arambula, 2017)

## Conclusion

- Breast density can increase with duration of contraceptive hormone use.
- The risk of developing breast cancer can also increase with contraceptive hormone use.
- An increase in breast density is directly related to the risk of breast cancer.
- Using 3-D mammography provides more detailed imaging than 2-D and is more effective in evaluating dense breast tissue.
- DBT is optimal for women with dense breasts and those using hormonal contraceptives.