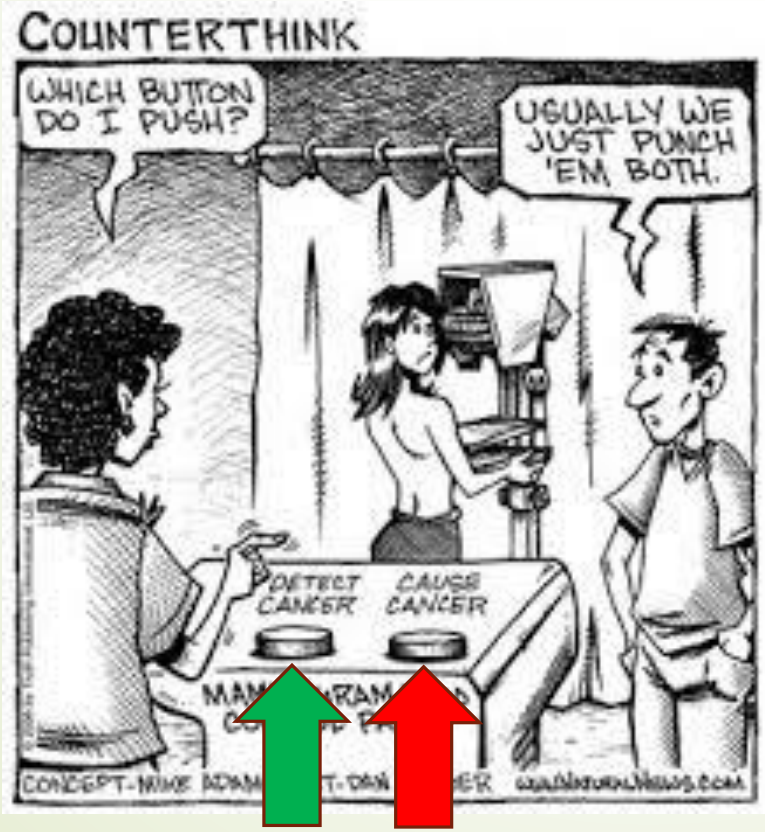
Pozicioniranje kod mamografije

Risk of carcinogenesis
vs.
Benefit of saving lives through early cancer detection and treatment



Breast Positioning Issues

- CC/MLO
- Supplemental Views

- Large Breasts
- Small Breasts
- Lactating Breast
- Implant Imaging
- Males
- Painfull breasts

- Difficult Patients
- Wheelchair/stretcher pt
- Chest Wall Deformities
- Kyphotic Patients
- Irradiated Breast
- Deformed Post-Surgical Breast
- Reduction Mammoplasty
- Protruding Abdomen
- Pacemaker, infusa-port (port-a-cath)

Breast Positioning Issues in Mammography Screening

- **CC/MLO**
- Supplemental Views

- Large Breasts
- Small Breasts
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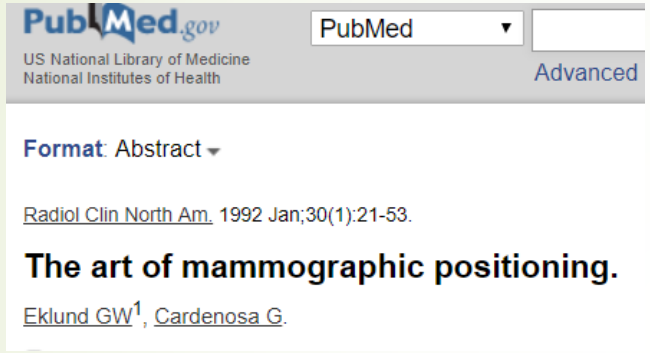
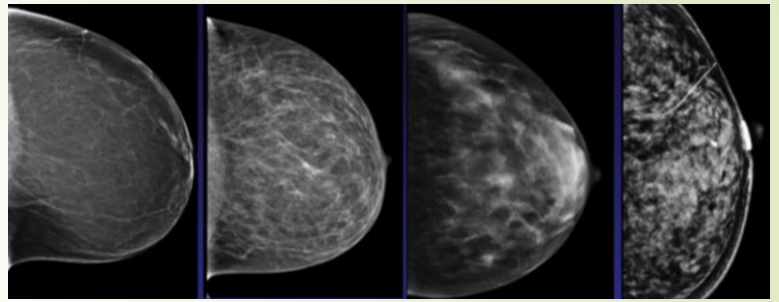
Pozicioniranje dojke je vještina i umjetnost…
ali na znanstvenim osnovama





ACR breast density I/II/III/IV

- Mamografsko pozicioniranje je različito od onog u konvencionalnoj radiografiji jer…
  - …anatomija i fiziologija dojke su promjenjivi
  - …anatomski orjentiri su nepouzdani: mamila, pektoralni mišić
  - …isti postupci pri pozicioniranju ne daju dosljedno uvijek isti učinak na snimci
- Kad nastane problem, *nema standardiziranog rješenja* – tada na scenu stupa vještina, iskustvo i intuicija…

Pozicioniranje kod mamografije treba biti **standardizirano**

- Što veće uključenje žljezdanog tkiva dojke na snimci – senzitivnost pretrage
- Što manje odbačenih i ponovljenih snimki – doza zračenja, vrijeme, troškovi
- Što manja potrošnja vremena i nelagoda pacijenta - učinkovitost
- Dosljednost u obučavanju mlađih izvršitelja probira - edukativnost
- Izbjegavanje profesionalnih ozljeda kod repetitivnih pokreta pri snimanju
- Lakša usporedba suslijednih snimki, topografska lokalizacija lezije u dojci

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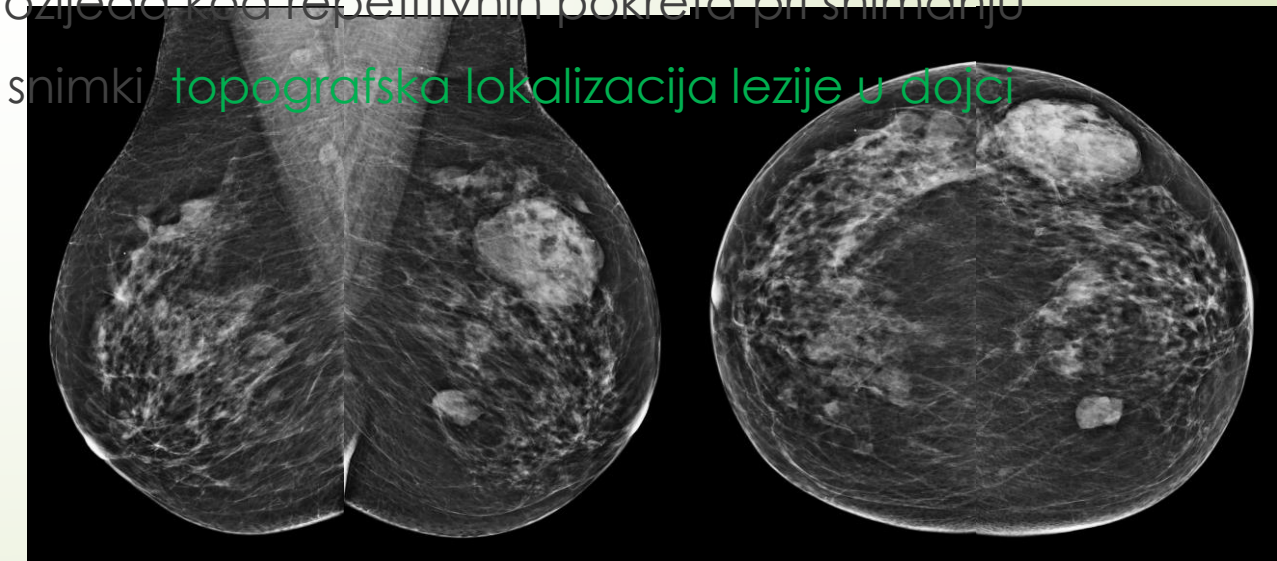
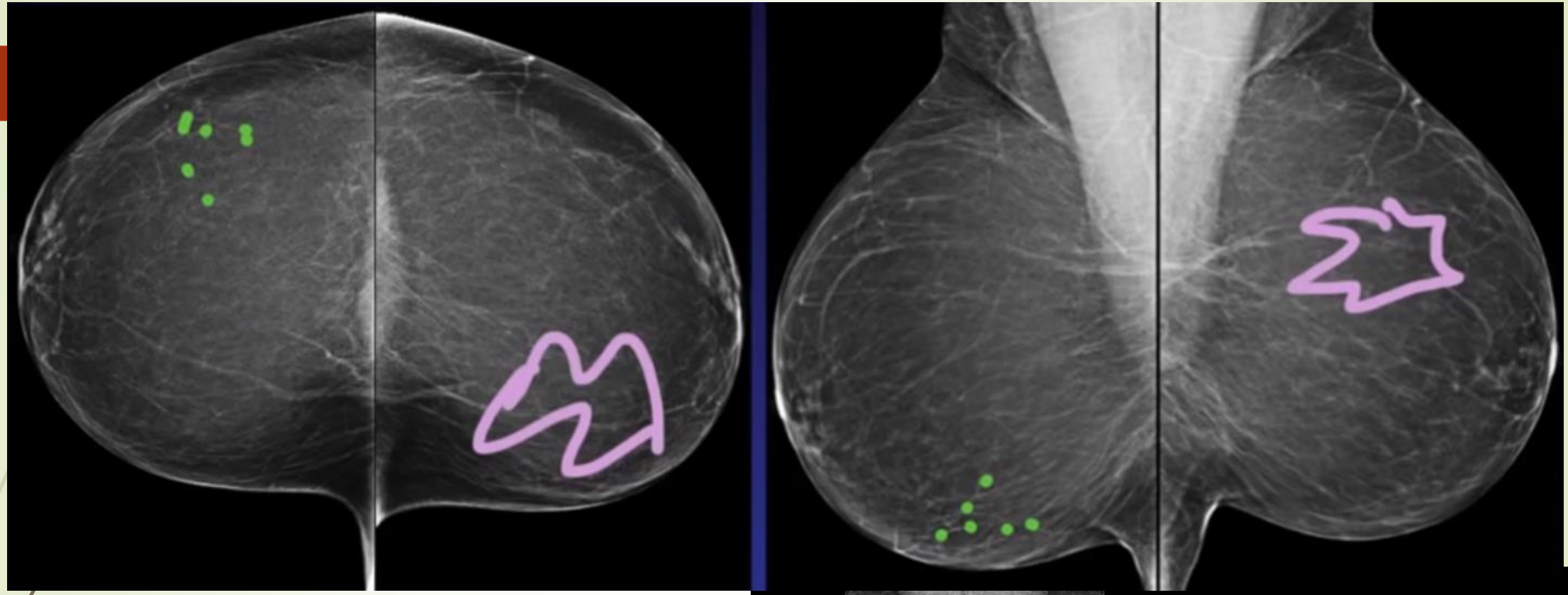
- Što manja odbačenih i ponovljenih snimki – doza, vrijeme, troškovi
- Učinkovitost, što manja potrošnja vremena i nelagoda pacijenta
- Dosljedne upute za obučavanje mlađih
- Izbjegavanje profesionalnih ozljeda kod repetitivnih pokreta pri snimanju
- Lakša usporedba suslijednih snimki, topografska lokalizacija lezije u dojci (triangulacija)





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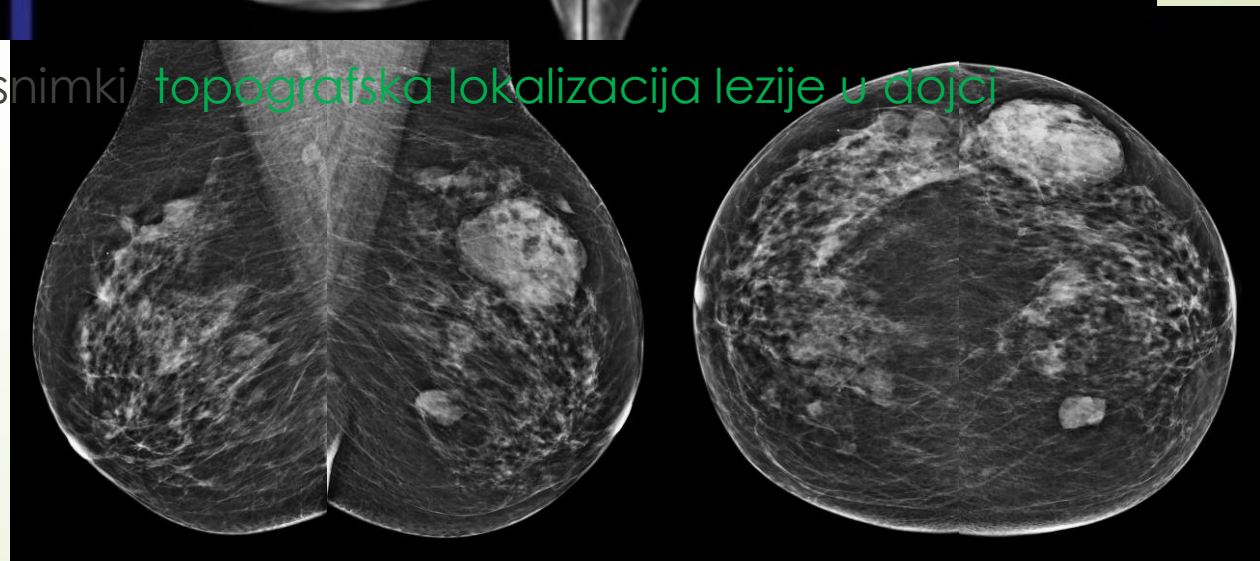
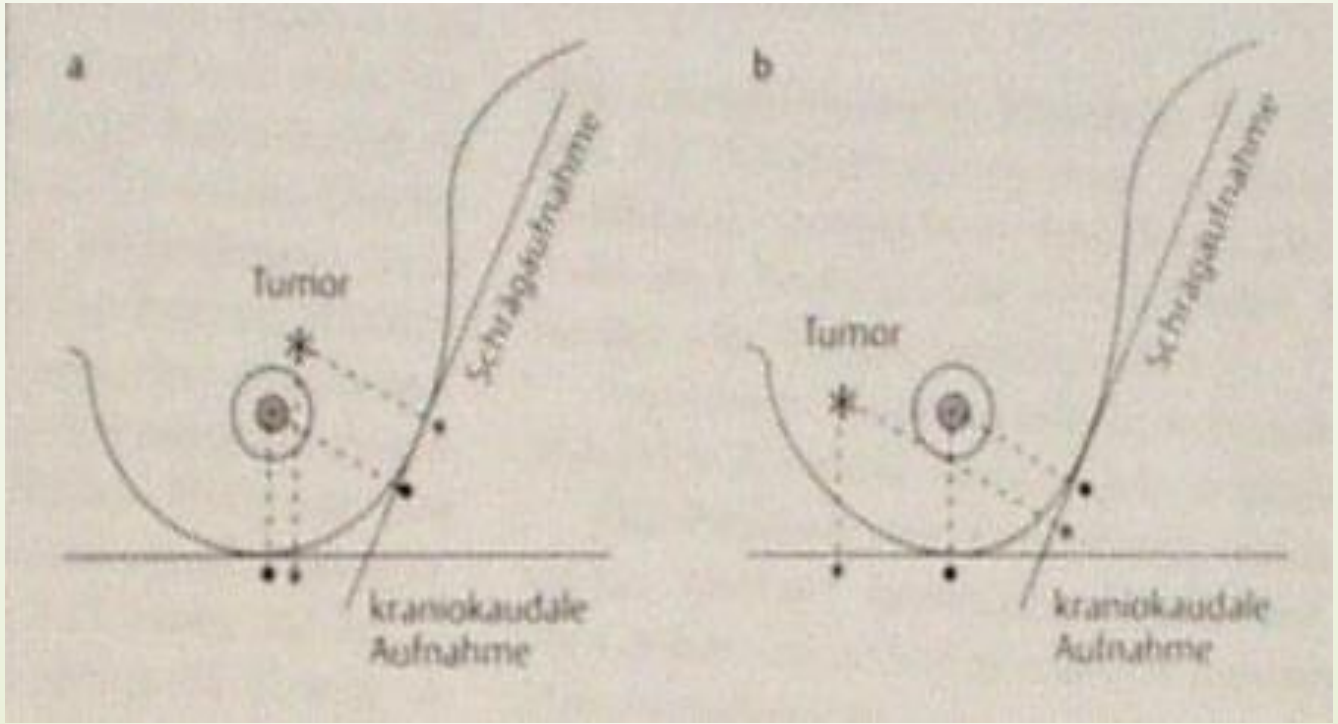


Mamografija – kosa (MLO-) snimka

otežana procjena prostornog smještaja lezije



Ciljevi pozicioniranja

- snimiti dojku **u položaju koji je što bliže njezinoj normalnoj anatomskoj poziciji**

- Dojka je **mobilan organ**
  - **Fiksirana u GMK, relativno mobilna u donjem i lateralnom dijelu**
- Kod mamografije treba ju **odvojiti od torakalne stijenke, i mobilni dio pomaknuti prema fiksiranom dijelu**
- Dojku treba dobro **stabilizirati kompresijom**

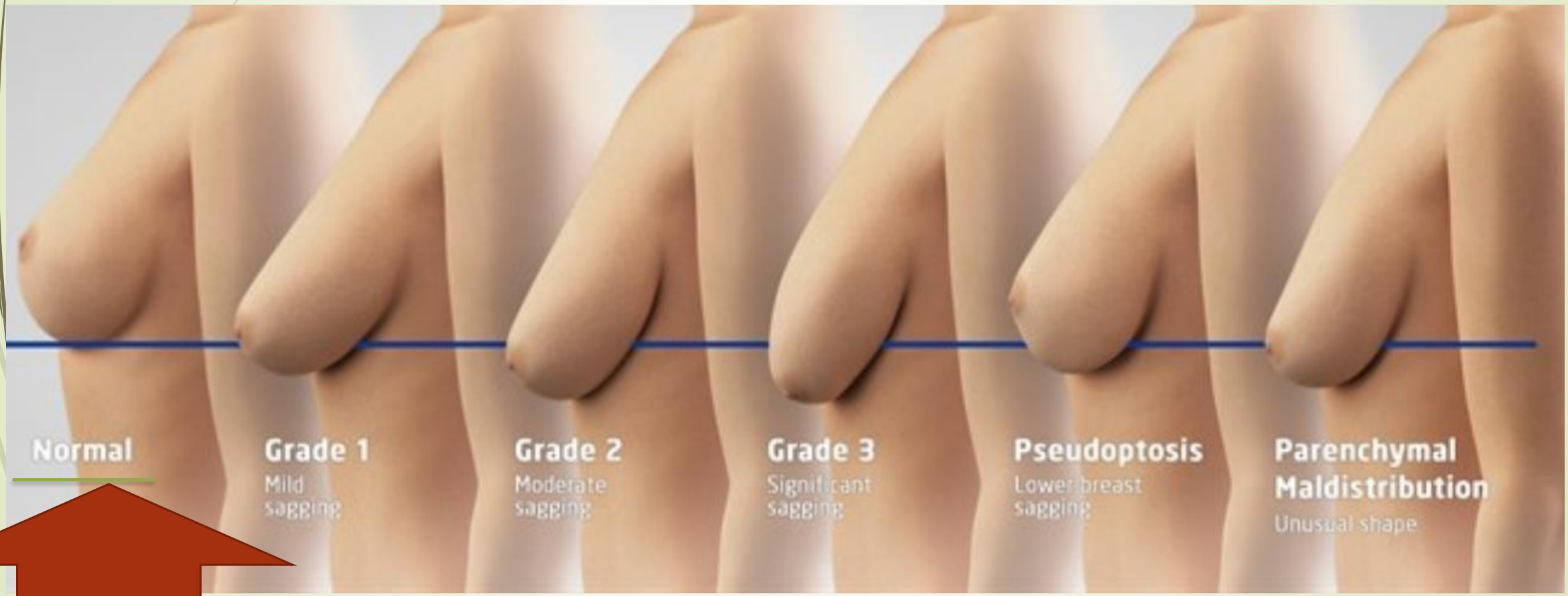
Ciljevi pozicioniranja

- snimiti dojku **u položaju koji je što bliže njezinoj normalnoj anatomskoj poziciji**

- **ŠTO VIŠE PRIKAZANOG ŽLJEZDANOG TKIVA - senzitivnost**
- **ŠTO MANJE SUPERPOZICIJE – specifičnost, senzitivnost**

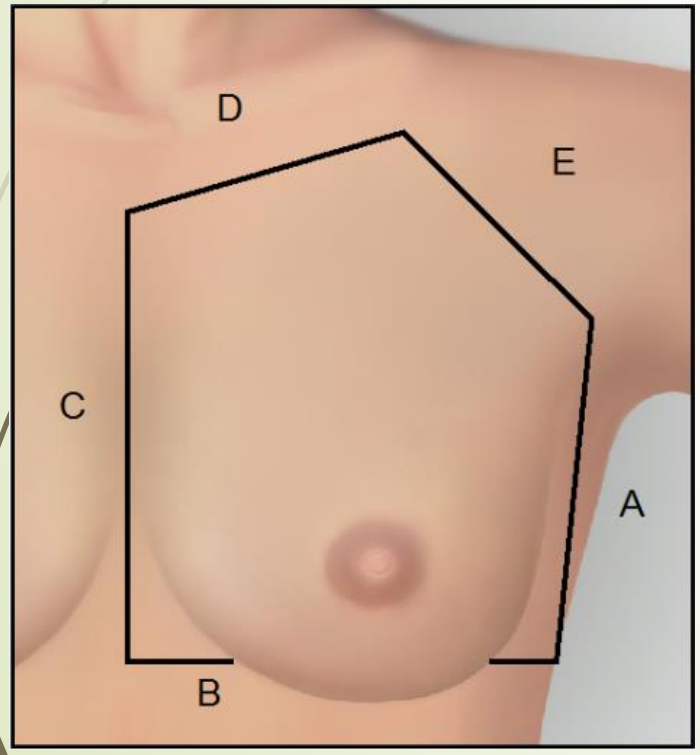
- Kod pozicioniranj dojke *treba misliti na „opasne zone"*
  - Subareolarnu
  - Prepektoralnu (retroglandularnu)
  - Medijalnu
  - Rubove dojke, rak može nastati čak i u aksili

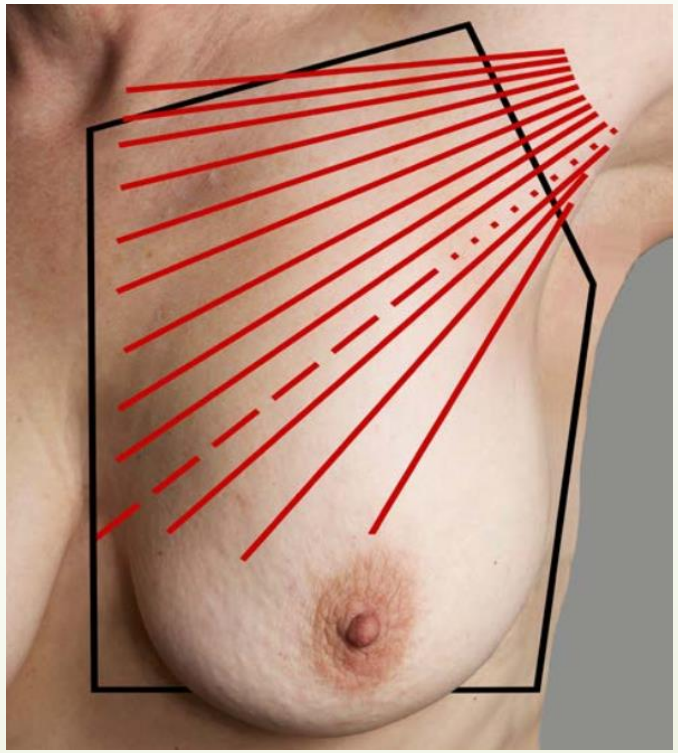
Kod pozicioniranja dojke treba tkivo dojke dovesti u „normalan" položaj

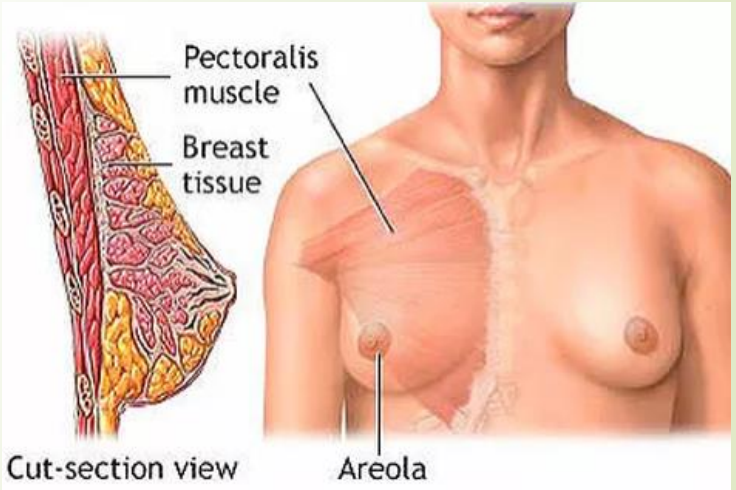


Anatomija

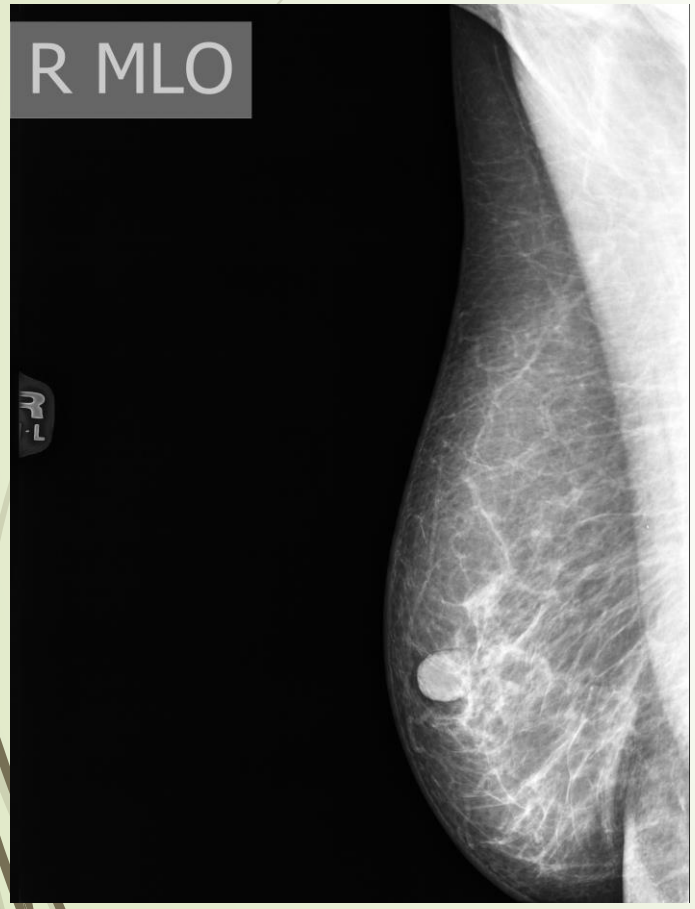
- Granice dojke, pektoralni mišić



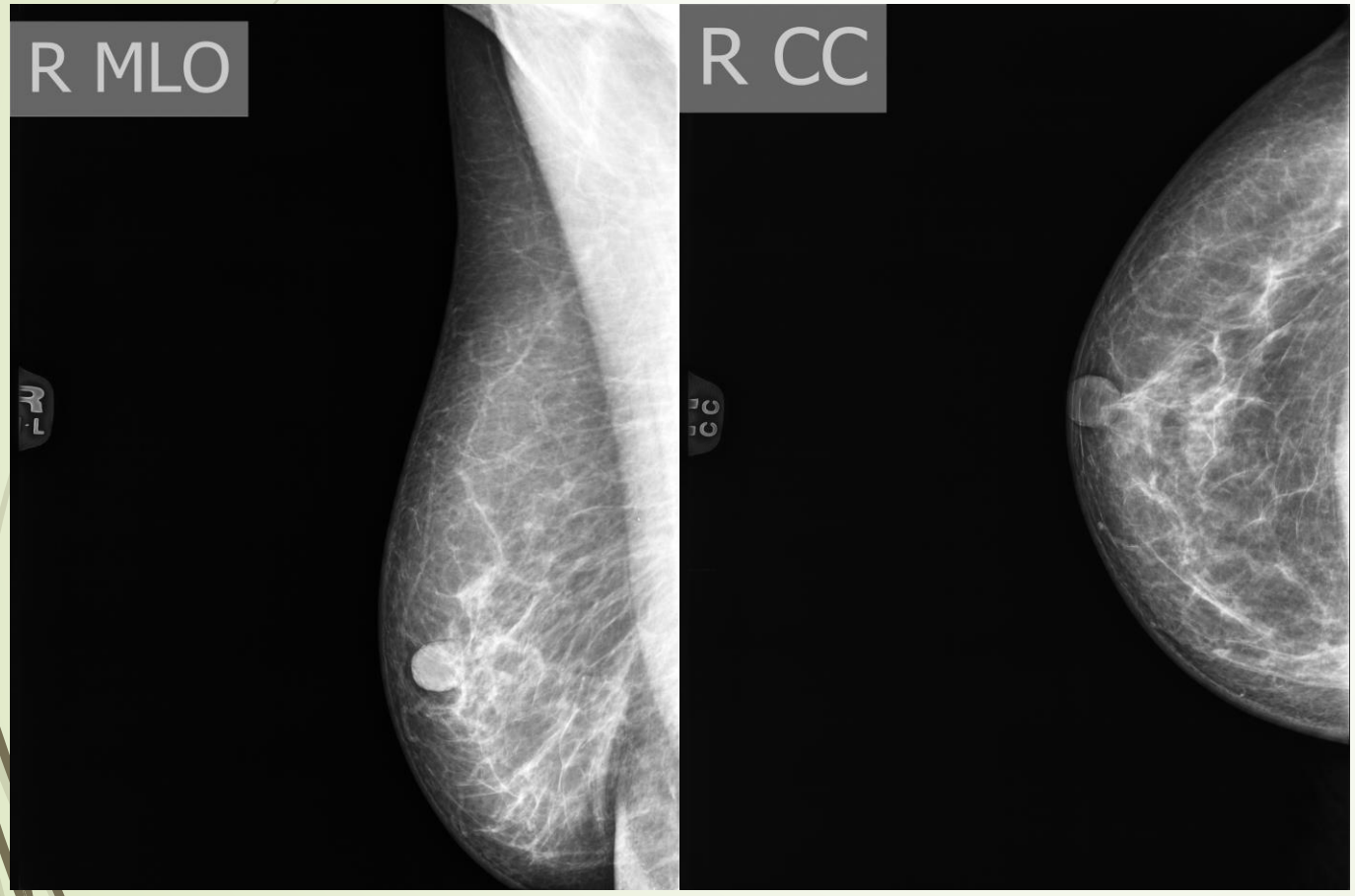




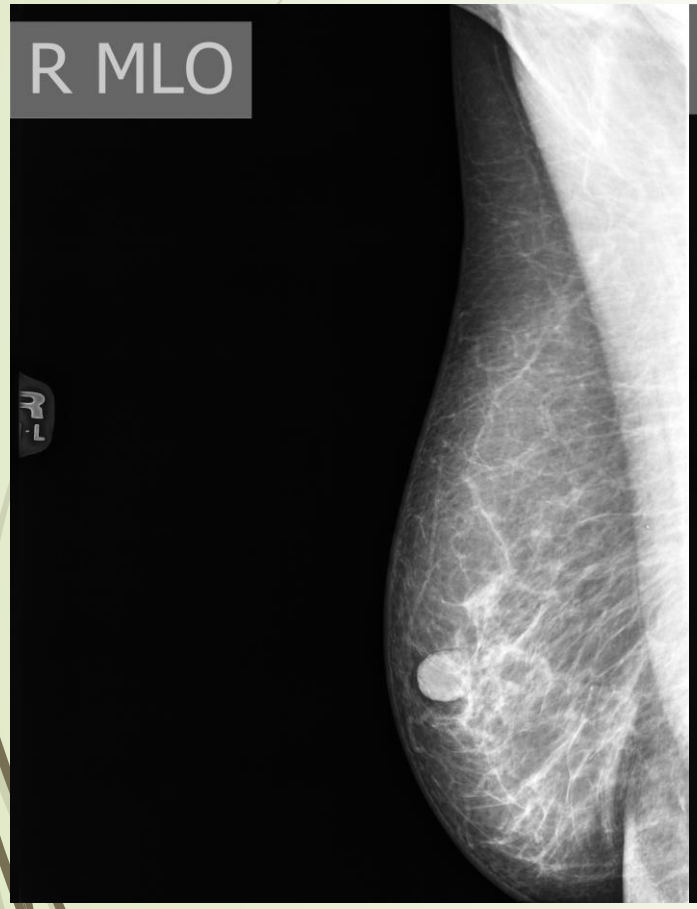
Primjer

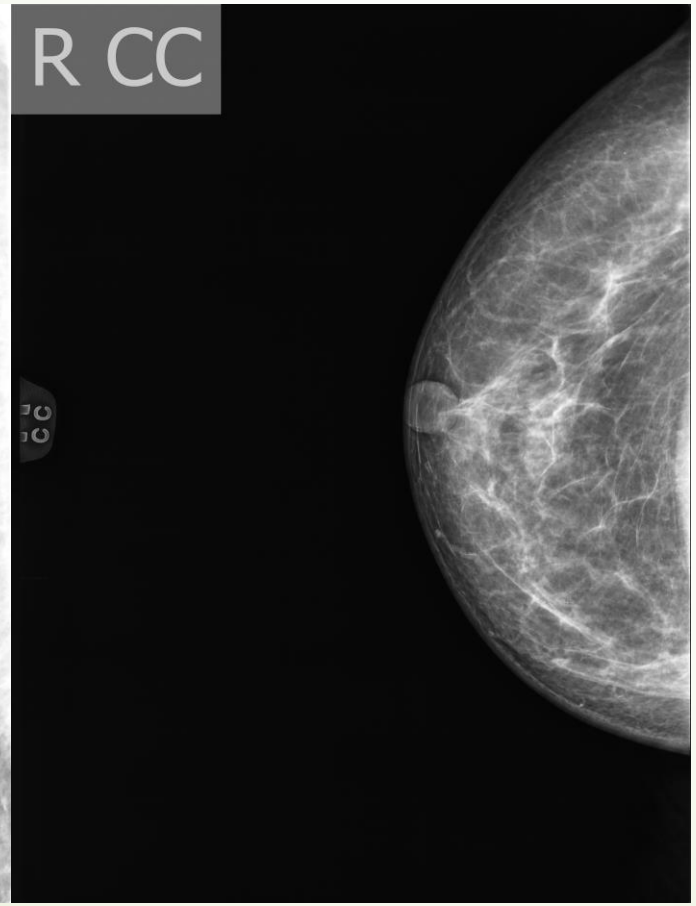


Primjer

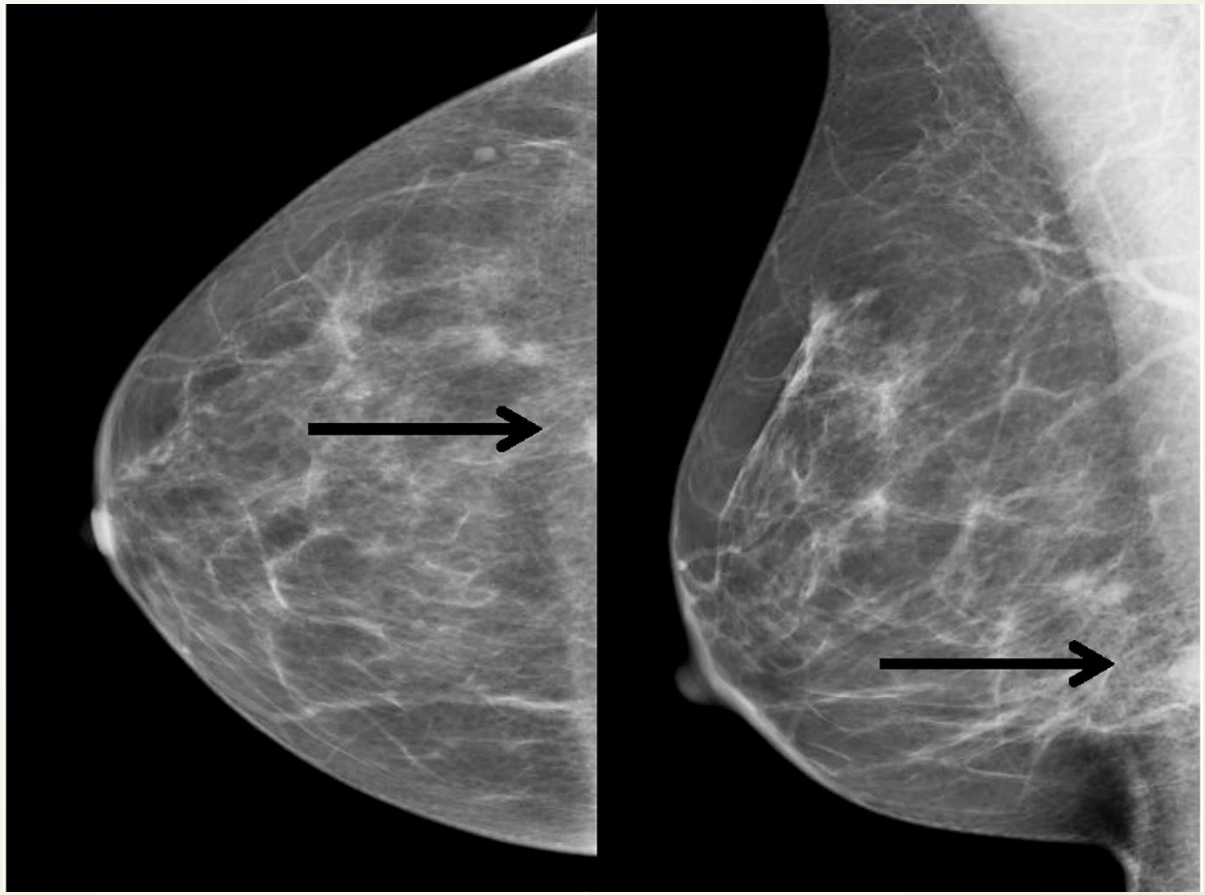


Primjer karcinoma u perifernom dijelu dojke koji **nije** prikazan na mamografiji

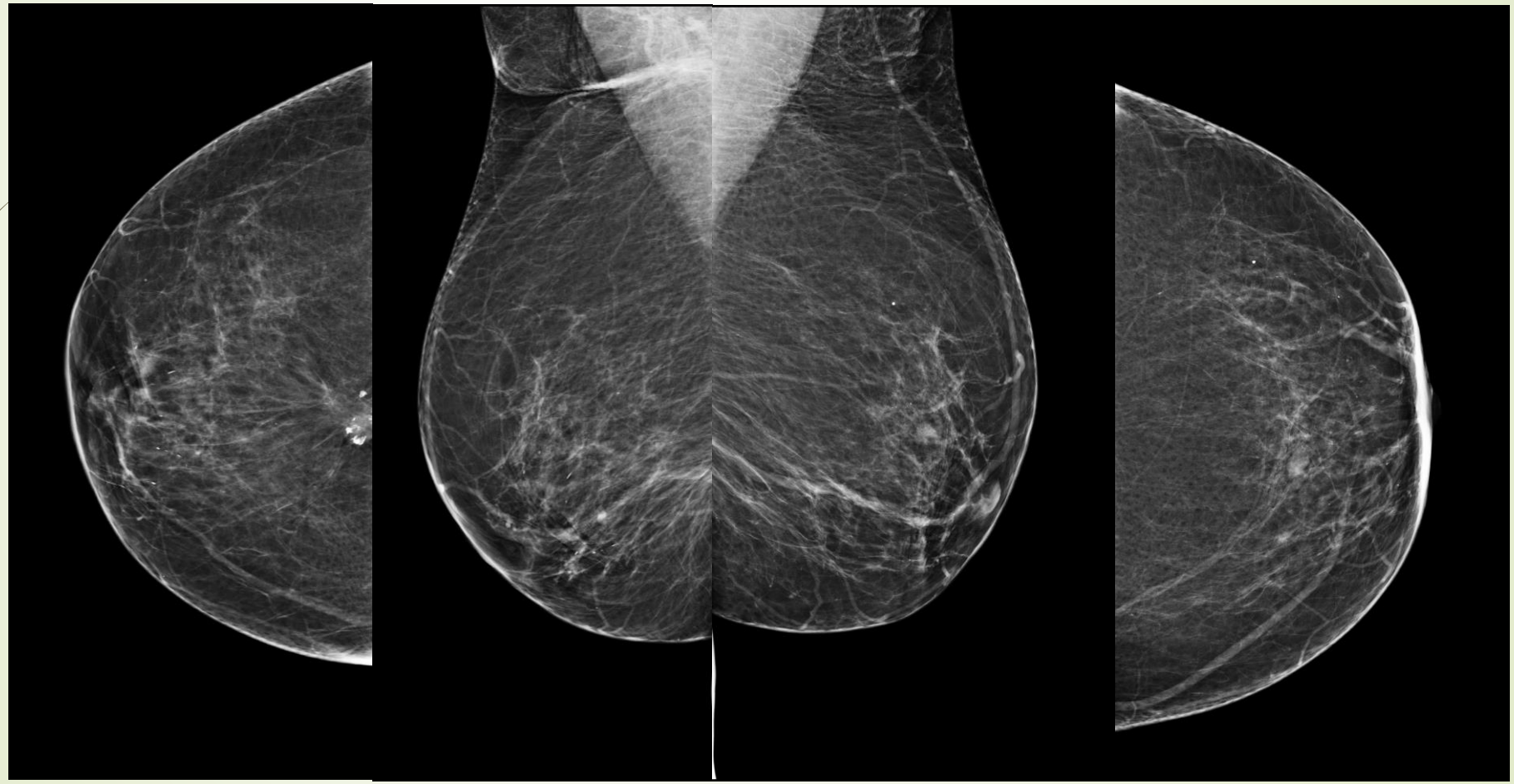




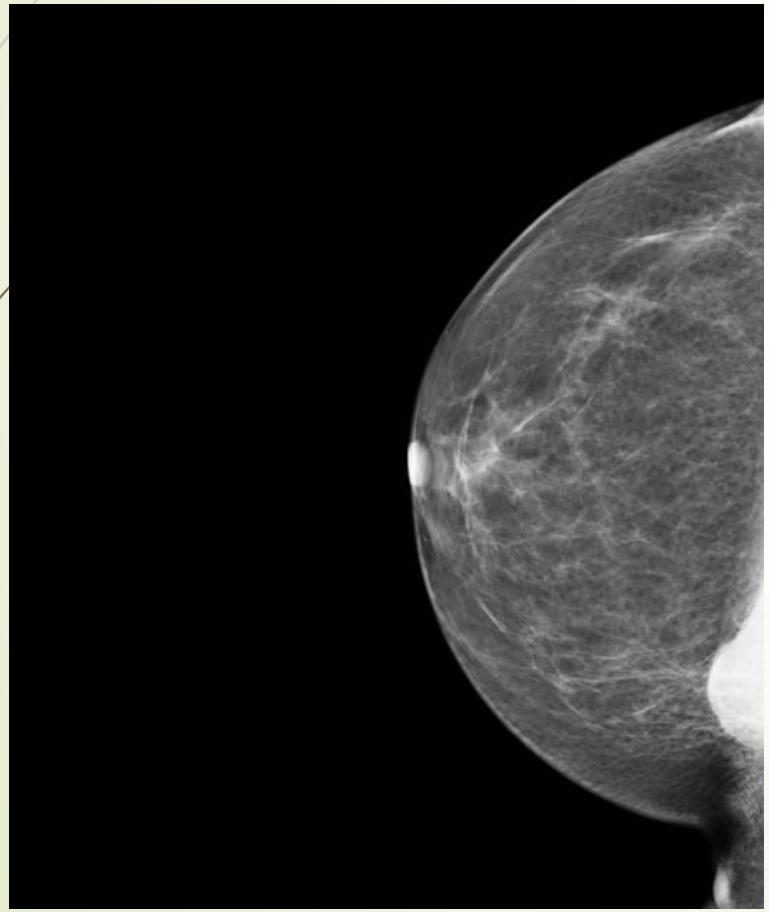
Primjer tvorbe u perifernom dijelu dojke koji je **jedva** prikazana na mamografiji



Primjer karcinoma u perifernom dijelu dojke koji je jedva prikazan samo na jednoj snimci

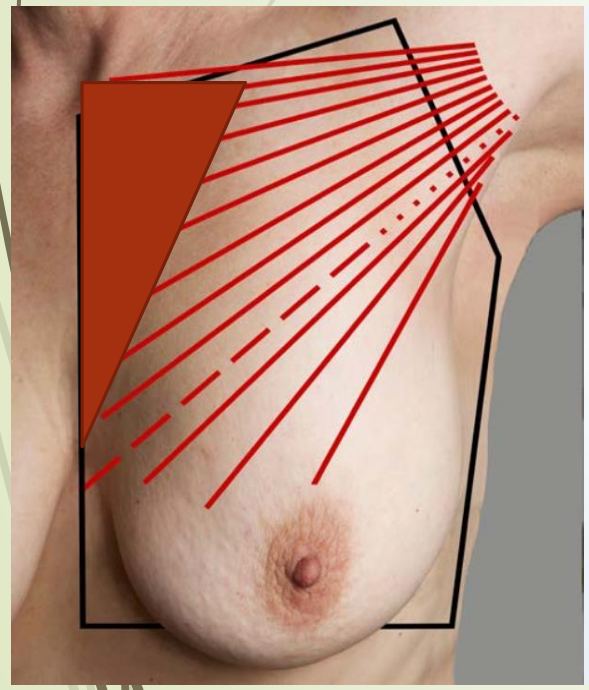


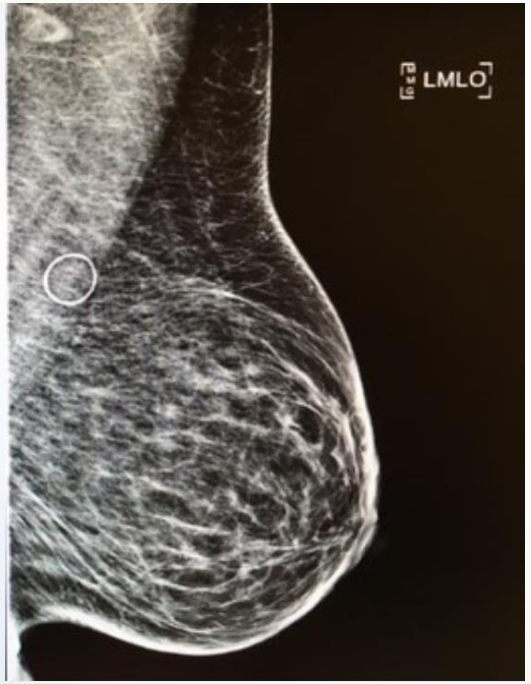
m. sternalis
anatomska varijanta

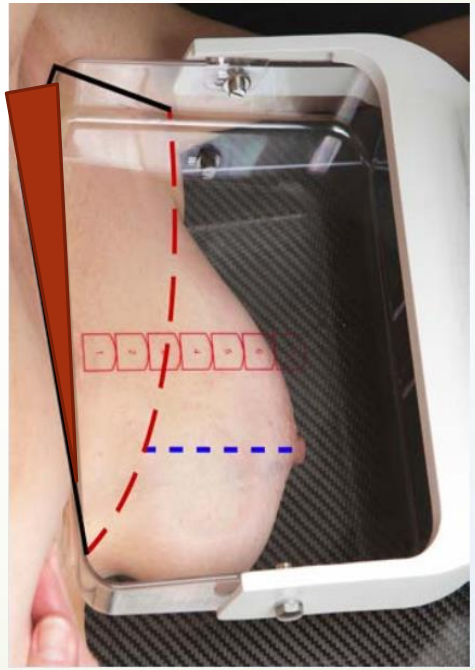


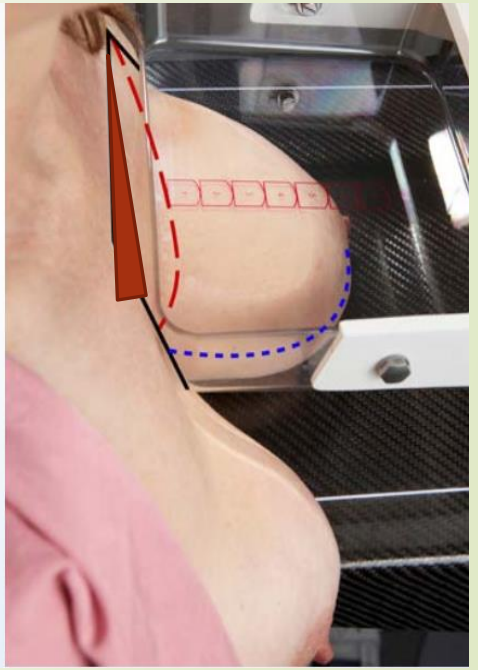
Neki dijelovi dojke su isključeni iz prikaza čak i pri najboljoj tehnici pozicioniranja dojke

- Dijelovi gornjeg medijalnog kvadranta, srećom su lako palpabilni i prikazivi ultrazvukom





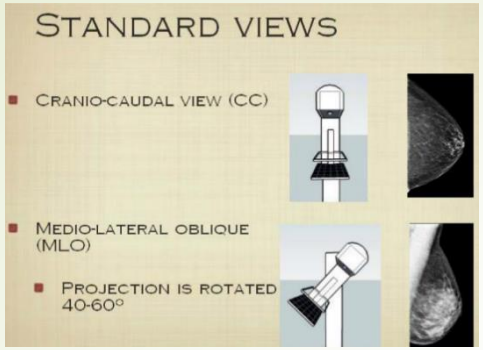


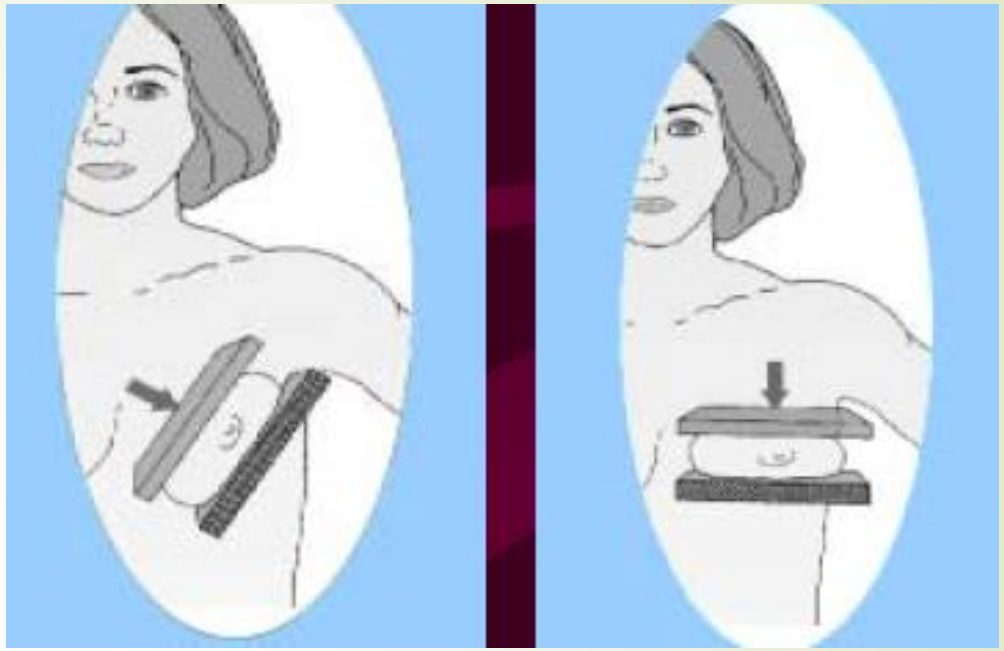


Pektoralni mišić

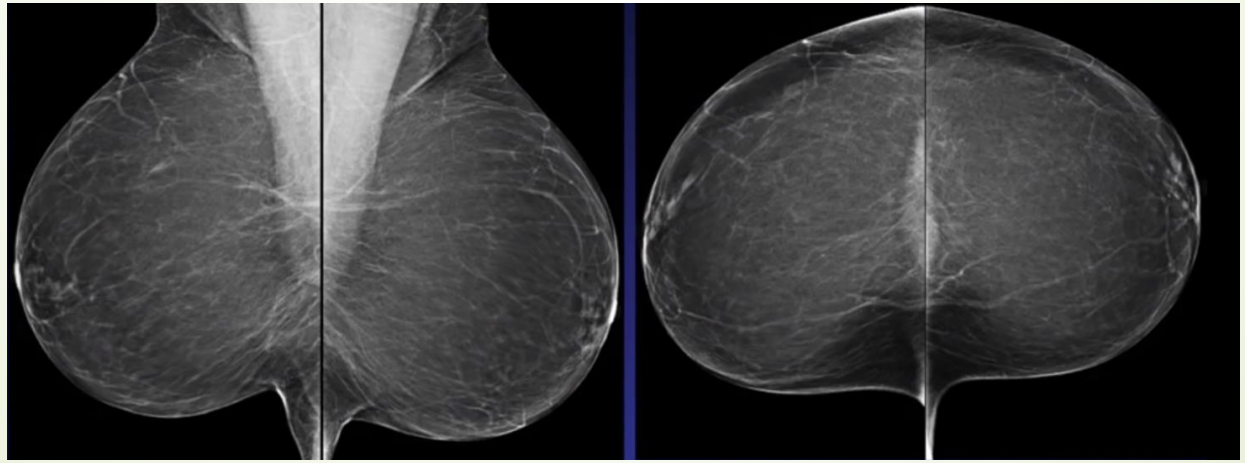
Iako pektoralni mišić uopće nije dio dojke,
njegov dobar prikaz je posredni dokaz
maksimalnog uključenja žljezdanog parenhima na snimci

- Kaudalno najmanje do PNL
  - Dobro uključenje parenhima – nije isključen DMK
  - Dobra kompresija
- Kranijalno u aksili što širi
  - Dobro uključenje parenhima - nije isključen GLK
  - Dobra kompresija, bezbolnost
- Konveksan ili barem ravan
  - Relaksacija, bezbolnost – dobra kompresija a time i transparencija parenhima, raširenost
- Dobro penetriran – ne prekriva parenhim koji se superponira s pektoralisom
  - Dobra ekspozicija i napon, dobra kompresija, adekvatno zacrnjenje





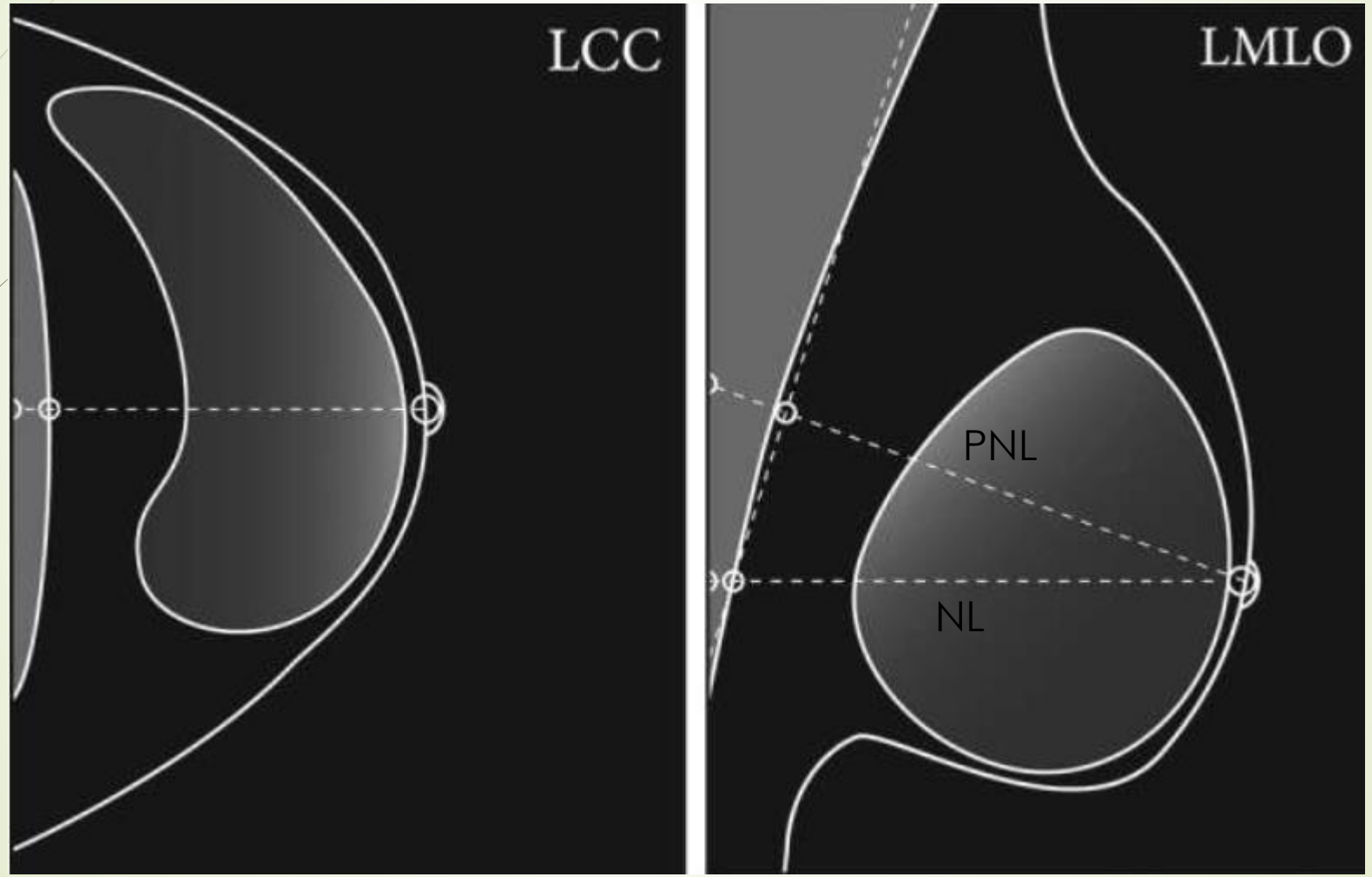
- Mediolateral oblique view (MLO) 40-60°
- Craniocaudal view (CC)



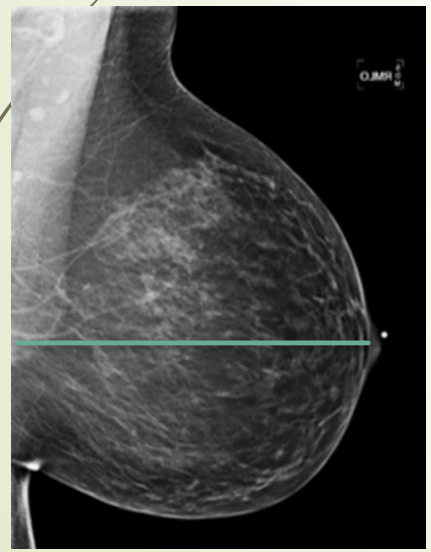
Mamografija – kosa (MLO-) snimka

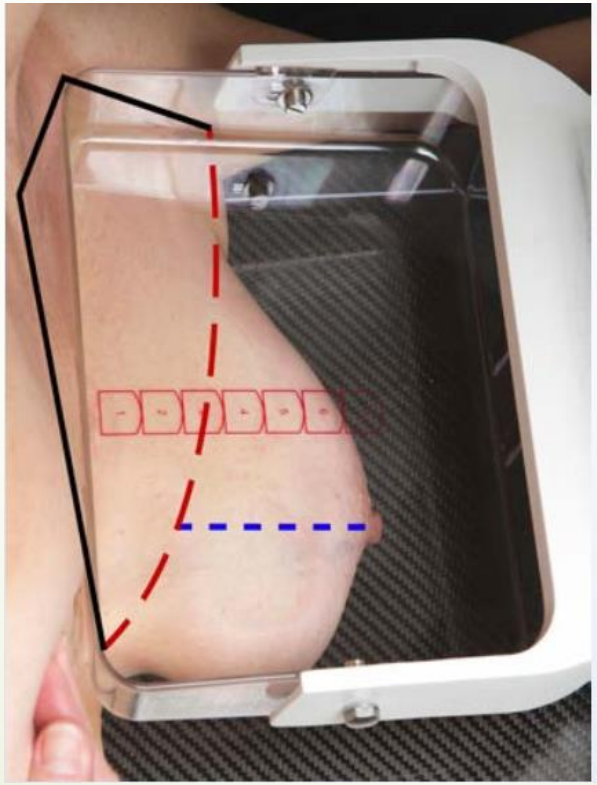
- temeljna je *standardna projekcija* (u skriningu može biti i jedina projekcija) i otkriva najviše karcinoma
- bolje se podnosi od CC-snimke
- *m. pektoralis* mora biti relaksiran unutrašnjom rotacijom humerusa i mobiliziran prema medijalno, ruka pacijentice oslanja se na gornji rub kazete

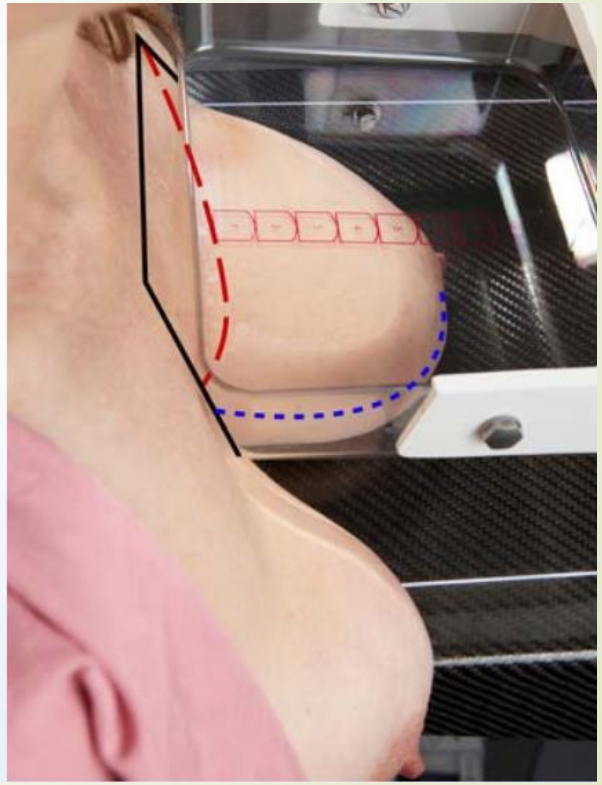
PNL= posterior nipple line, NL= nipple line



- Podignuti dojku kranijalno tako da **PNL bude okomita na stijenku toraksa**







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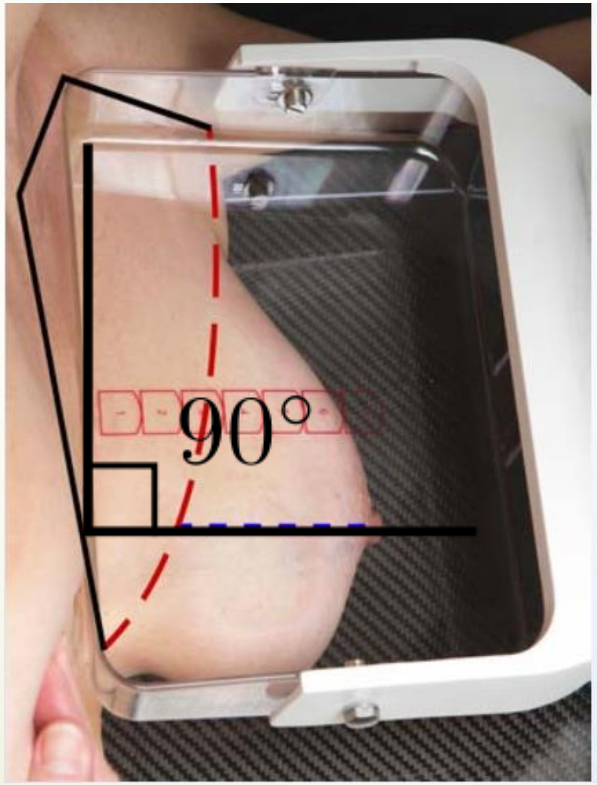
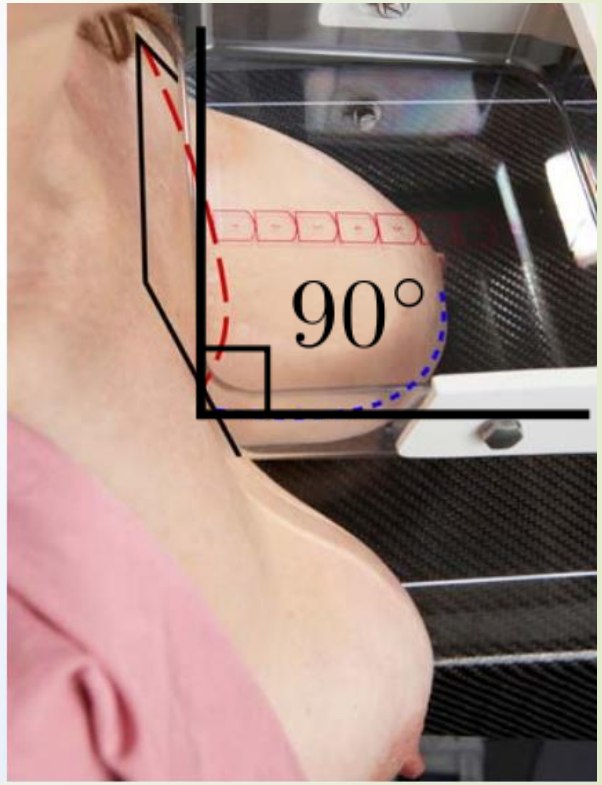
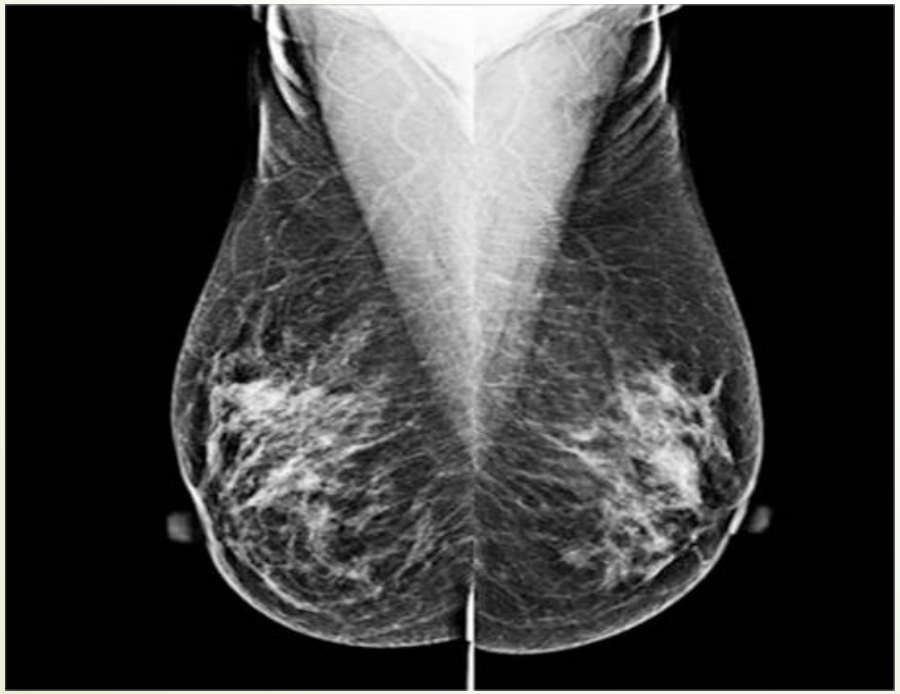


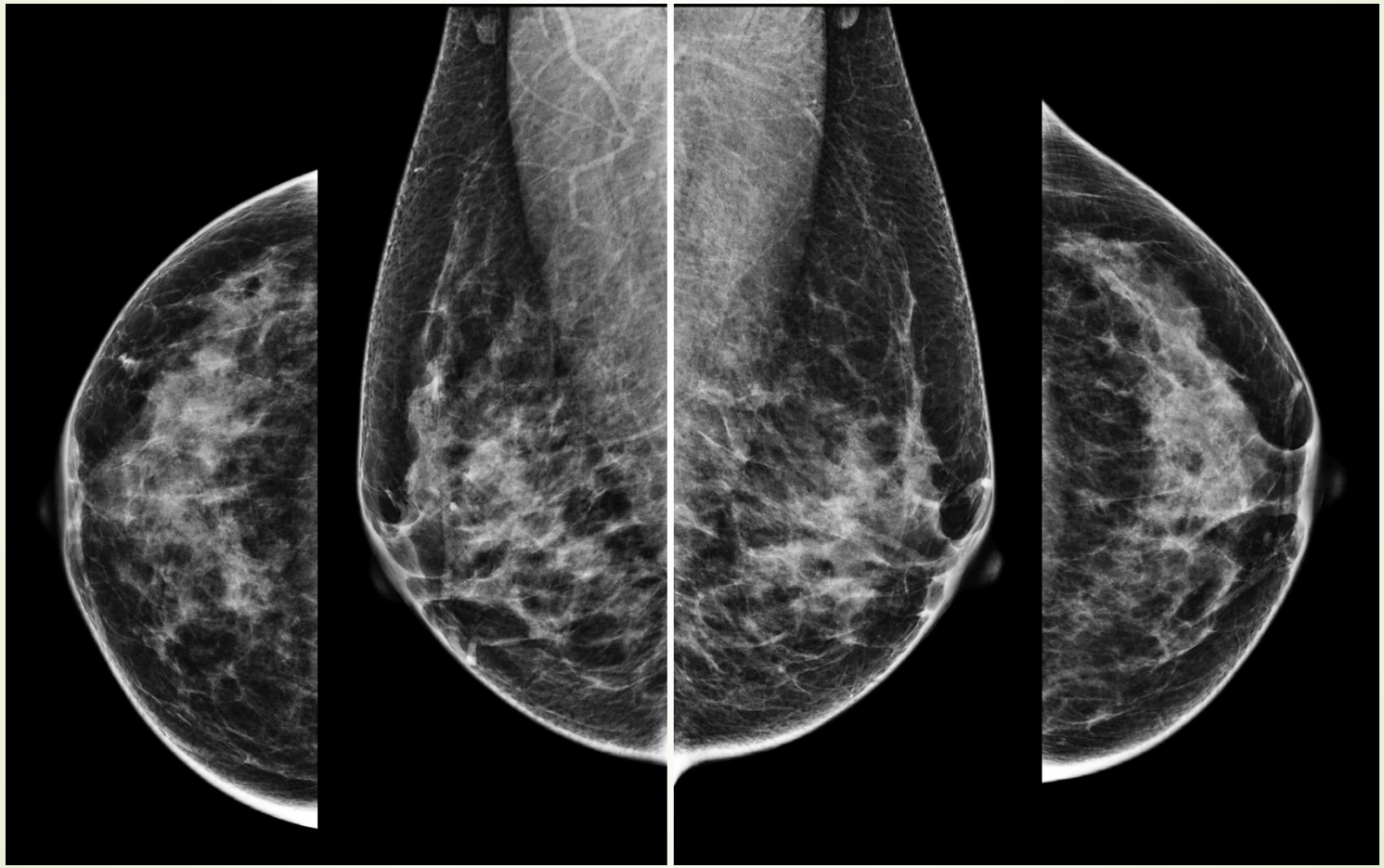


Duljina pektoralisa

- Treba biti najmanje do razine PNL, bolje do NL
- Duljina prikazanog pektoralisa ovisna je od kuta snimanja, koji treba biti oko 50 st.

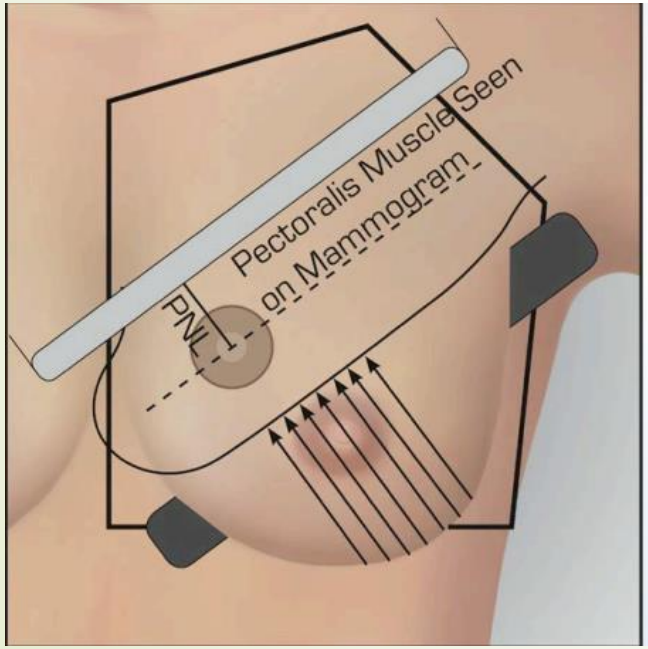


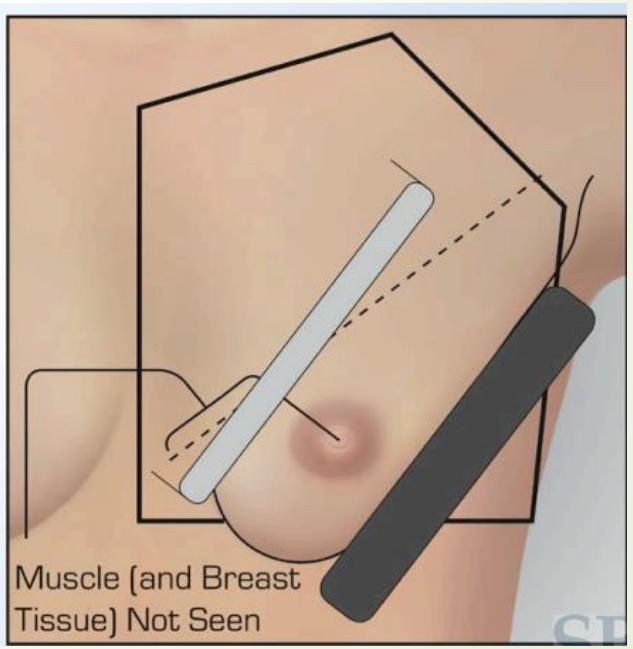
Pektoralis do NL



MLO kut snimanja

- 40-50-60 st. ovisno o tjelesnom habitusu pacijentice
- VAŽNO – suslijedne snimki kroz godine trebaju biti uvijek pod istim kutem





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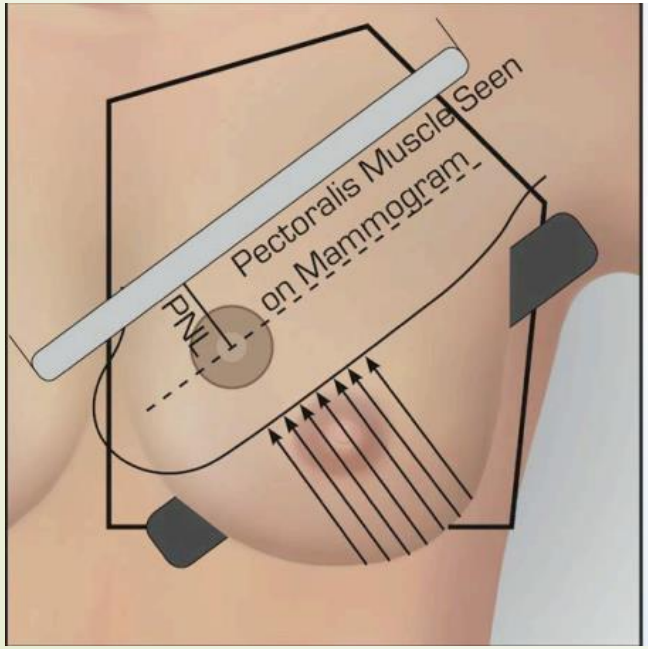
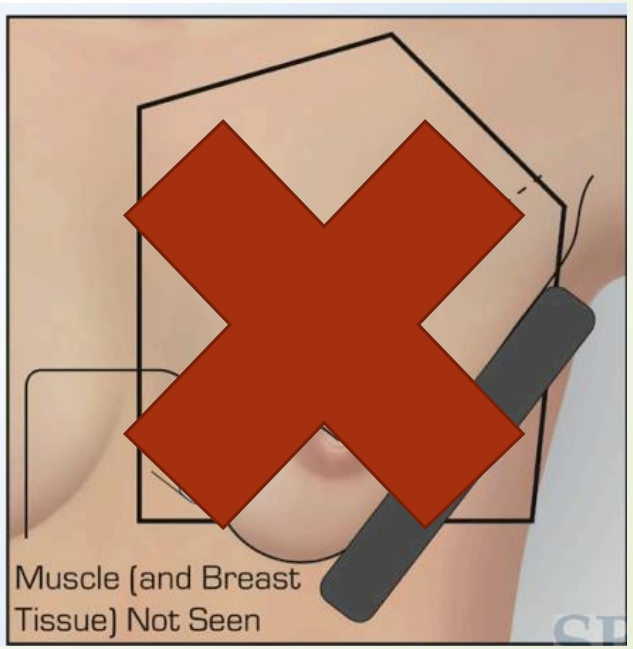
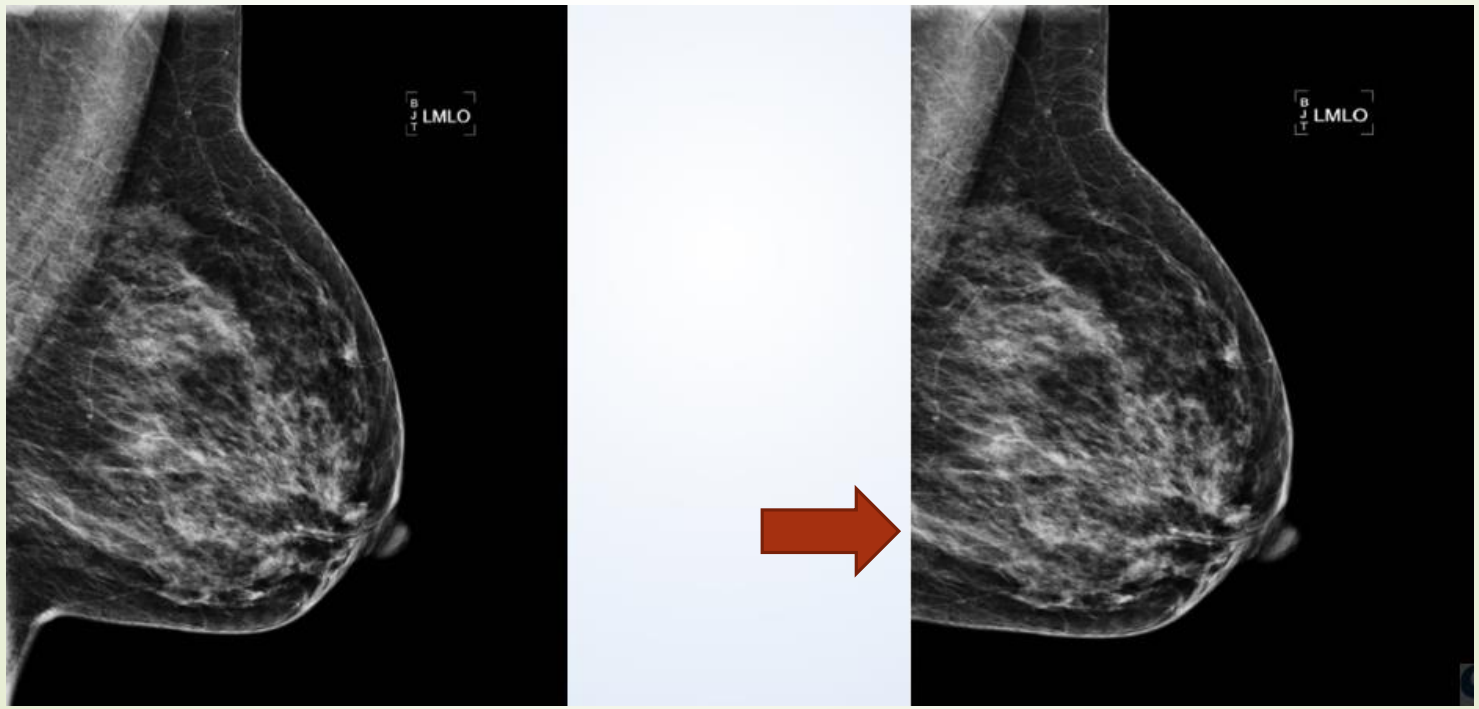




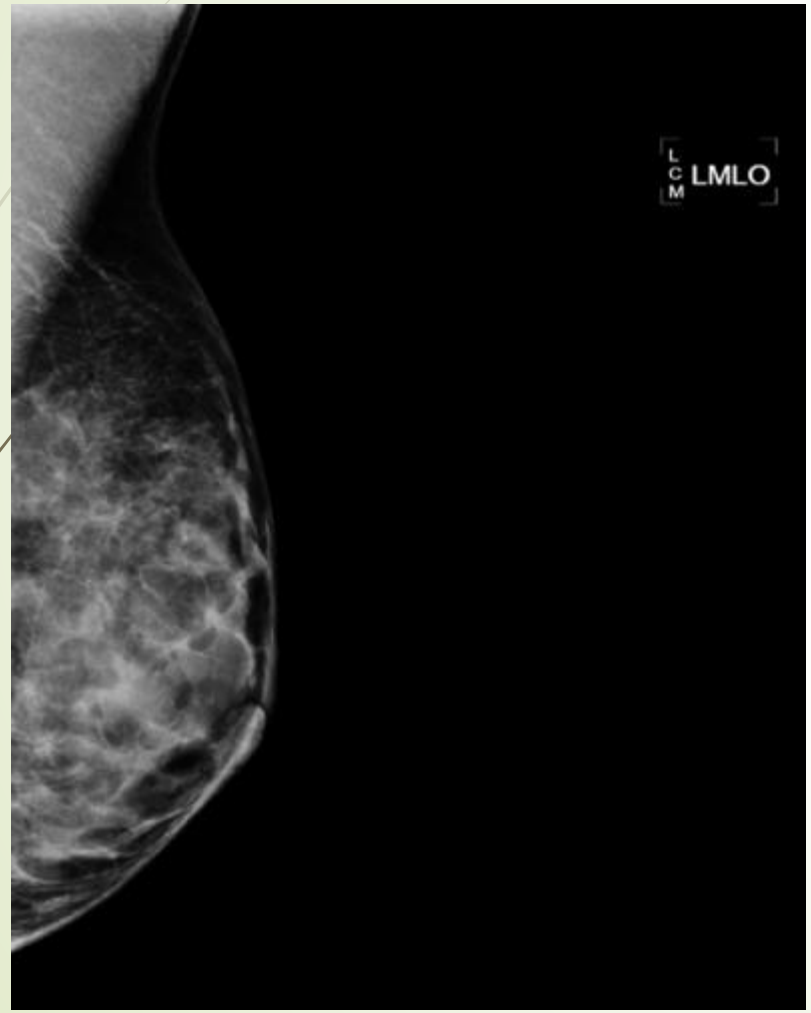
Neprikladan kut snimanja - isključenje dijela parenhima sa snimke

- adekvatan kut snimanja

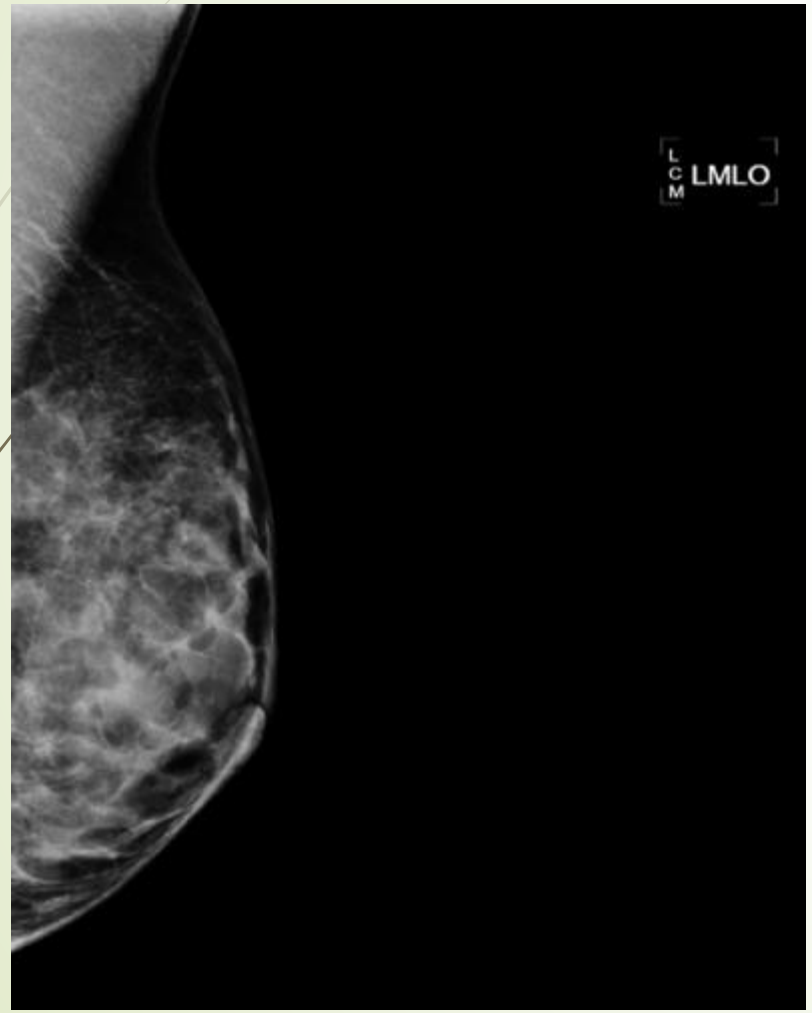
kut je previše uspravan



Kut snimanja ili pacijentica?

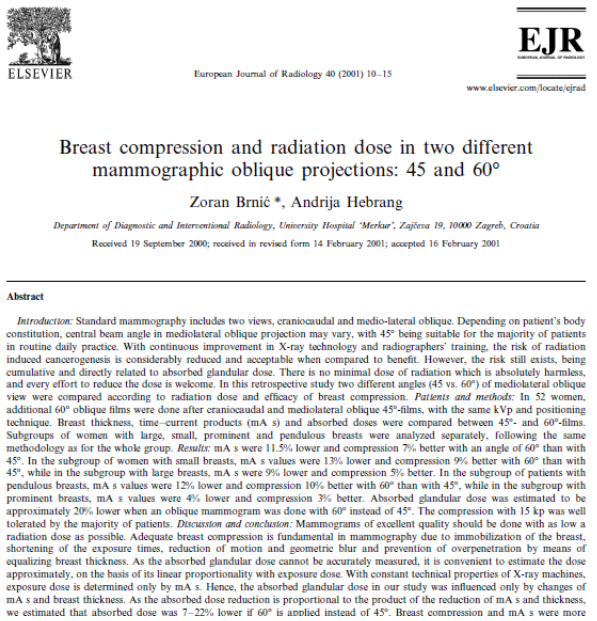


Kut snimanja ili pacijentica?



- sastav dojke: ovdje je dojka vrlo gusta parenhimska – bolna?
- pektoralis je slabo uključen i nije relaksiran

AGD MLO 60 vs. 45



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Breast compression and radiation dose in two different mammographic oblique projections: 45 and 60°

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Abstract

Introduction: Standard mammography includes two views, craniocaudal and medio-lateral oblique. Depending on patient's body constitution, central beam angle in mediolateral oblique projection may vary, with 45° being suitable for the majority of patients in routine daily practice. With continuous improvement in X-ray technology and radiographers' training, the risk of radiation induced cancerogenesis is considerably reduced and acceptable when compared to benefit. However, the risk still exists, being cumulative and directly related to absorbed glandular dose. There is no minimal dose of radiation which is absolutely harmless, and every effort to reduce the dose is welcome. In this retrospective study two different angles (45 vs. 60°) of mediolateral oblique view were compared according to radiation dose and efficacy of breast compression. *Patients and methods:* In 52 women, additional 60° oblique films were done after craniocaudal and mediolateral oblique 45°-films, with the same kVp and positioning technique. Breast thickness, time–current products (mA s) and absorbed doses were compared between 45°- and 60°-films. Subgroups of women with large, small, prominent and pendulous breasts were analyzed separately, following the same methodology as for the whole group. *Results:* mA s were 11.5% lower and compression 7% better with an angle of 60° than with 45°. In the subgroup of women with small breasts, mA s values were 13% lower and compression 9% better with 60° than with 45°, while in the subgroup with large breasts, mA s were 9% lower and compression 5% better. In the subgroup of patients with pendulous breasts, mA s values were 12% lower and compression 10% better with 60° than with 45°, while in the subgroup with prominent breasts, mA s values were 4% lower and compression 3% better. Absorbed glandular dose was estimated to be approximately 20% lower when an oblique mammogram was done with 60° instead of 45°. The compression with 15 kp was well tolerated by the majority of patients. *Discussion and conclusion:* Mammograms of excellent quality should be done with as low a radiation dose as possible. Adequate breast compression is fundamental in mammography due to immobilization of the breast, shortening of the exposure times, reduction of motion and geometric blur and prevention of overpenetration by means of equalizing breast thickness. As the absorbed glandular dose cannot be accurately measured, it is convenient to estimate the dose approximately, on the basis of its linear proportionality with exposure dose. With constant technical properties of X-ray machines, exposure dose is determined only by mA s. Hence, the absorbed glandular dose in our study was influenced only by changes of mA s and breast thickness. As the absorbed dose reduction is proportional to the product of the reduction of mA s and thickness, we estimated that absorbed dose was 7–22% lower if 60° is applied instead of 45°. Breast compression and mA s were more

- 7-22% lower AGD with 60 deg. instead of 45 deg.
- Fibroglandular tissue in the 60 degrees-view is projected onto a larger film area, with less effect of superimposition
- MLO 60 especially advisable for smaller and pendulous breasts because of
  - lower MGD
  - better compression
  - better image quality compared to MLO 45

Diagn Interv Radiol 2007; 13:134–139

BREAST IMAGING

ORIGINAL ARTICLE

Clinical evaluation of breast dose and the factors affecting breast dose in screen-film mammography

Ayşegül Özdemir

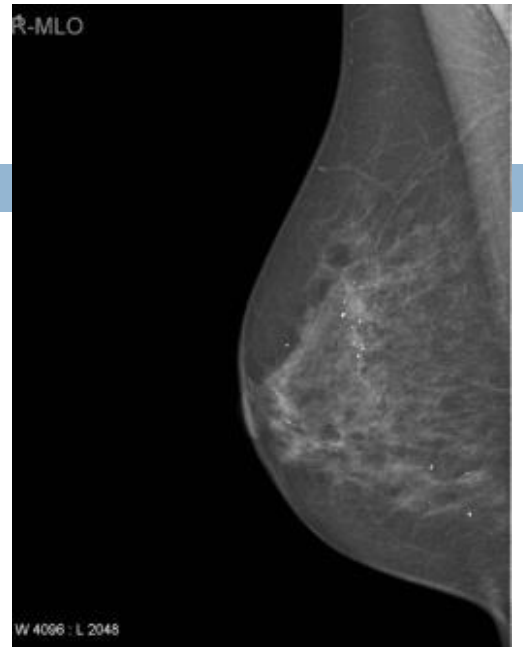
Table 4. Comparisons of breast thickness, mAs, and mean glandular dose (MGD) obtained in craniocaudal (CC) and 45° mediolateral oblique (MLO) imaging projections. Values are mean ± standard deviation (SD).

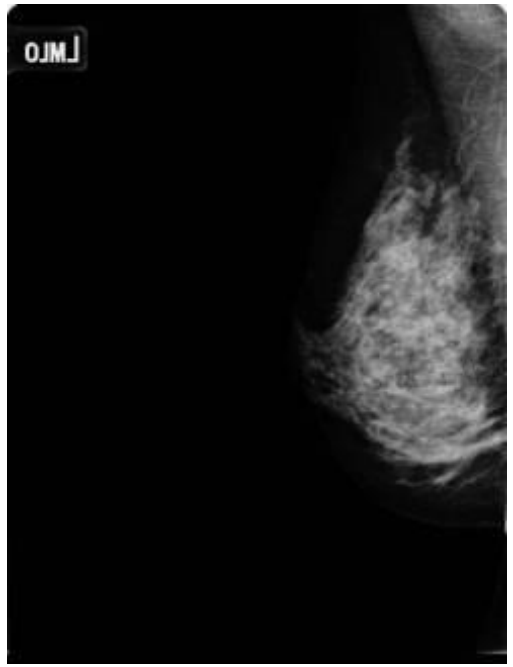
Projection	n[a]	Thickness (mm)	mAs	MGD (mGy)
CC	37	56.2 ± 4.4	55.3 ± 15.0	1.0 ± 0.2
45° MLO	62	64.2 ± 7.5	87.7 ± 27.2	1.4 ± 0.4
P[b]		<0.05	<0.05	<0.05

[a]Study group: large breasts and Kodak 2000 film/Kodak 2190 screen combination.
[b]Significance *P* value of Student's t test.

Table 5. Comparisons of breast thickness, mAs, and mean glandular dose (MGD) obtained in 45° and 60° mediolateral oblique (MLO) projections. Values are mean ± standard deviation (SD).

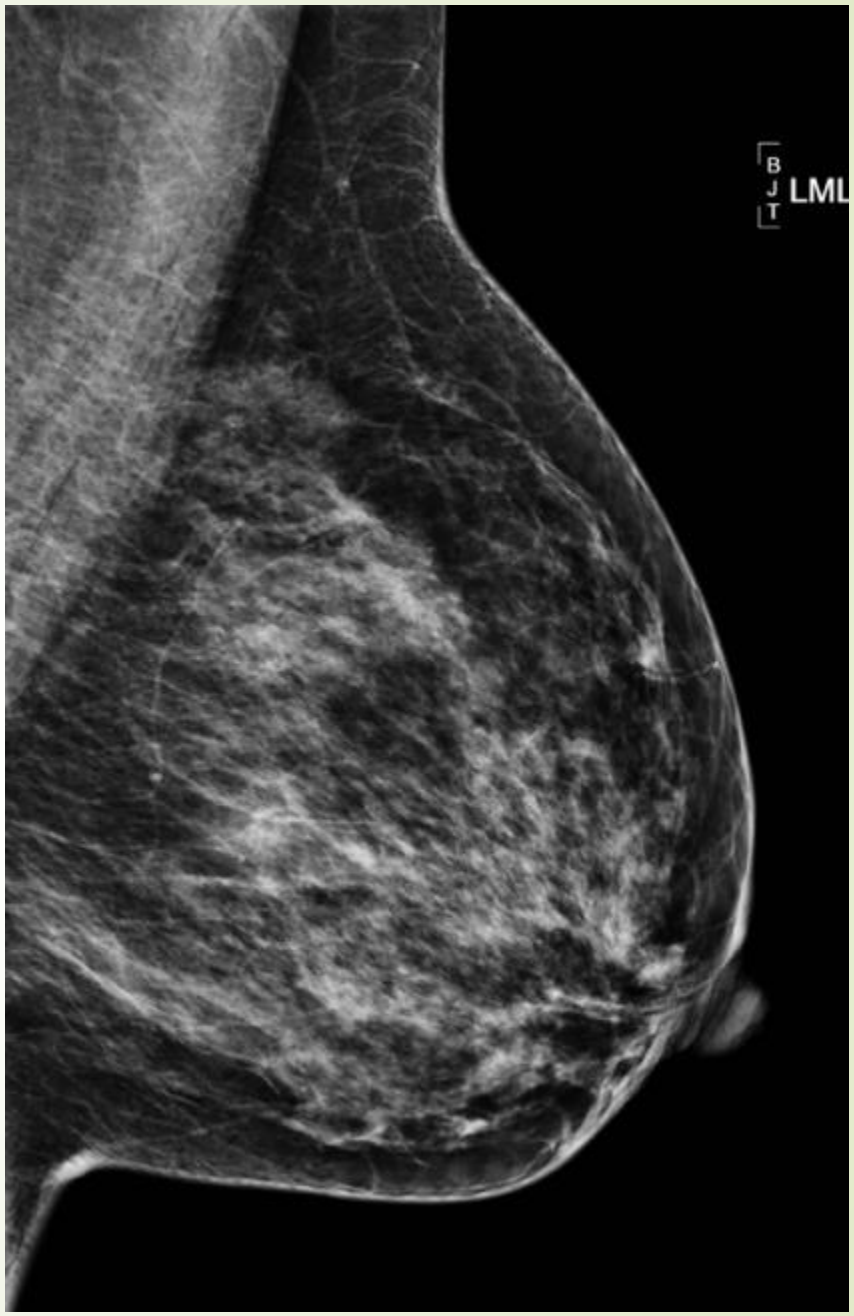
MLO angle	n[a]	Thickness (mm)	mAs	MGD (mGy)
45°	42	64.2 ± 10.7	79.1 ± 25.6	1.3 ± 0.3
60°	42	62.2 ± 9.9	71.8 ± 21.3	1.2 ± 0.3
P[b]		<0.05	<0.05	< 0.05



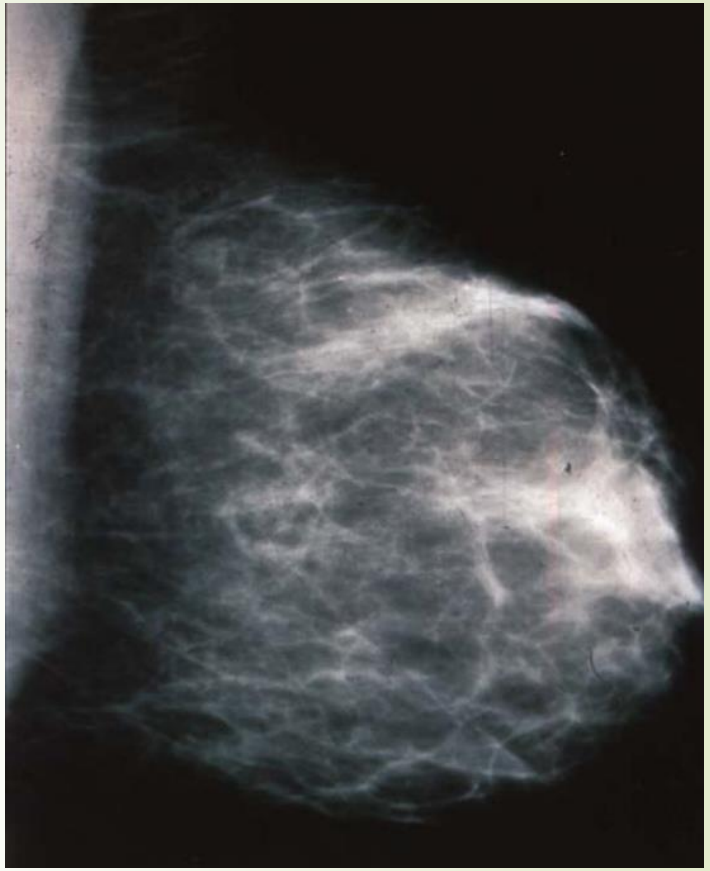


Širina pektoralisa

- Što širi, to bolji
- Širina ovisi o mogućnosti smještaja receptora slike u aksili



Što ovdje nije dobro?



Što ovdje nije dobro?

- Razlozi?
- Pacijentica ima velike dojke
- …prevelike za ovu veličinu receptora
- Rad. tehnolog je trebao uporabiti veći format receptora slike

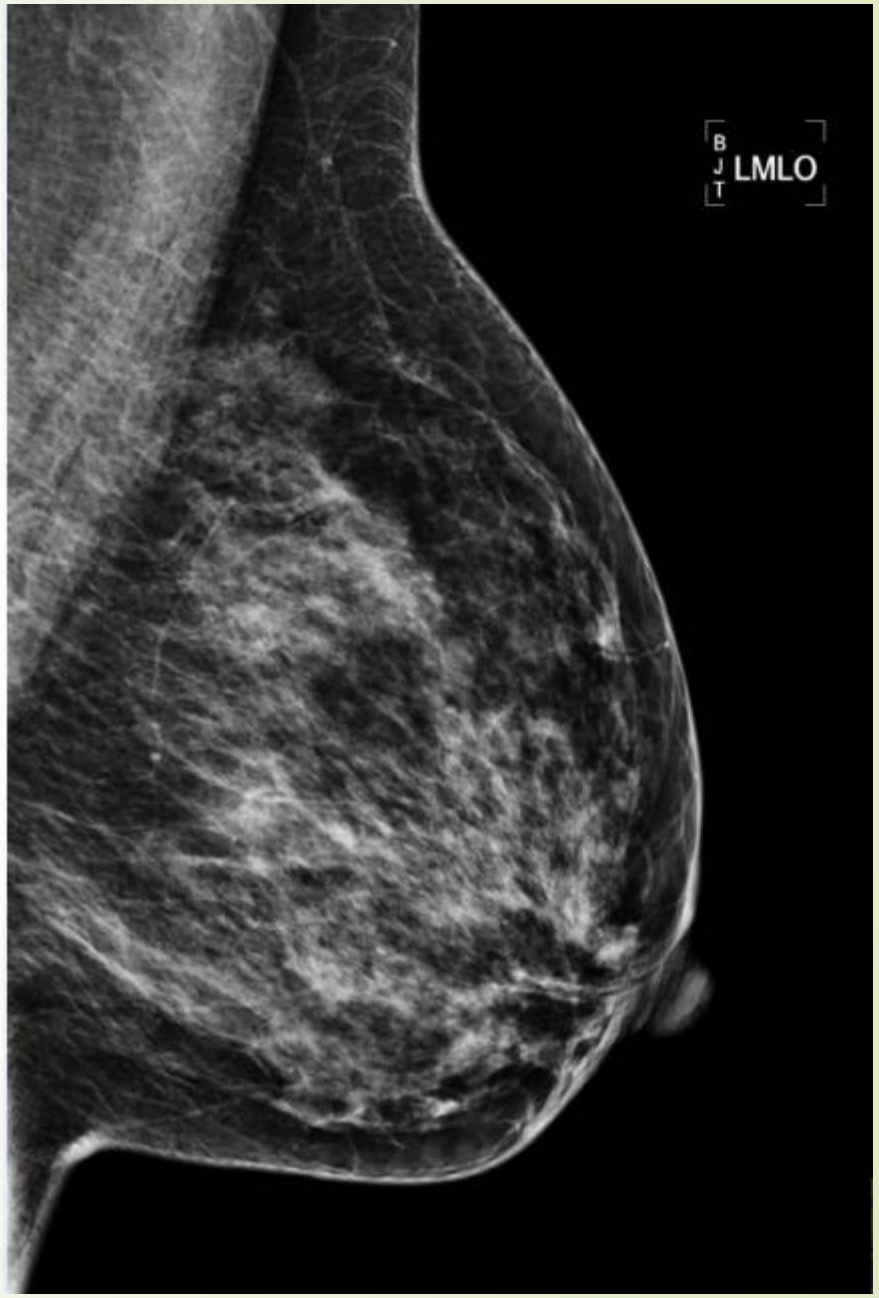
Što ovdje ne valja?

Što ovdje ne valja?

- Tko je „kriv”, pacijent ili tehnolog?
- Kriv je tehnolog, jer nije dobro centrirao dojku na velikom formatu snimke, dolje ima slobodnog prostora a gore je odrezan dio aksilarnog nabora i pektoralis nema dovoljnu širinu prikaza

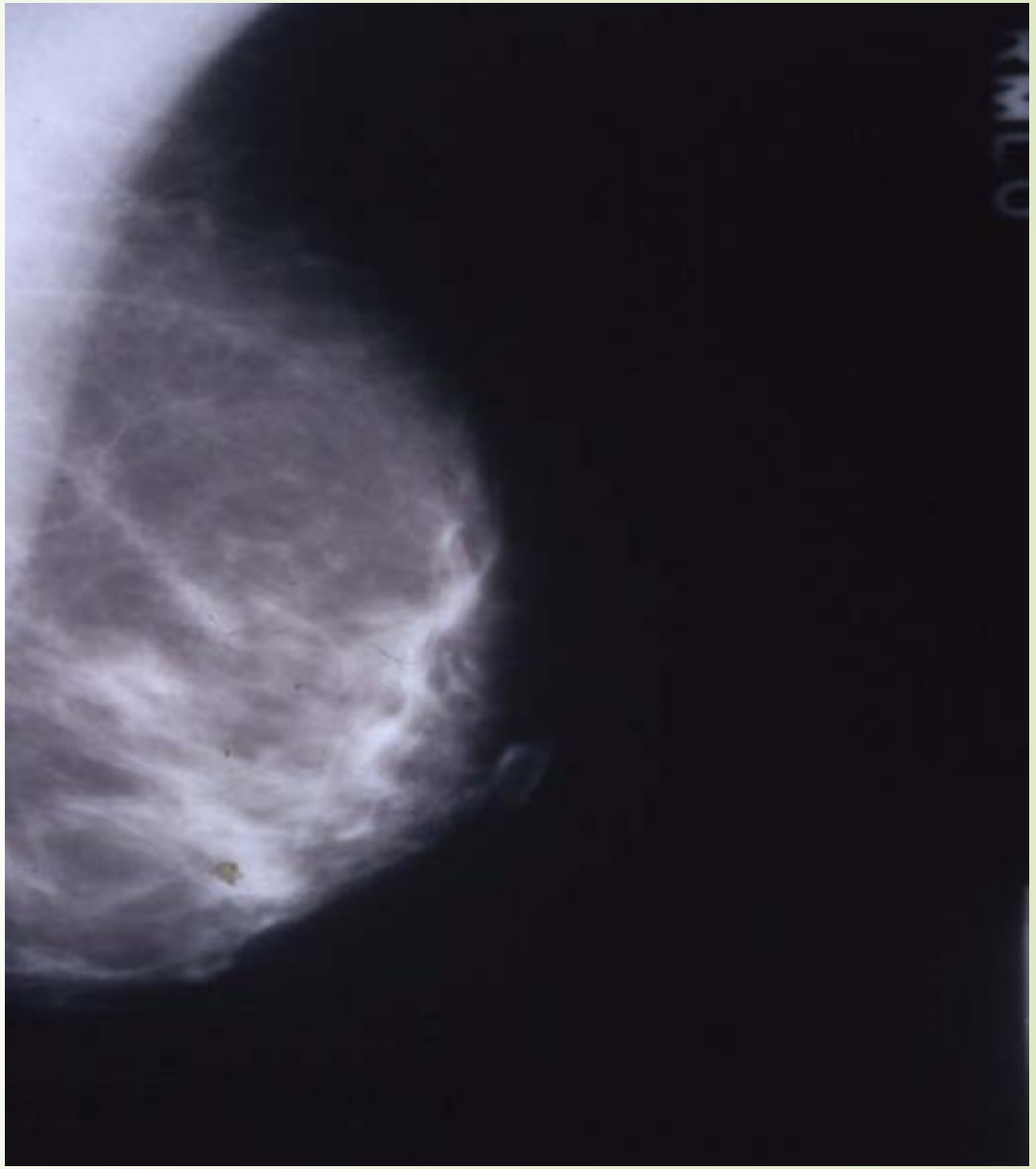
Kontura pektoralisa
Transparencija pektoralisa

- Treba biti **konveksna ili barem ravna**
- Nerelaksirani mišići ramena i ruke – konkavan obris pektoralisa i isključenje dijela parenhima sa snimke



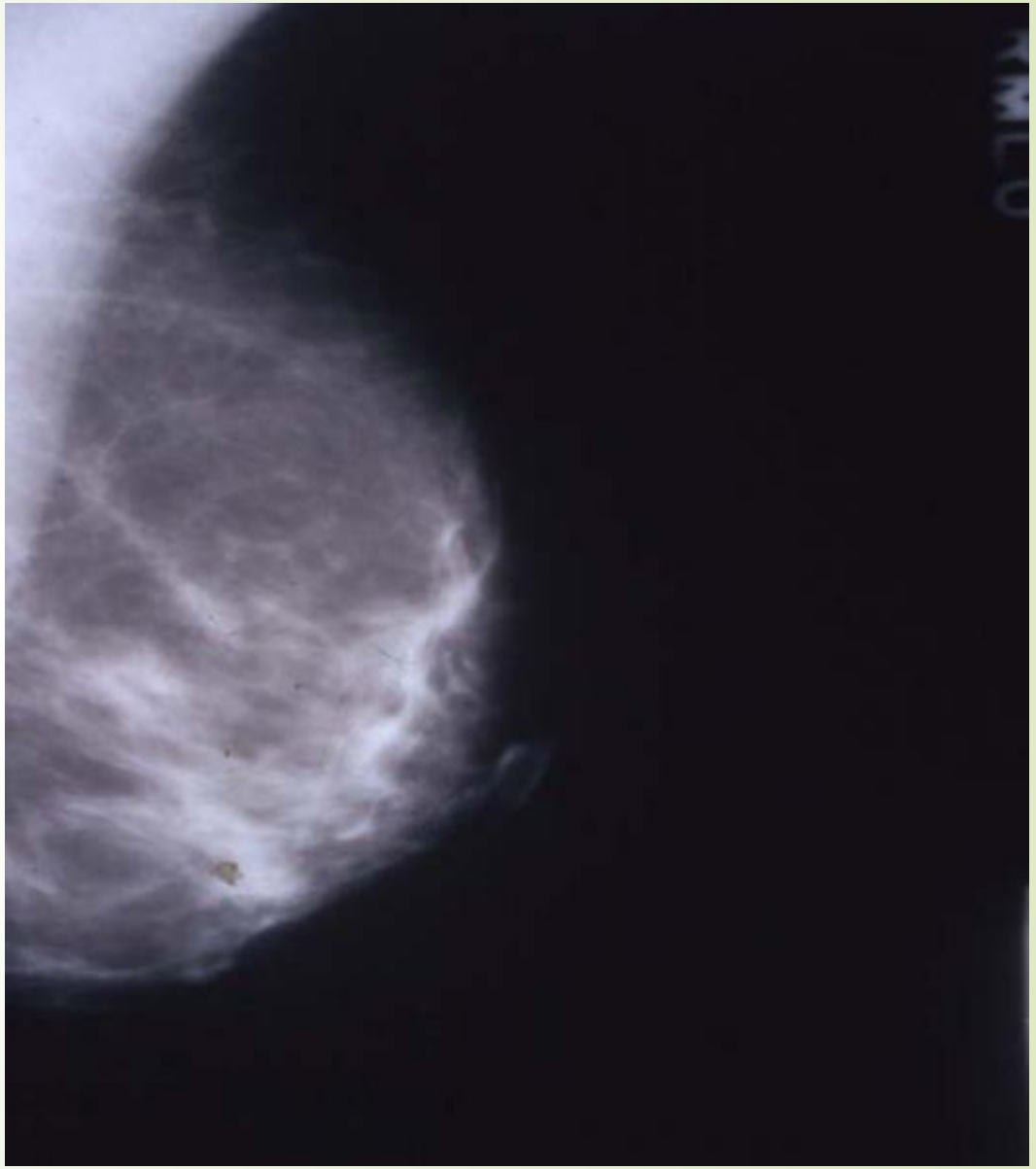
Što ovdje ne valja?

- Nerelaksiran pektoralis
- Netransparentan pektoralis
- Nema intramamarnog nabora
- …

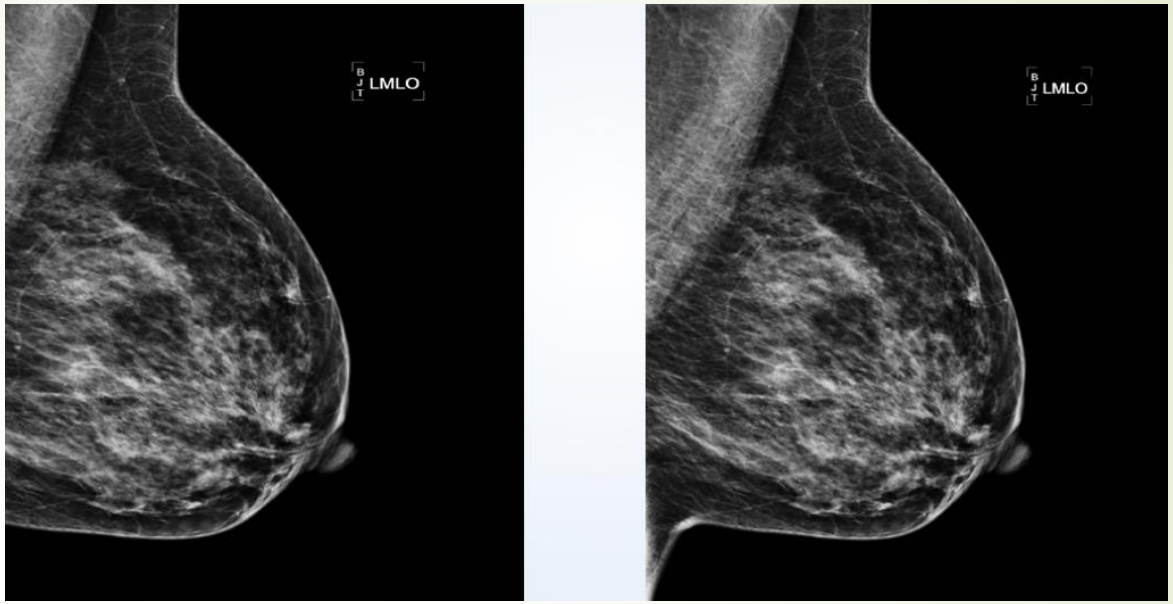


Što ovdje ne valja?

- Konkavan pektoralis
- Netransparentan pektoralis
- Nema intramamarnog nabora
- …relaksacija ruke i ramena



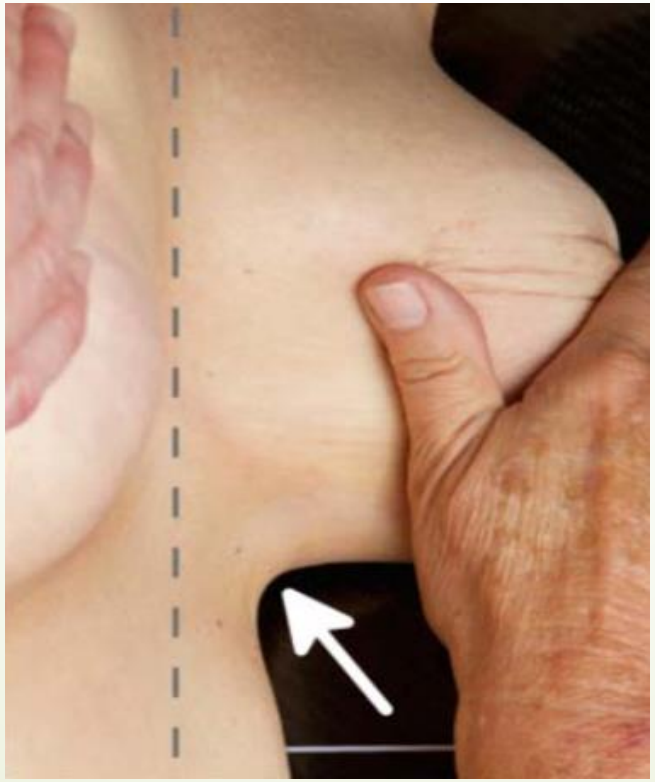
Prikaz inframamarnog nabora



- Receptor slike kod **novih FFDM i DBT uređaja** ima veće dimenzije nego konvencionalni Bucky za SFM, pa je njegovo smještanje u aksilarnom području otežano
- tehniku pozicioniranja moramo prilagođavati tehnološkom dizajnu uređaja

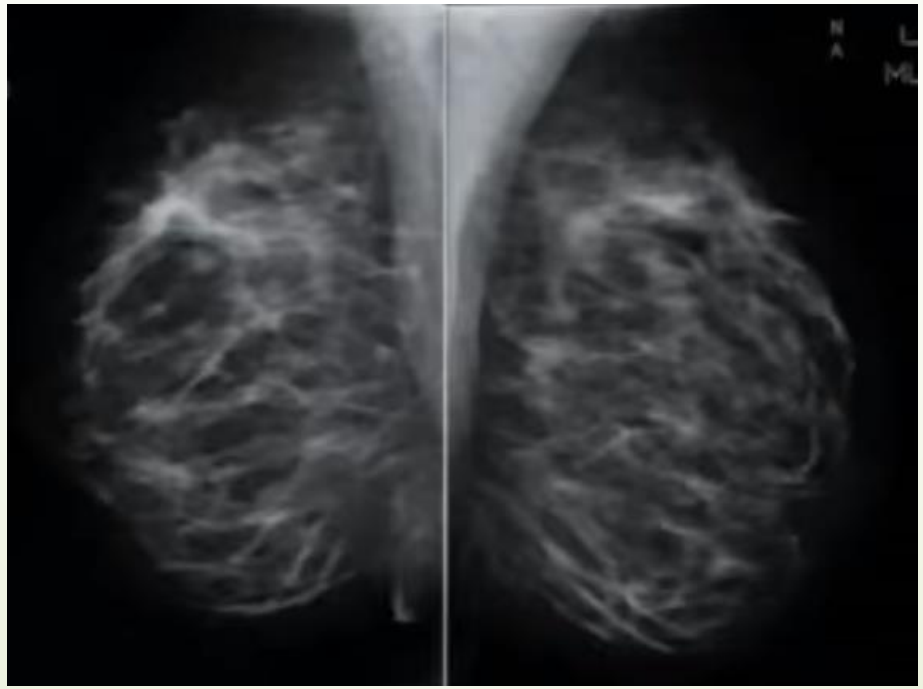
Prikaz inframamarnog nabora

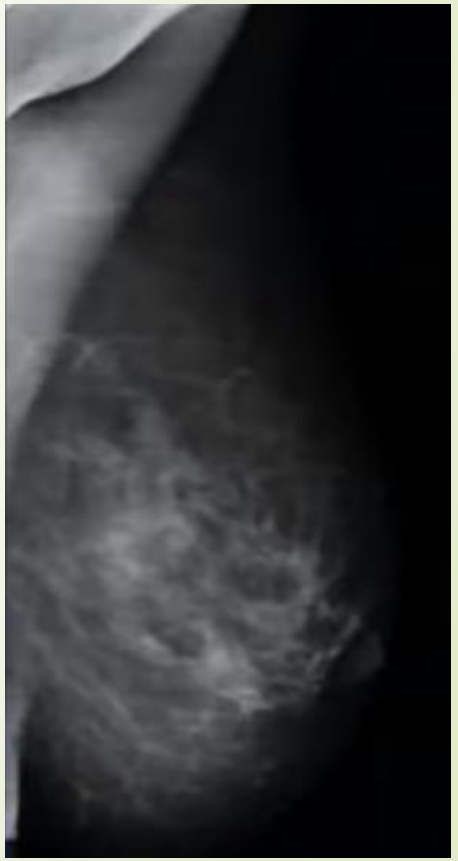
- Ključna je pozicija **prednjeg donjeg** kuta receptora slike, koji mora biti ***kaudalnije od razine mamile, na pola puta do pupka pacijentice***
- **Rub receptora slike** treba biti ***dorzalnije od inframamarnog nabora***



M. latissimus dorsi

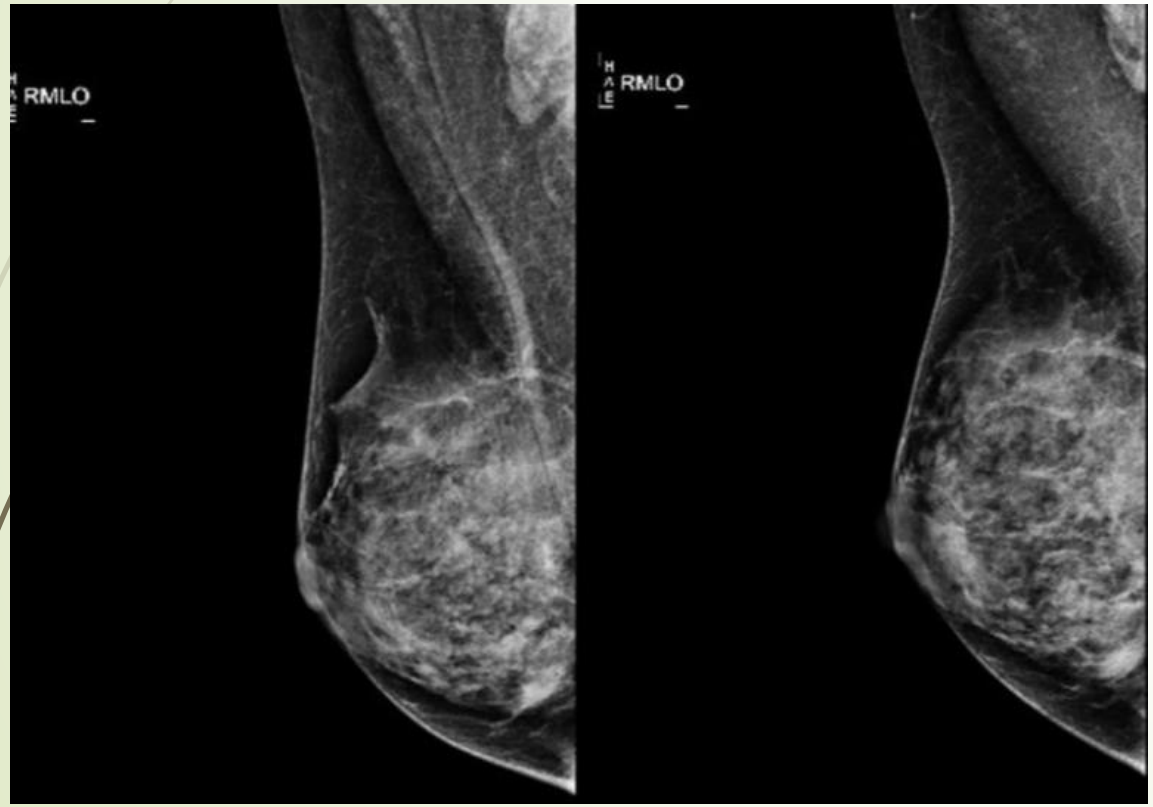
- Zahvaćenost latissimusa na slici sprječava adekvatnu kompresiju dojke
- Dojka je slabo komprimirana a tkivo nije dobro separirano
- IMF sa zračnim gapom
- Mamila nije u profilu





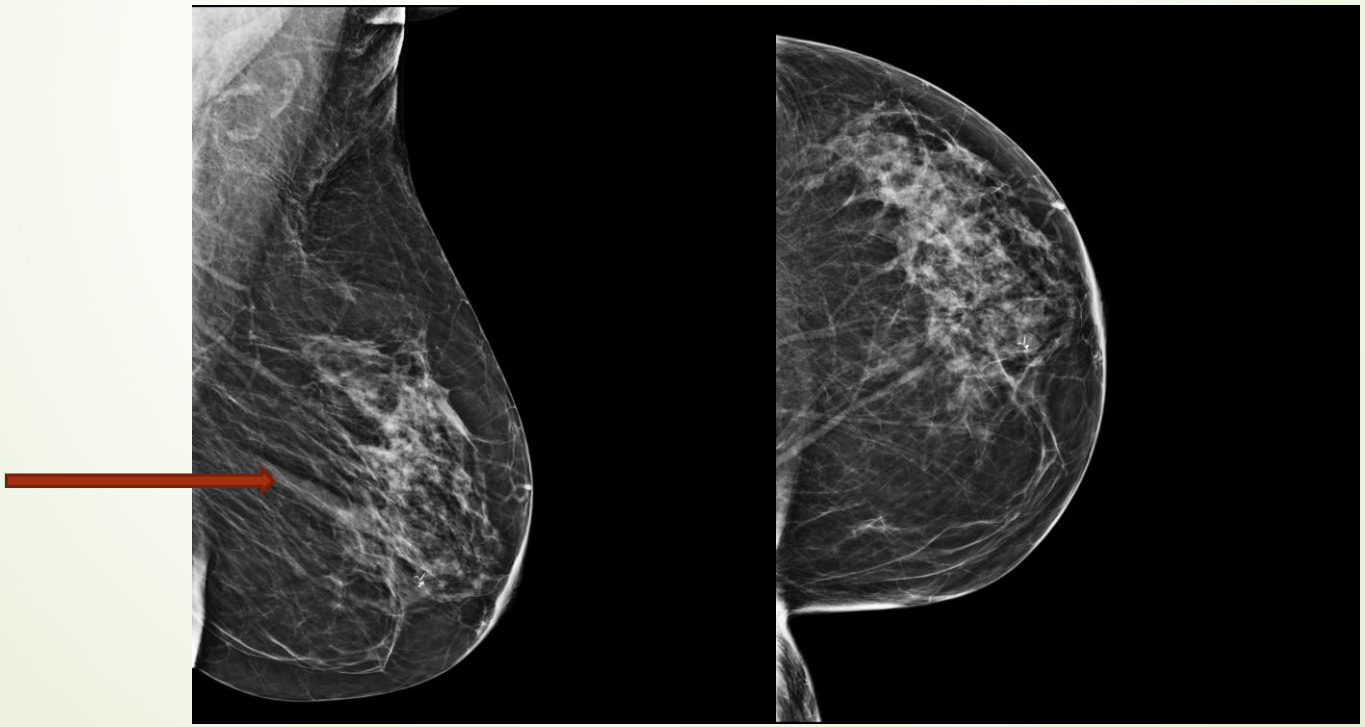
Nabori kože

- u aksili nisu problem, ali ako prekrivaju parenhim, treba iz izbjeći



Nabori kože

- Prepoznaju se po transparenciji uz nabor



Nabori kože

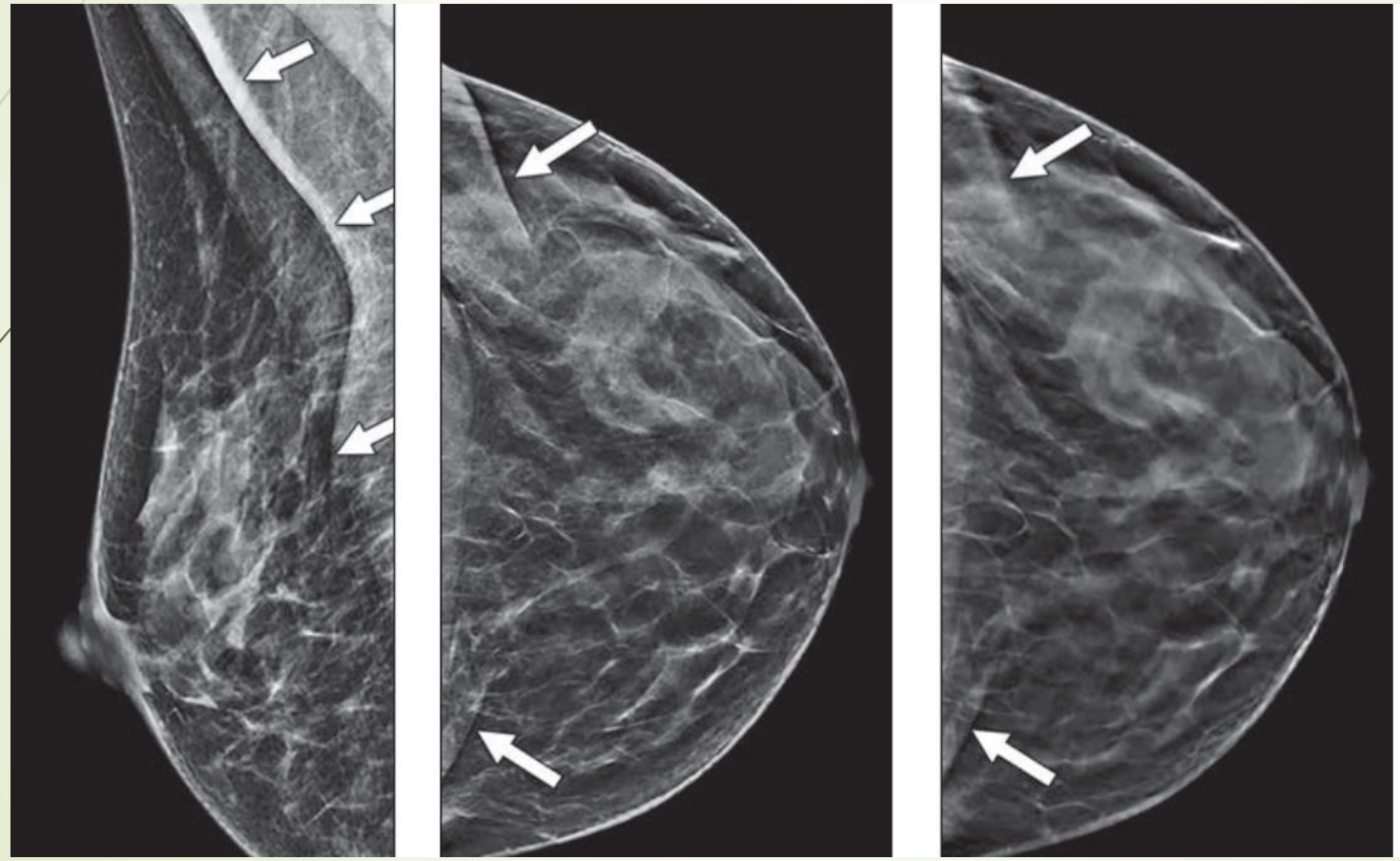
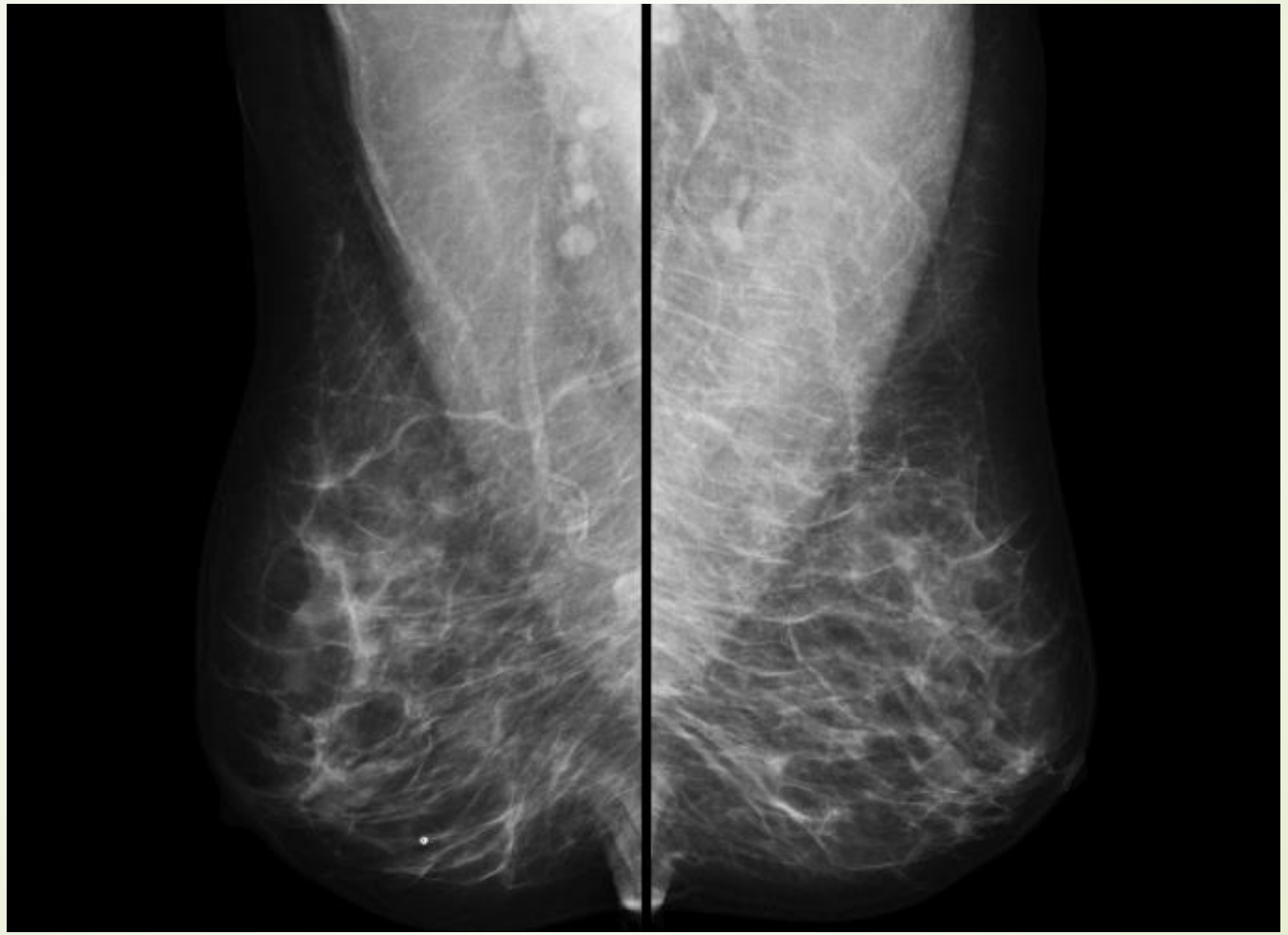
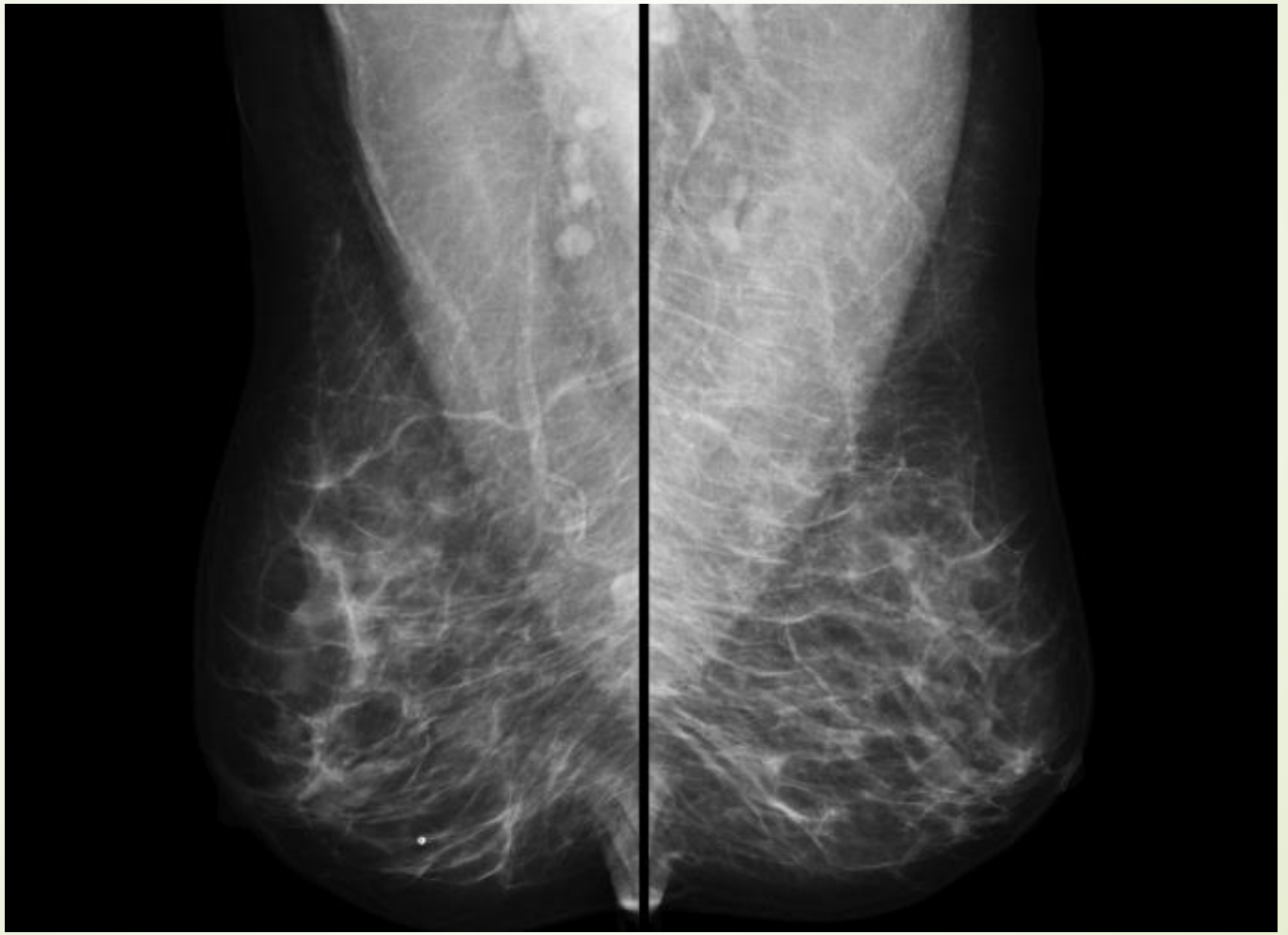


Fig. 4—Examples of skin folds included in digital breast tomosynthesis (DBT) images of 48-year-old woman. Some positioning criteria were noted to be more subjective in nature, including skin folds. However, skin folds were often seen most in areas where only fatty tissue was present. Additionally, skin folds would be detected on only first and last few slices of DBT examinations and thus would be unlikely to interfere with examination interpretation.
A, Example of skin fold (*arrows*) on edge of DBT image that does not significantly compromise evaluation of fibroglandular tissue.
B, Synthesized 2D mammography image from DBT examination shows skin folds (*arrows*).

Simetrični „zrcalni” prikaz obje dojke

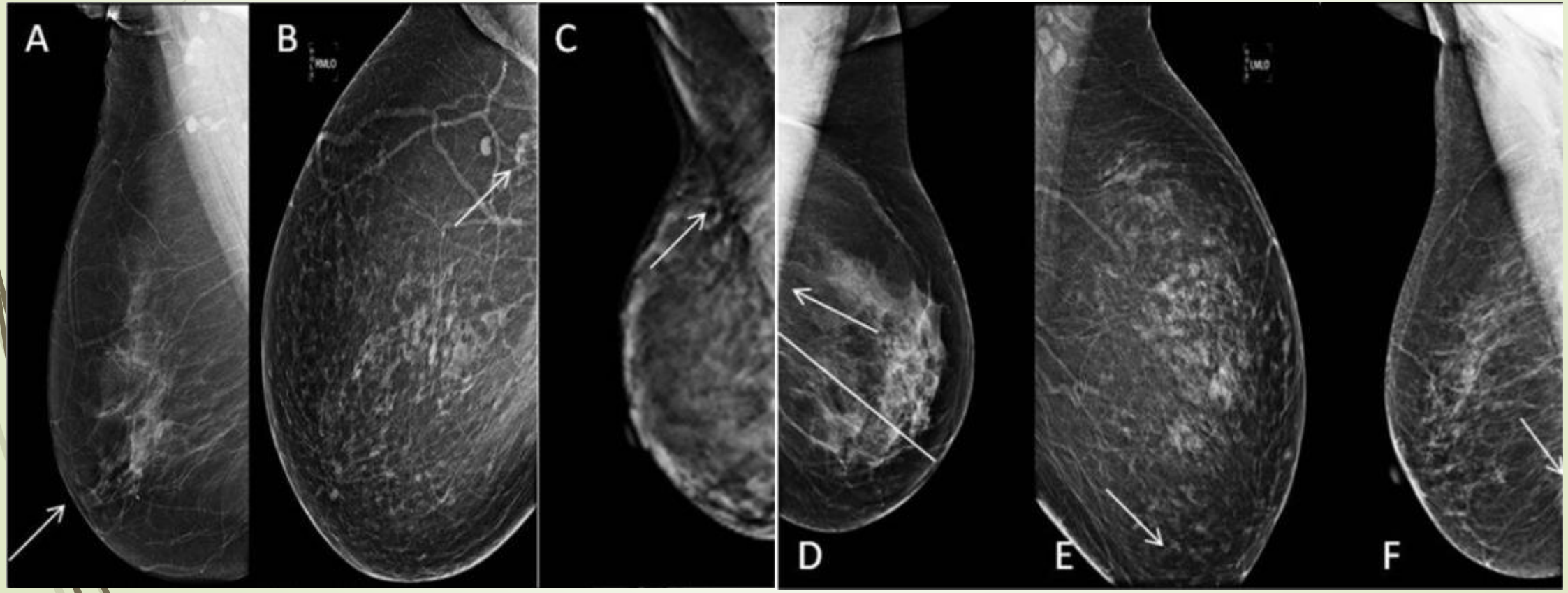


Simetrični „zrcalni” prikaz obje dojke



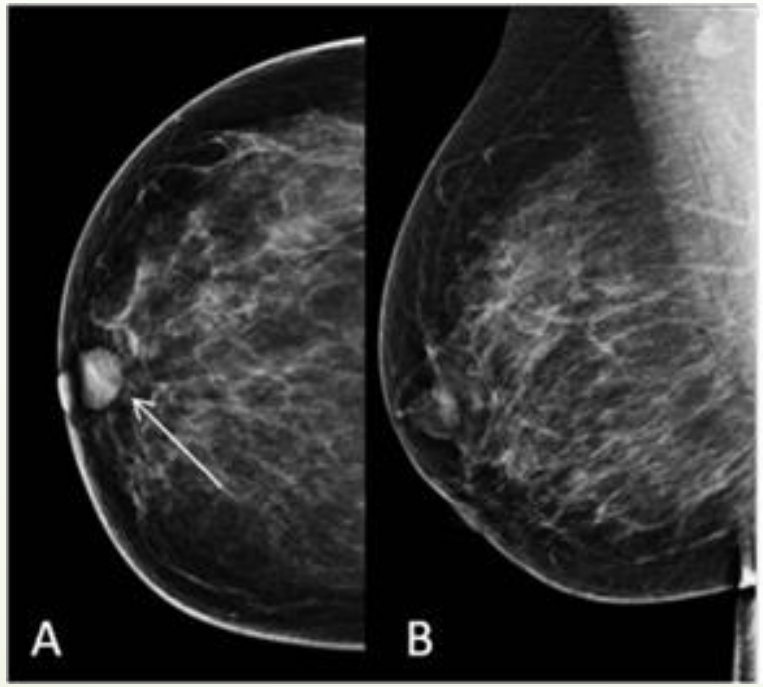
MLO greške

- 20% svih dijagnostičkih pogrešaka kod mamografije uzrokovane su nedostatcima pozicioniranja, 15% greškama ekspozicije, a 14% nedostatcima kod kompresije dojke
- Mamila (A), pektoralis (B,C,D), rez donjeg kvadranta (E), inframamarni nabor (F)



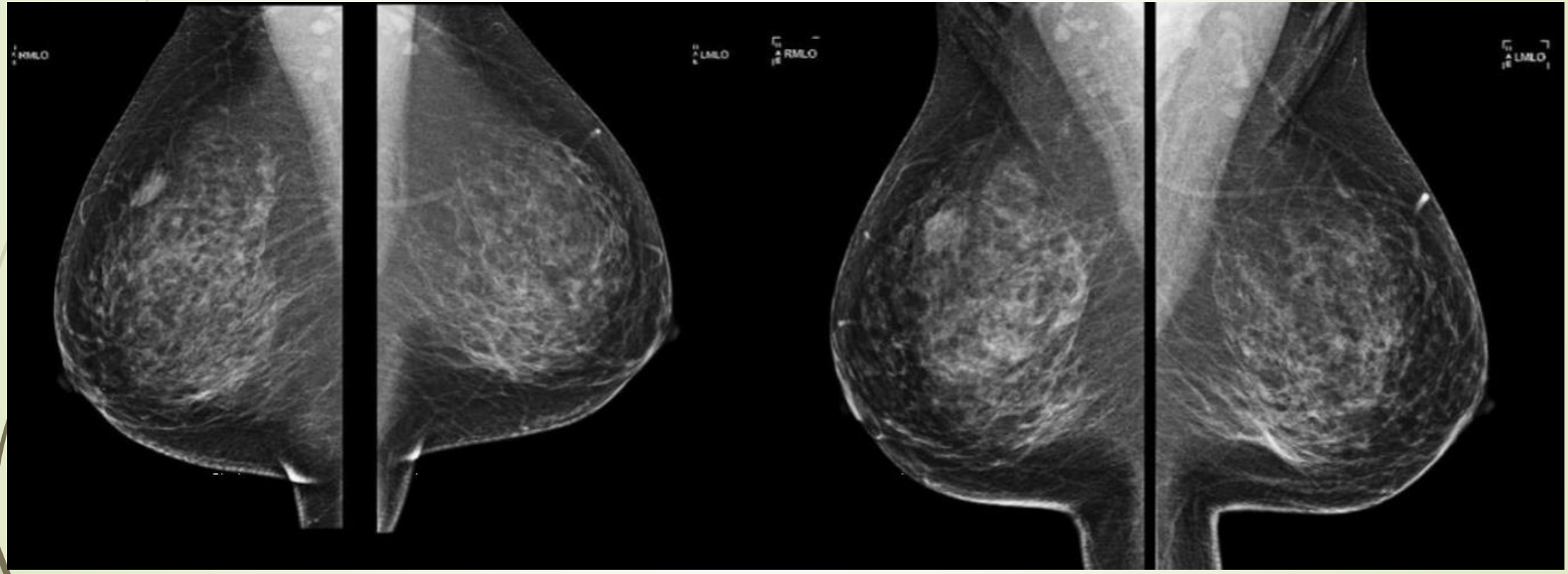
MLO greške

- Mamila, pektoralis, asimetrija, inframamarni nabor



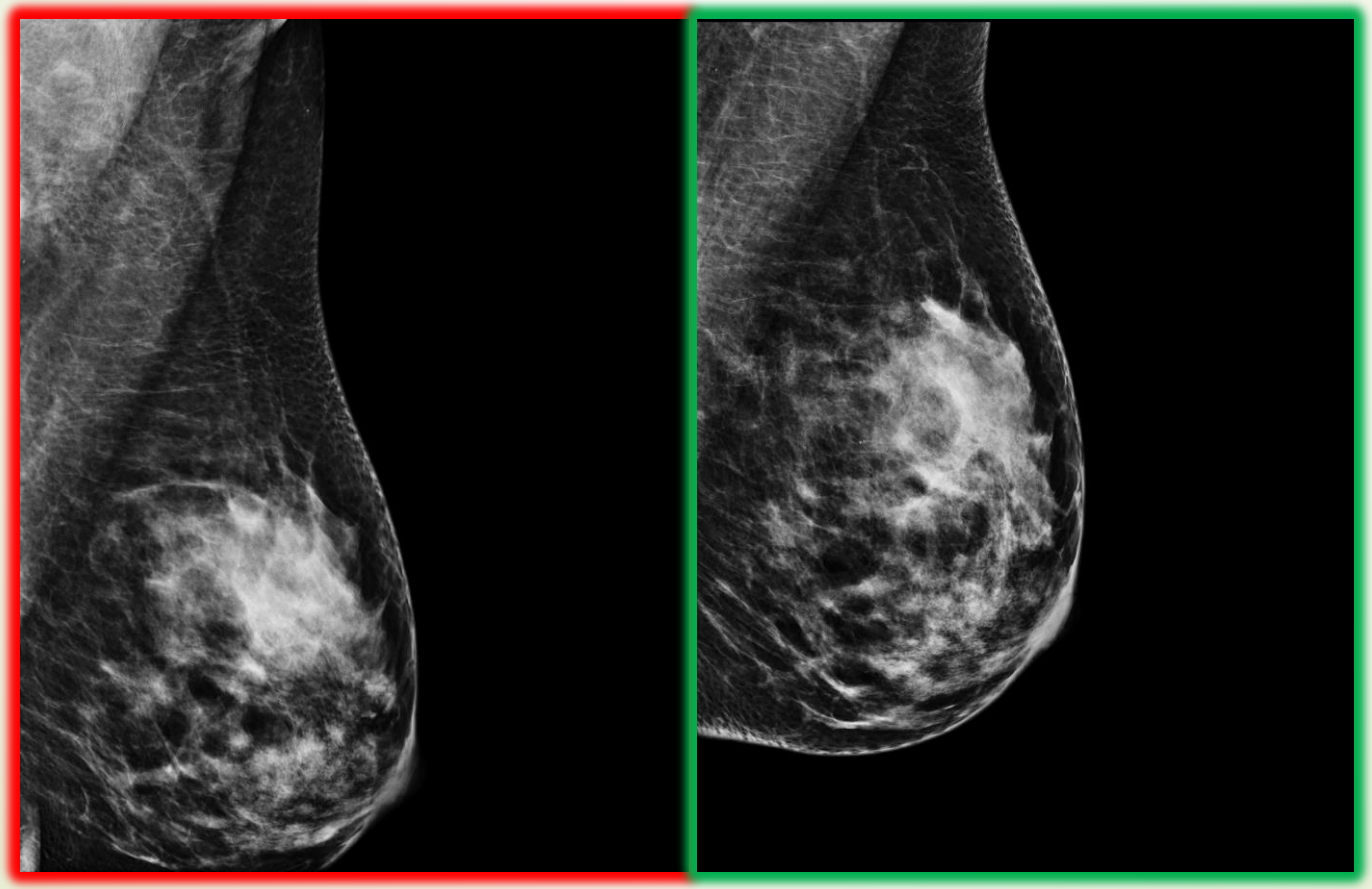
MLO greške

- Loš prikaz aksilarnog nabora (premali format receptora slike)



MLO greške

- Odrezanost donjeg dijela dojke



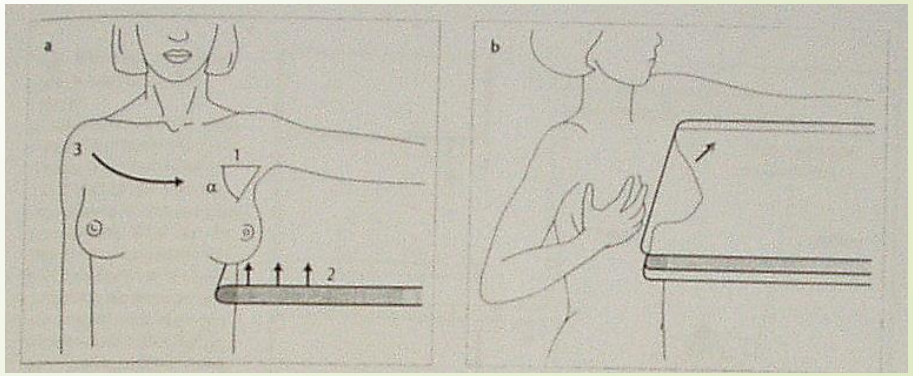
Pozicioniranje kod mamografije

Pozicioniranje dojki kod mamografije

Pozicioniranje kod mamografije je **namještanje cijelog tijela** a ne samo dojke

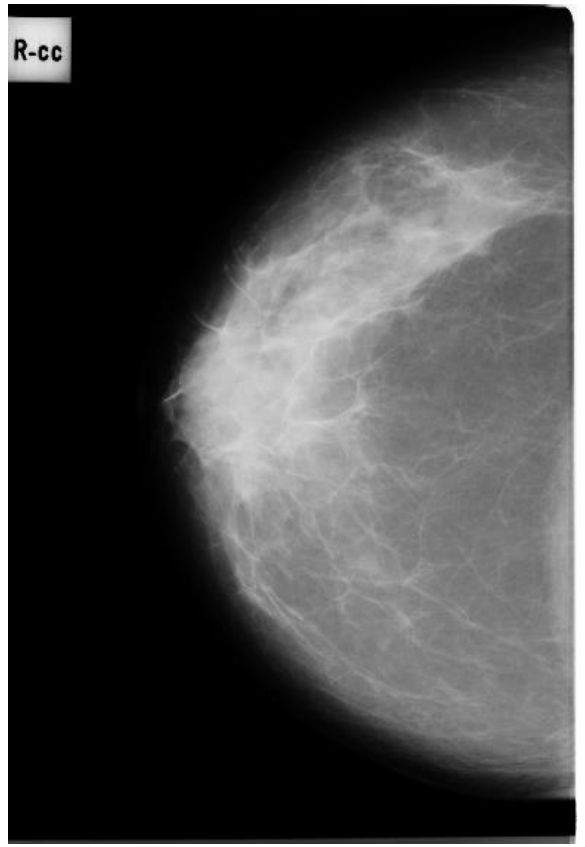
MLO

- Pacijentice imaju različit **tjelesni habitus** – pravilan odabir kuta *mlo*
- Podignuta nadlaktica pacijentice oslanja se na gornji rub receptora slike
- Unutrašnja rotacija humerusa osigurava relaksaciju pektoralisa
- Noge, kukovi i ramena što više naprijed, ali da ne ometaju kompresiju
- Pacijentica se treba nagnuti naprijed prema uređaju, a okretanjem pacijentice prema uređaju u tijeku kompresije postižemo bolje uključenje inframamarnog nabora
- Pacijentica svojom rukom treba odmaknuti drugu dojku

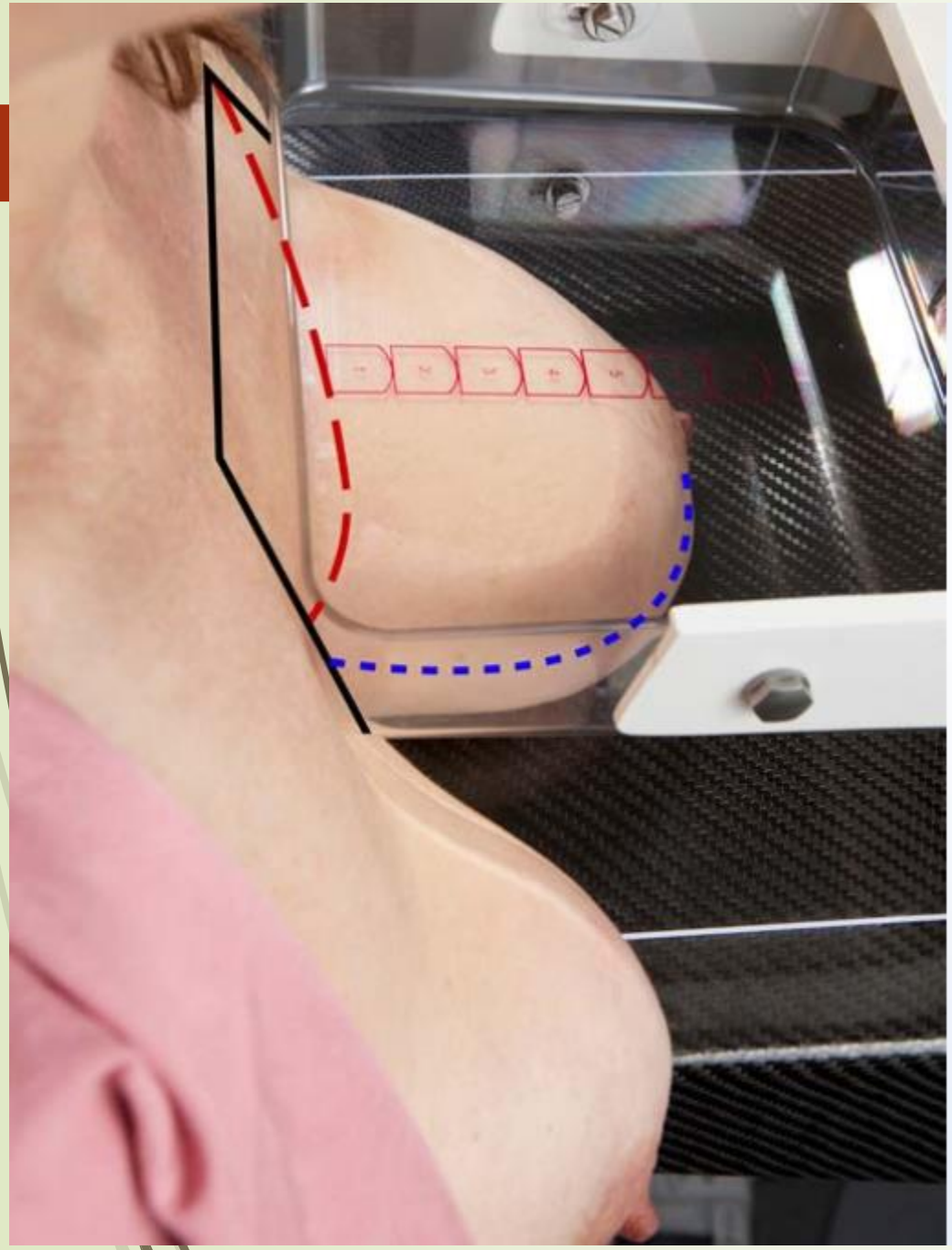


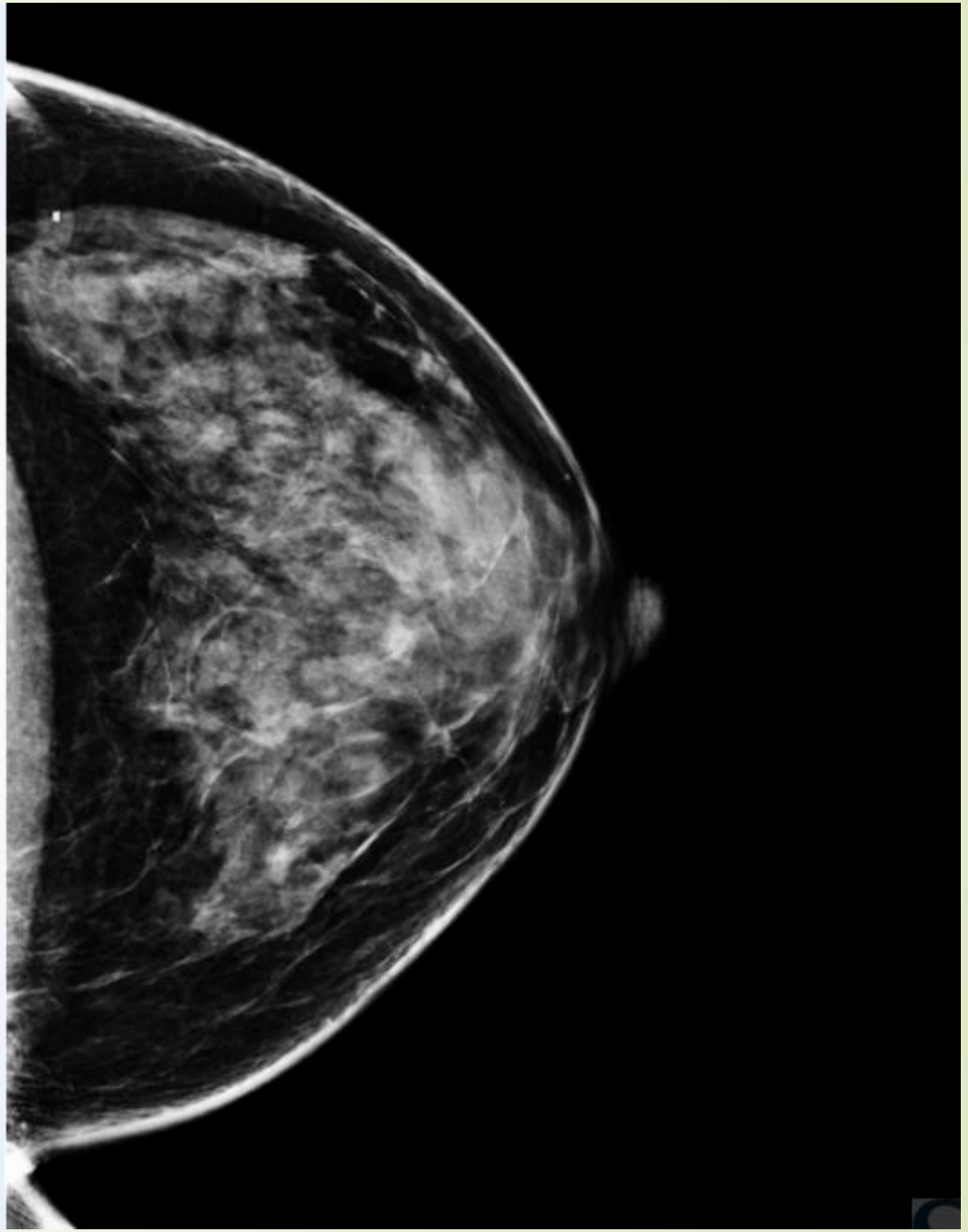
- ***CC-snimka***

Kriteriji dobre kvalitete:

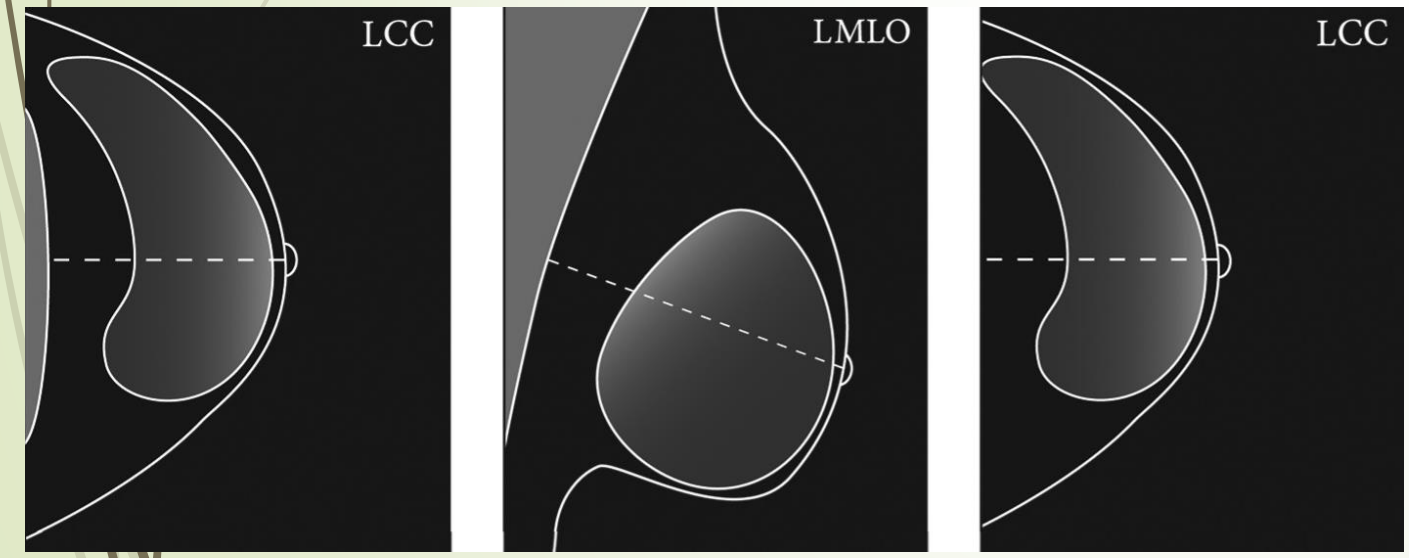


- **odličan prikaz medijalnih kvadranata**
- **prikazano što više lateralnog tkiva,** ali ne na štetu prikaza medijalnog dijela dojke
- vidljiv medijalni pripoj dojke na sternalnu regiju
- **prikaz prepektoralnog masnog tkiva**
- pektoralis u 30-60% snimaka
- …ako se ne vidi pektoralis, tada PNL (CC) ≥ PNL (MLO) – 1 cm
- **mamila centrirana i u profilu**

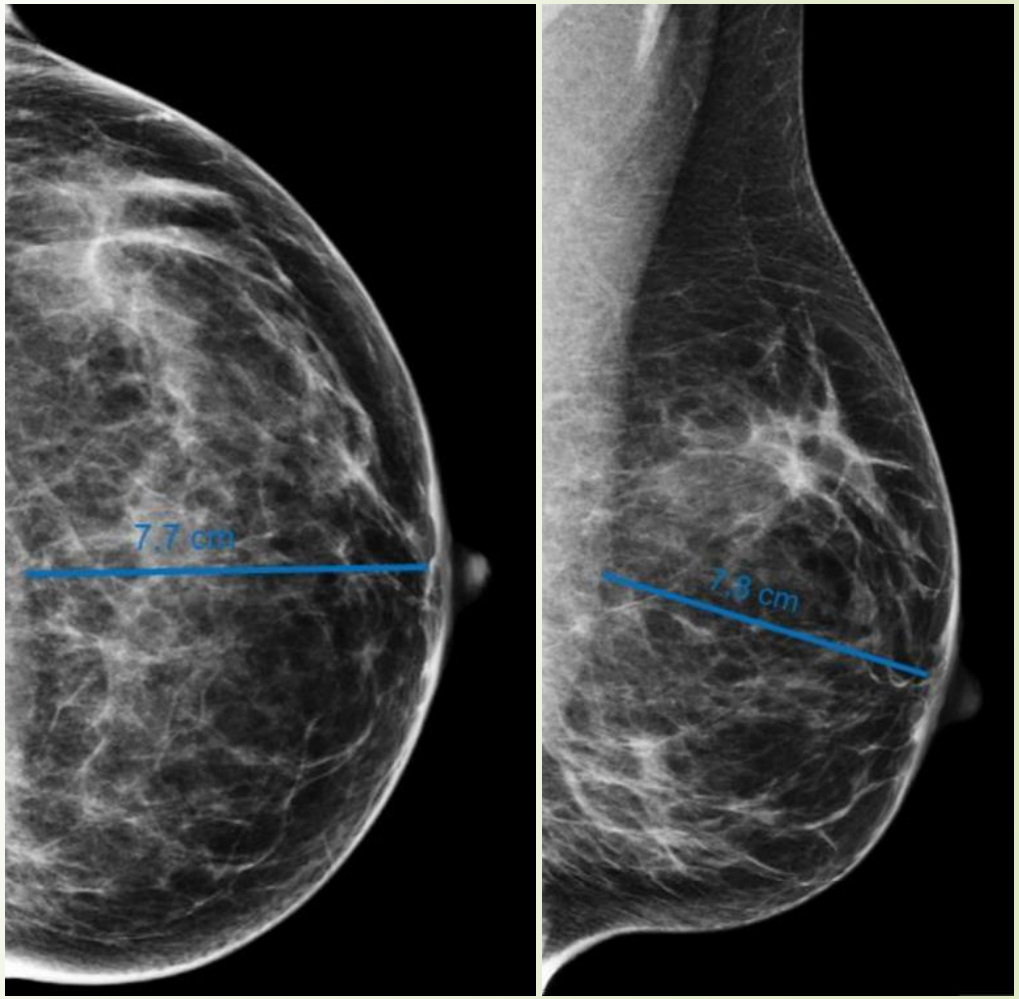




PNL (CC) ≥ PNL (MLO) – 1 cm



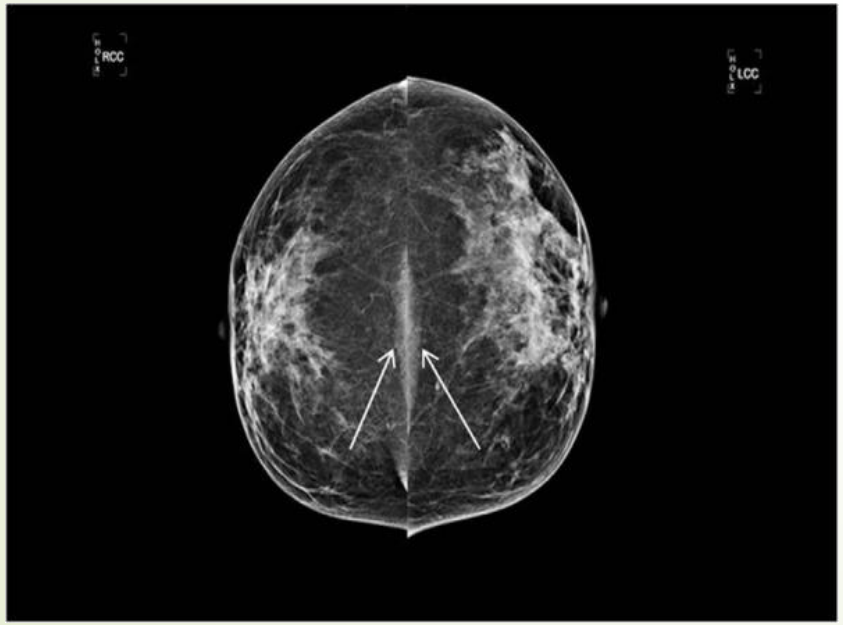
Idealno

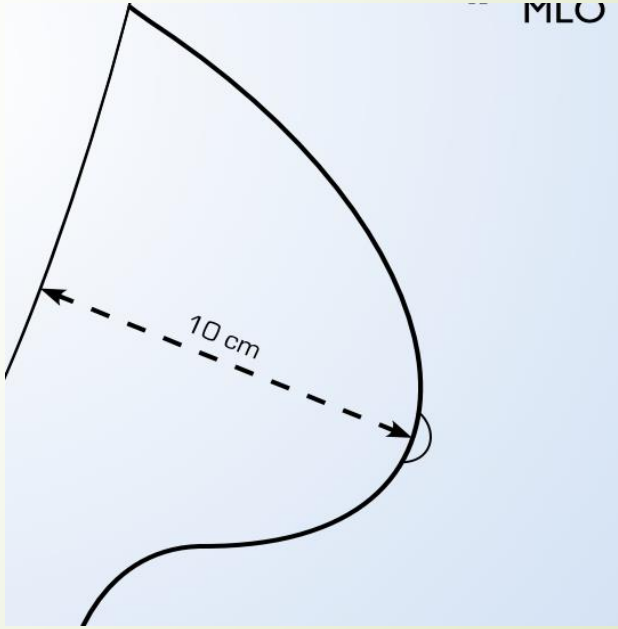


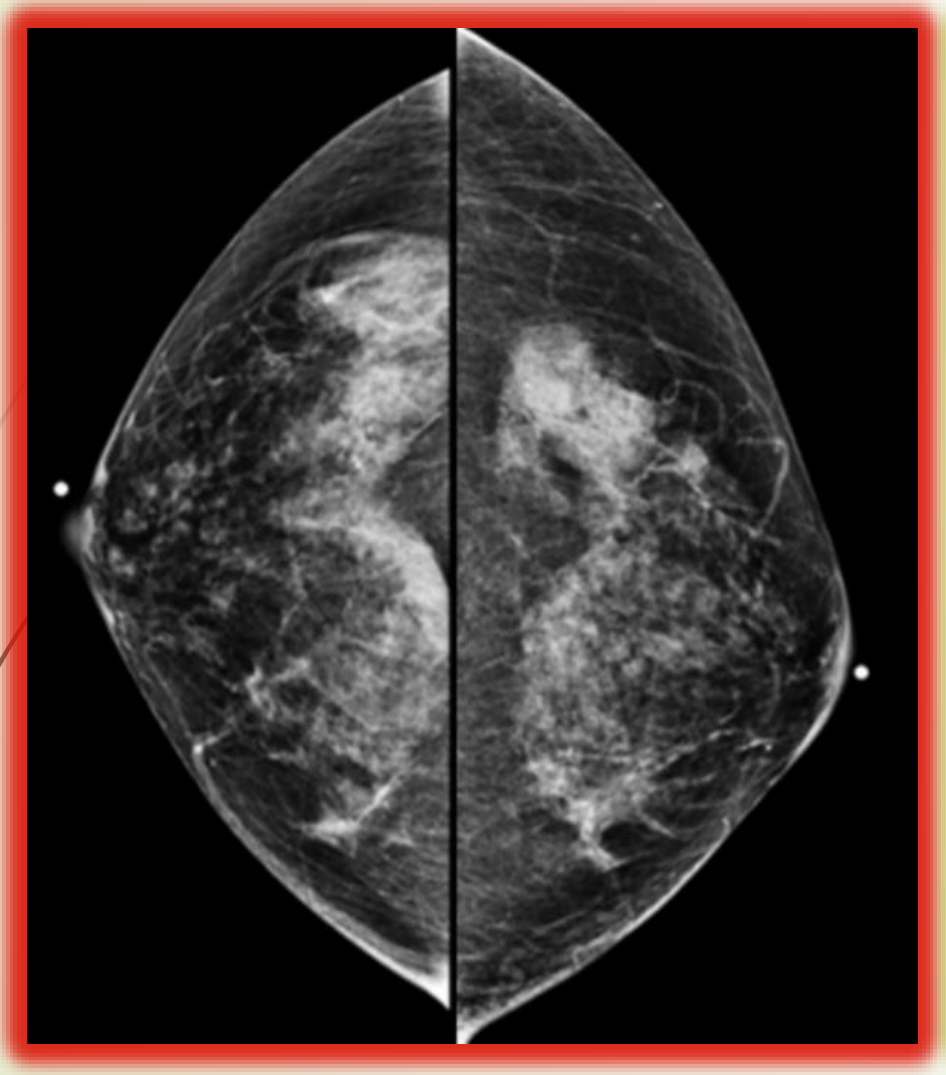
prihvatljivo

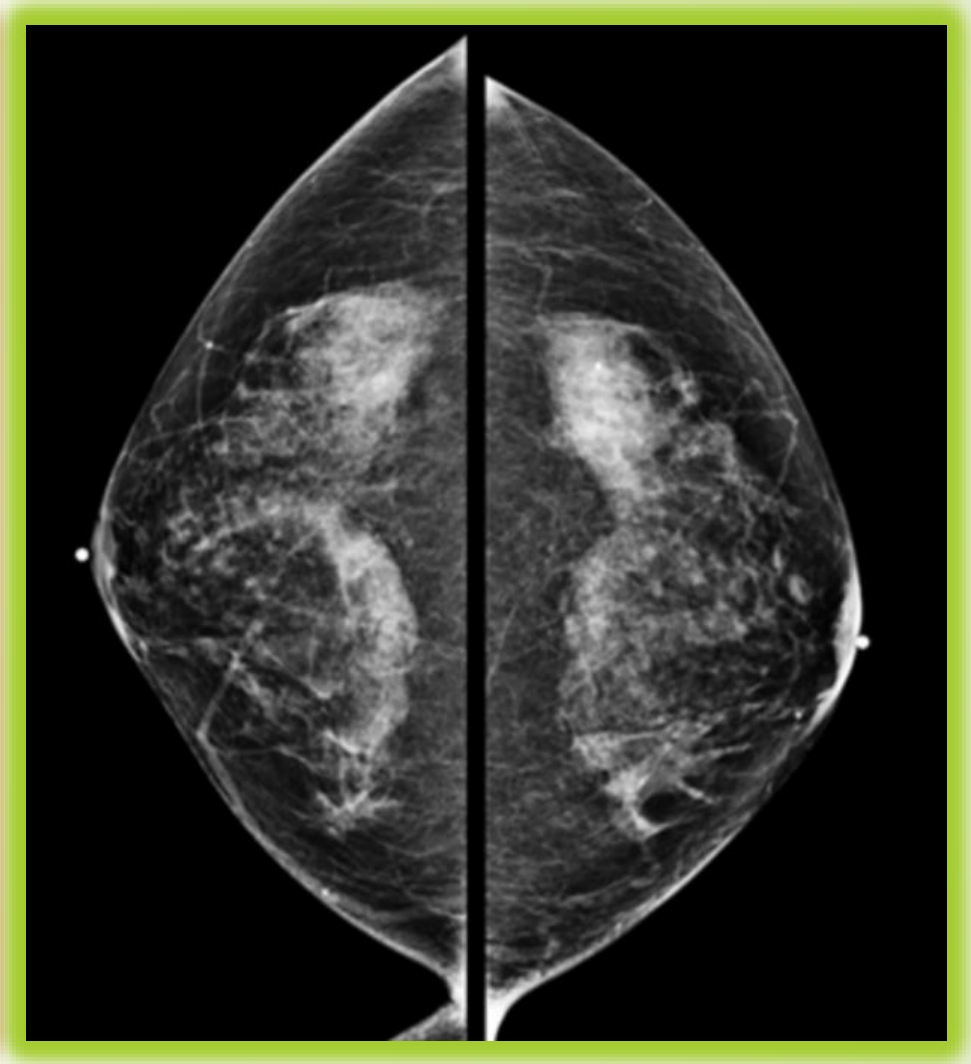
Važan je izdašan prikaz prepektoralnog masnog tkiva

- Duljina PNL na MLO snimci služi nam za procjenu kvalitete CC snimke
- ako se pektoralis ne vidi na CC, tada PNL(CC) treba u ovom slučaju biti najmanje 10 - 1 = 9 cm

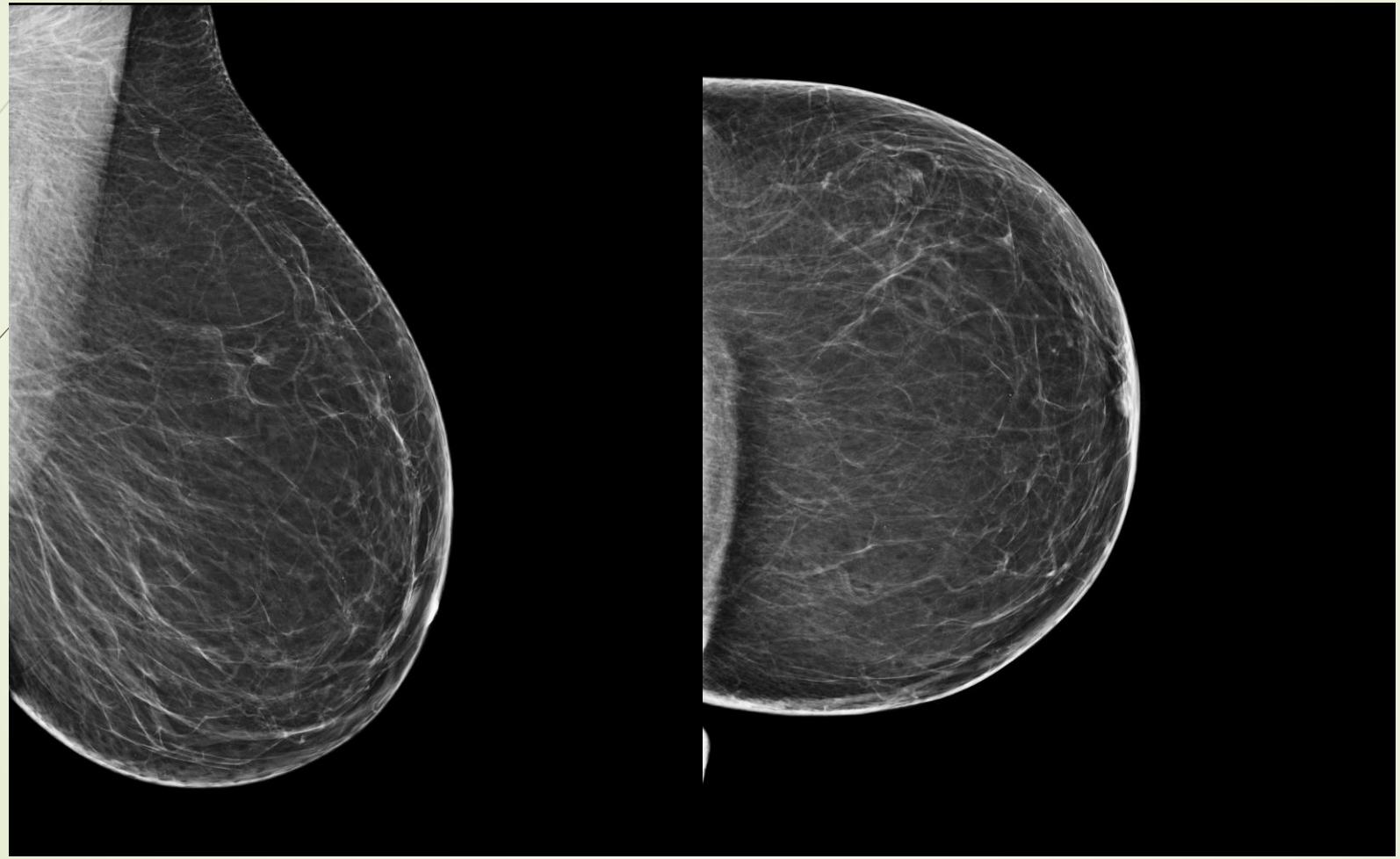




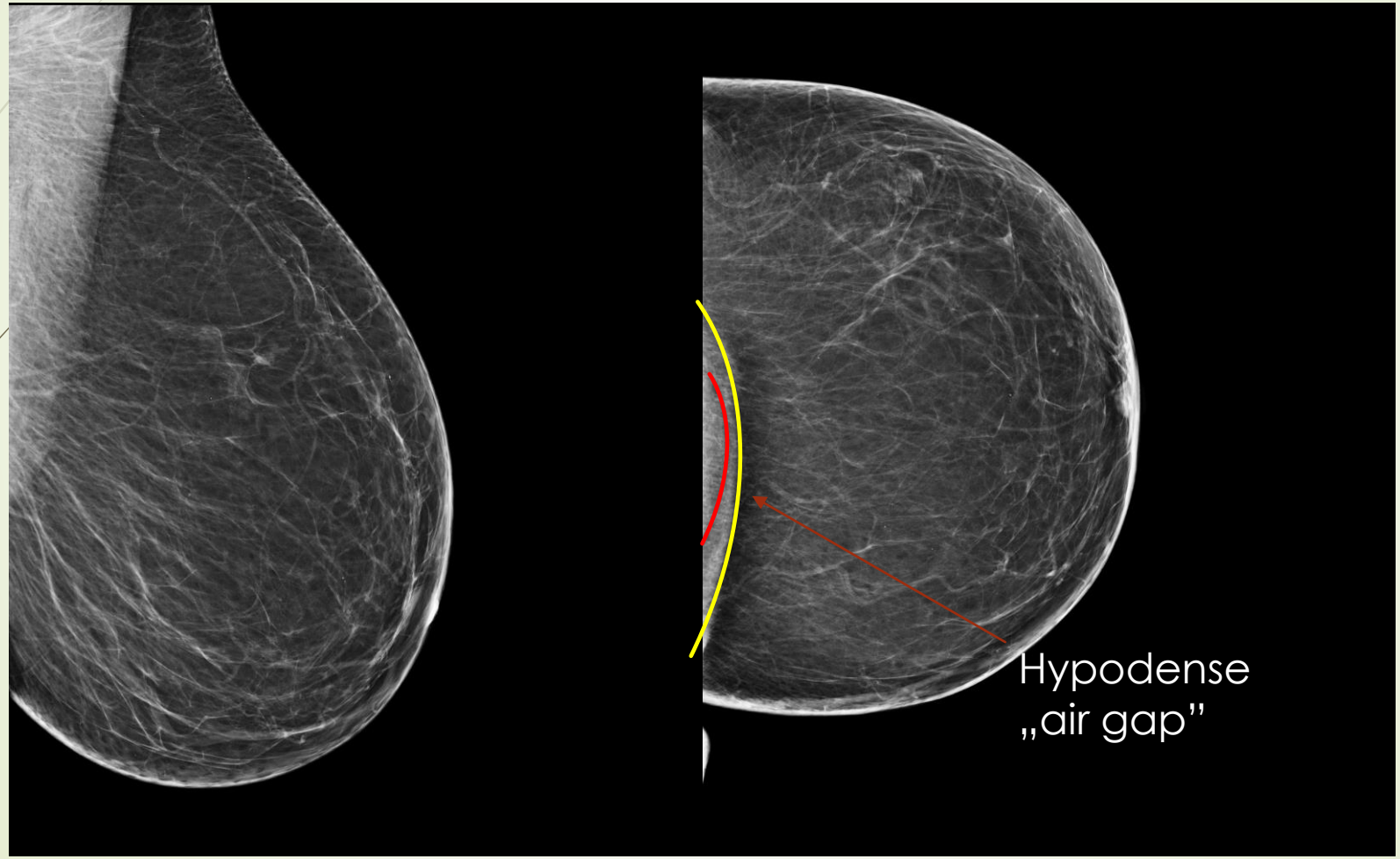




Pektoralis vs. nabor kože



Pektoralis vs. nabor kože



Pektoralis ili nabor kože?

Pektoralis ili nabor kože?

Transparencija potkožne masti

Summary of the origins for the three key image quality criteria descriptors for the craniocaudal view

Author and year	Inclusion of pectoral muscle	PNL and 1 cm measurement	Retroglandular fat
Eklund and Cardenosa (1992)[38] p. 36	More than 25%[a]	Nil	Nil
Hendrick, Bassett and Dodd (1992)[60] p. 75	Approximately 20%[a]	Nil	Nil
Bassett et al (1993)[36] p. 805	32%	Yes	Yes
Eklund et al (1994)[64] p. 300	30–40%[a]	Yes	Yes
Bassett et al (1994)[66] p .66	Approximately 30%[a]	Yes	Yes
European Commission (1996)[67,67]	Yes[a]	Nil	Yes
American College of Radiology (1999)[68] p. 86	30 to 40%[a]	Yes	Yes

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A review of mammographic positioning image quality criteria for the craniocaudal projection

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Abstract Go to:

Detection of breast cancer is reliant on optimal breast positioning and the production of quality images. Two projections, the mediolateral oblique and craniocaudal (CC), are routinely performed. Determination of successful positioning and inclusion of all breast tissue is achieved through meeting stated image quality criteria. For the CC view, current image quality criteria are inconsistent. Absence of reliable anatomical markers, other than the nipple, further contribute to difficulties in assessing the quality of CC views. The aim of this paper was to explore published international quality standards to identify and find the origin of any CC positioning criteria which might provide for quantitative assessment. The pectoralis major (pectoral) muscle was identified as a key posterior anatomical structure to establish optimum breast tissue inclusion on mammographic projections. It forms the first two of the three main CC metrics that are frequently reported (1) visualization of the pectoral muscle, (2) measurement of the posterior nipple line and (3) depiction of retroglandular fat. This literature review explores the origin of the three metrics, and

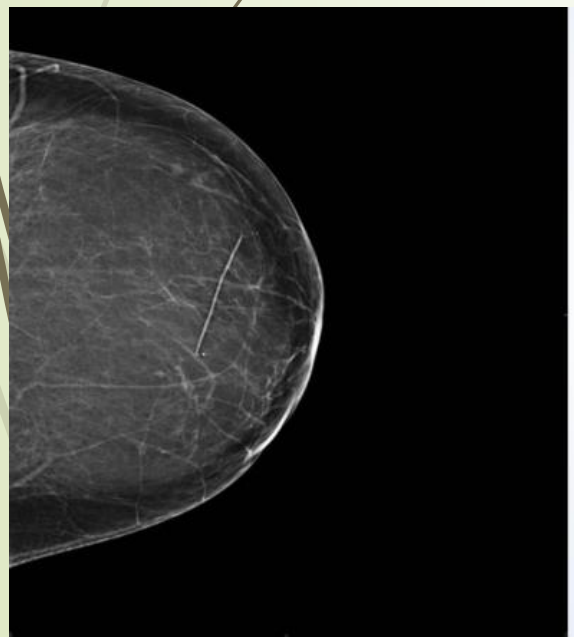
Pozicioniranje kod mamografije je **namještanje cijelog tijela** a ne samo dojke

CC

- Noge, kukovi i ramena što više naprijed, ali da ne ometaju kompresiju
- pristupiti dojci s medijalne strane
  - druga ruka slobodna za privlačenje pacijentice prema receptoru slike
  - omogućuje vizualni kontakt
- podignuti dojku tako da je PNL okomita na torakalni zid, da se dojka kod kompresije ne izvuče i da se izbjegnu bolovi zbog natezanja kože gornjeg dijela dojke
- receptor slike podići do visine inframamarne brazde
- povući dojku naprijed s obje ruke
- izvršiti kompresiju fiksiranog medijalnog dijela dojke, uz istovremeno uvlačenje lateralnog dijela dojke pod ploču, pritom se mogu pojaviti nabori kože koji se izravnaju prstom umetnutim između dojke i kompresijske ploče
- istovremeno s kompresijom može se lagano podizati receptor slike
- glava pacijentice treba biti odmaknuta i zarotirana na drugu stranu
- pacijentica svojom rukom treba odmaknuti drugu dojku
- Paziti da se pacijentica ne propinje na prste

Podignutu dojku s PNL **okomitom** na torakalnu stijenku treba s **obje ruke** povući **prema naprijed** na stol za snimanje

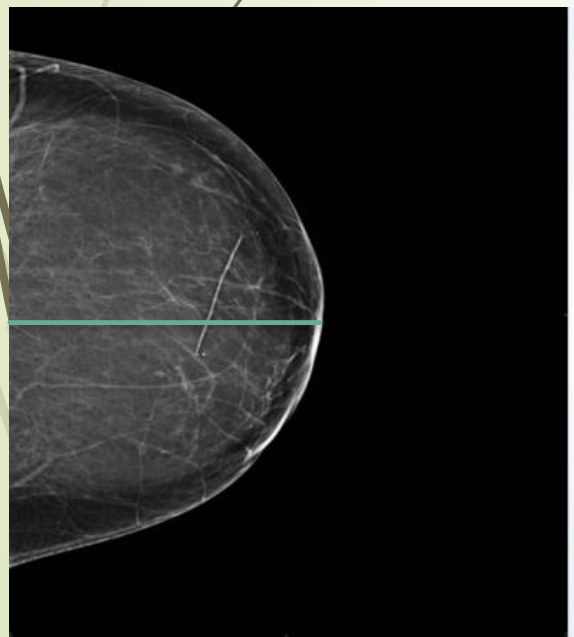
dojka jednostavno stavljena na podlogu jednom rukom bez povlačenja



dojka pravilno pozicionirana na podlozi povlačenjem prema naprijed s obje ruke

Podignutu dojku s PNL **okomitom** na torakalnu stijenku treba s **obje ruke** povući **prema naprijed** na stol za snimanje

dojka jednostavno stavljena na podlogu jednom rukom bez povlačenja



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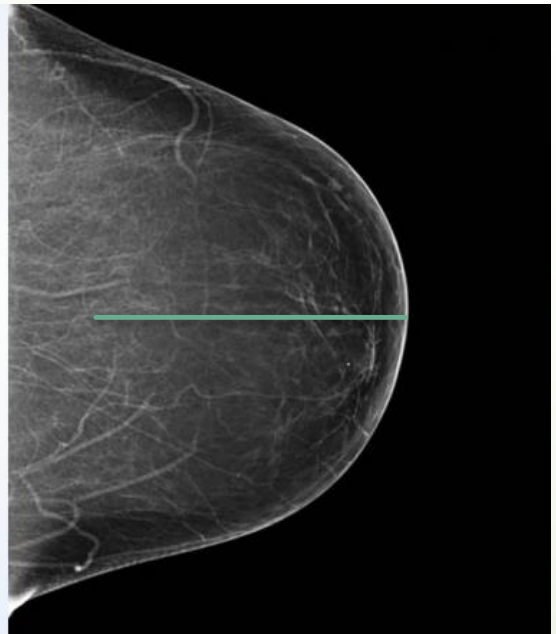

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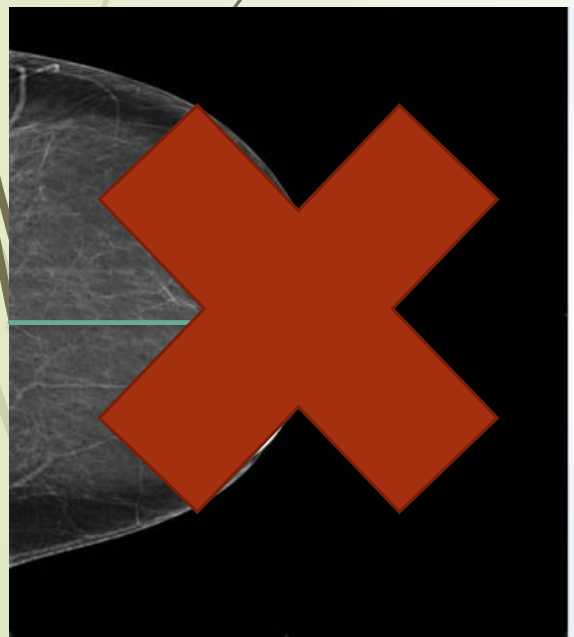
dojka jednostavno stavljena na podlogu jednom rukom bez povlačenja



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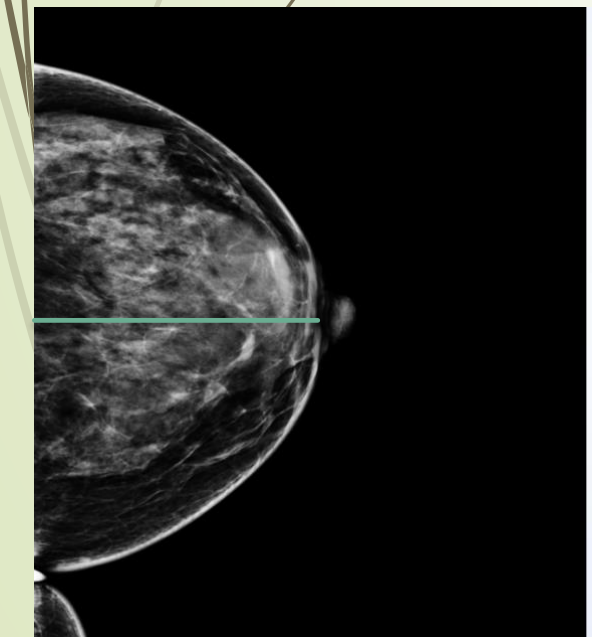
Podignutu dojku s PNL **okomitom** na torakalnu stijenku treba s **obje ruke** povući **prema naprijed** na stol za snimanje

dojka jednostavno stavljena na podlogu jednom rukom bez povlačenja



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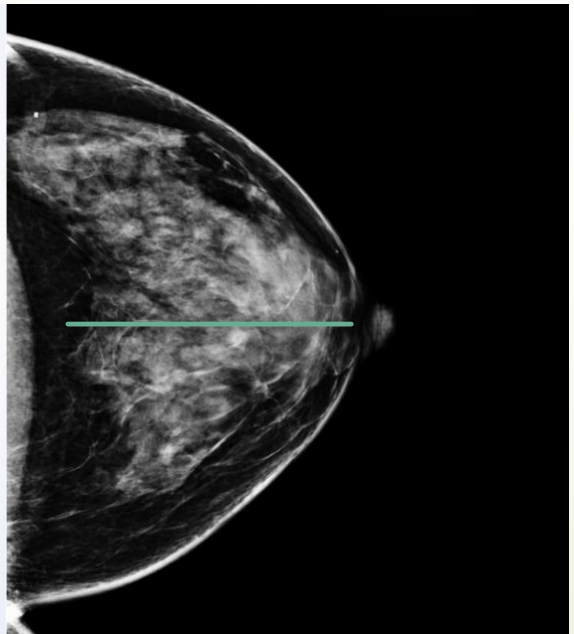

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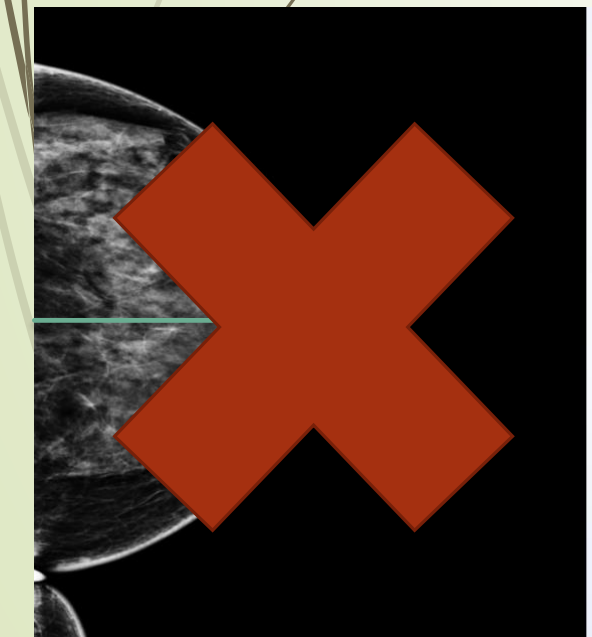

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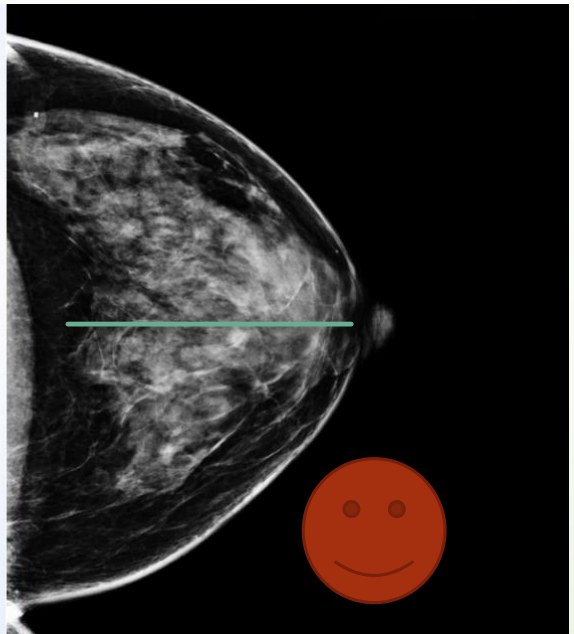

Podignutu dojku s PNL **okomitom** na torakalnu stijenku treba s **obje ruke** povući **prema naprijed** na stol za snimanje

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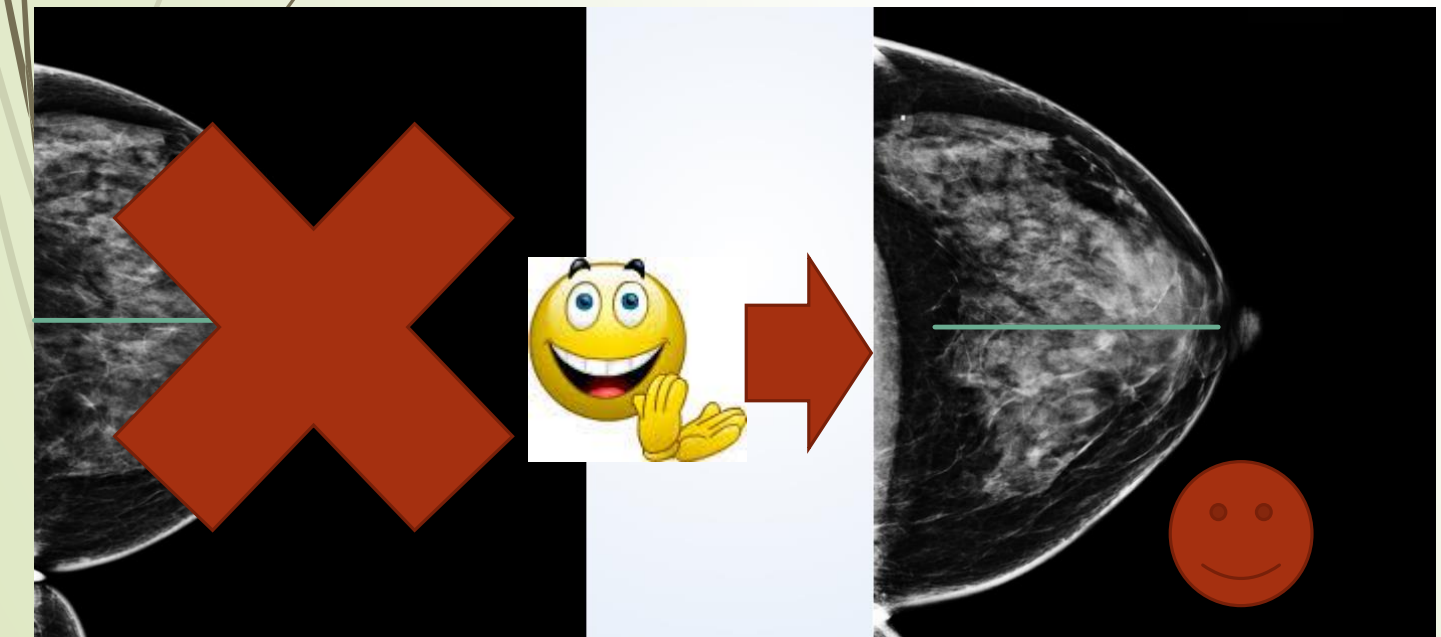
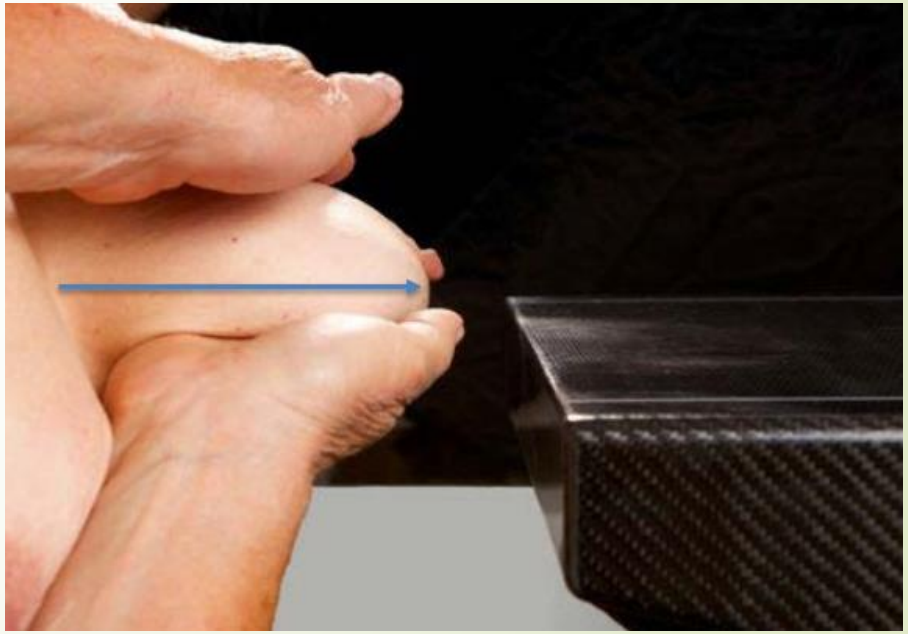
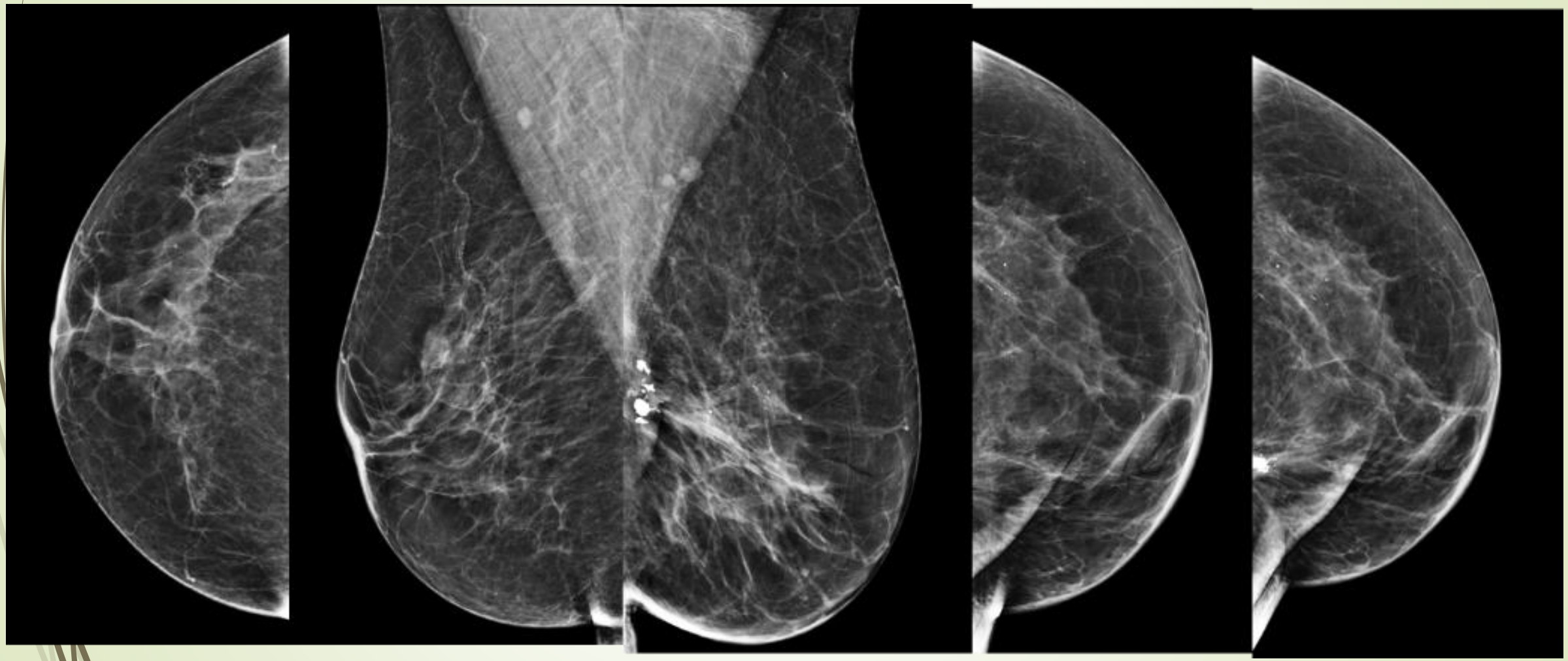


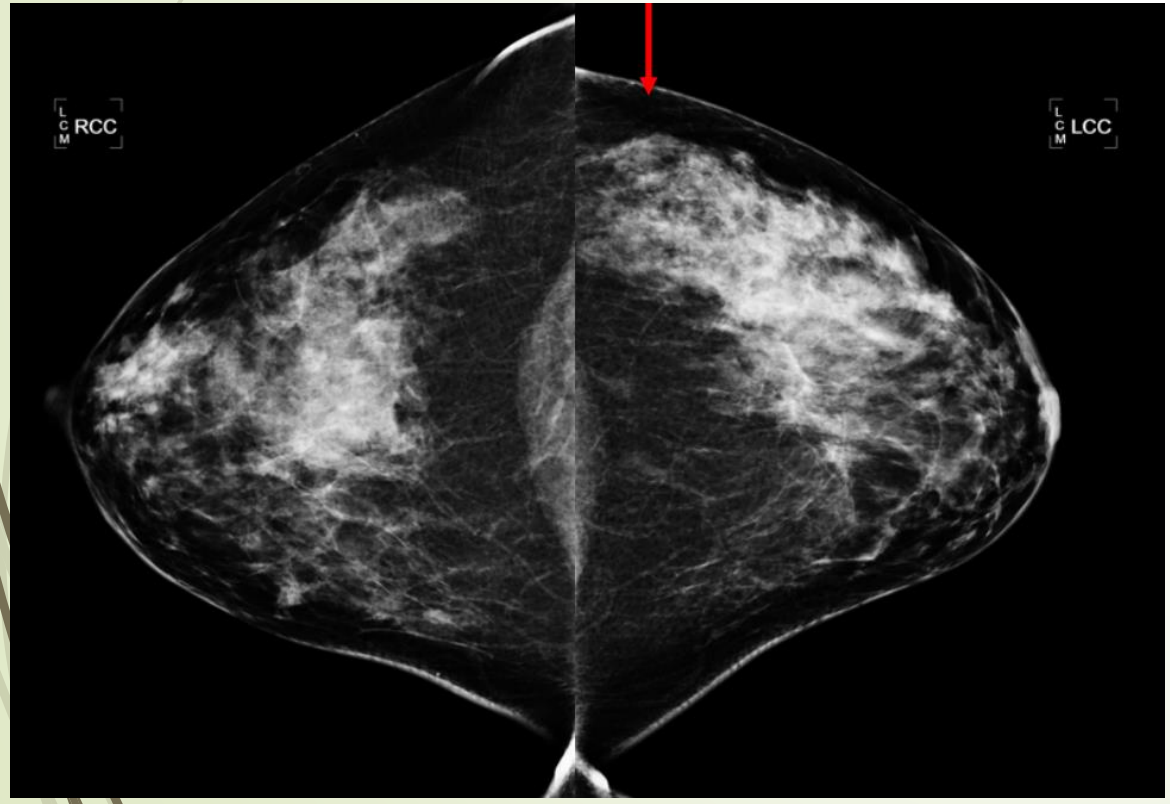


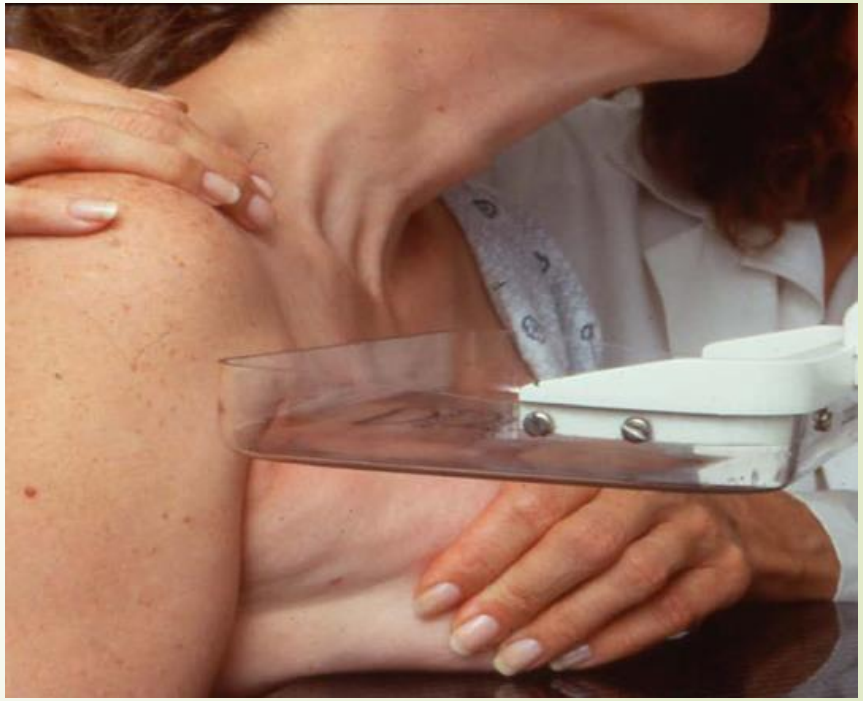


Lateralni dio dojke **uvući pod kompresijsku ploču**

Dobar prikaz lateralnog dijela dojke

Lateralni dio nije privučen

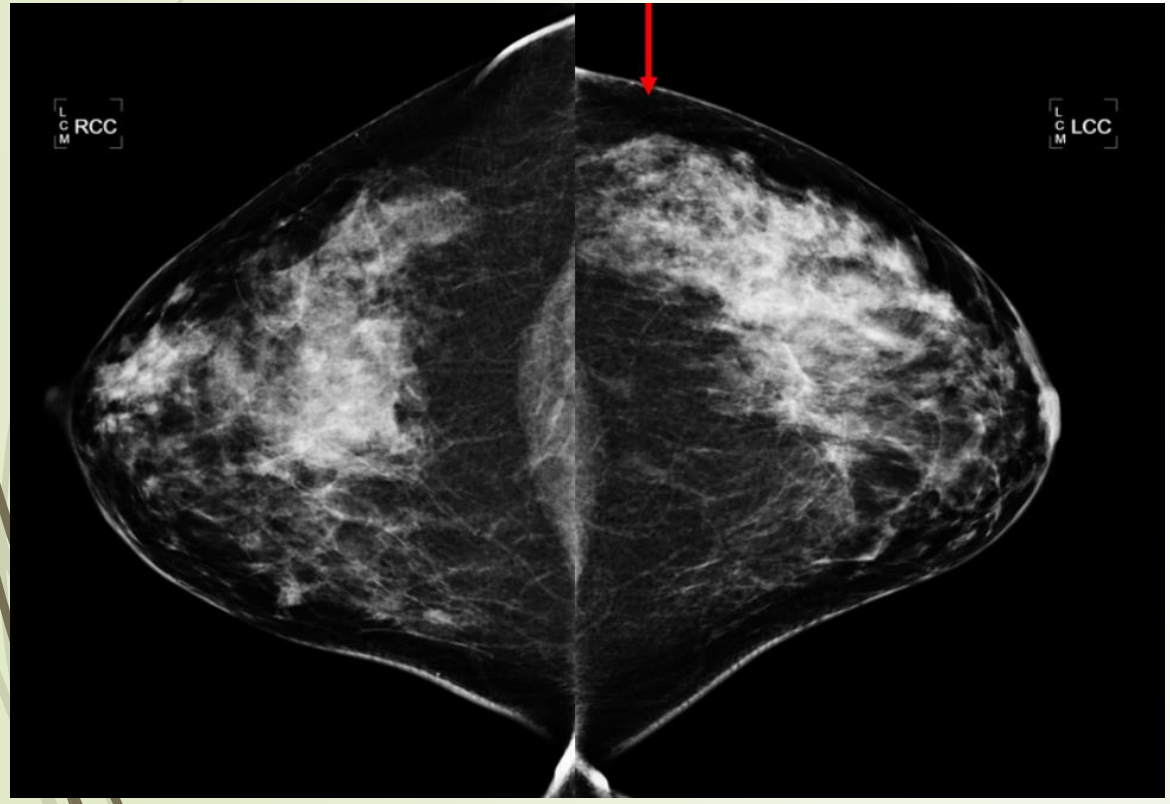


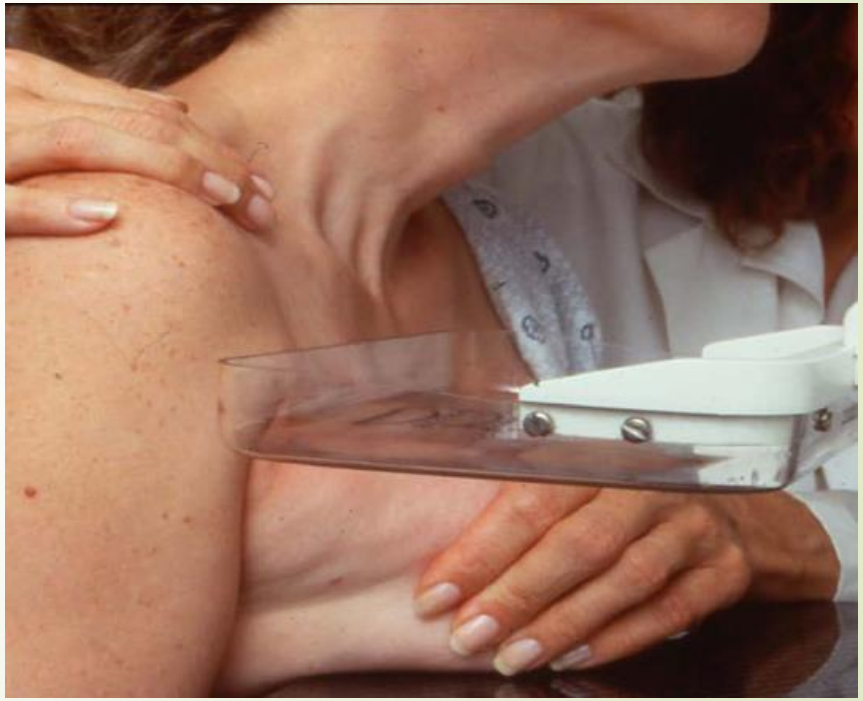


Lateralni dio dojke **uvući pod kompresijsku ploču**

Dobar prikaz lateralnog dijela dojke

Lateralni dio nije privučen

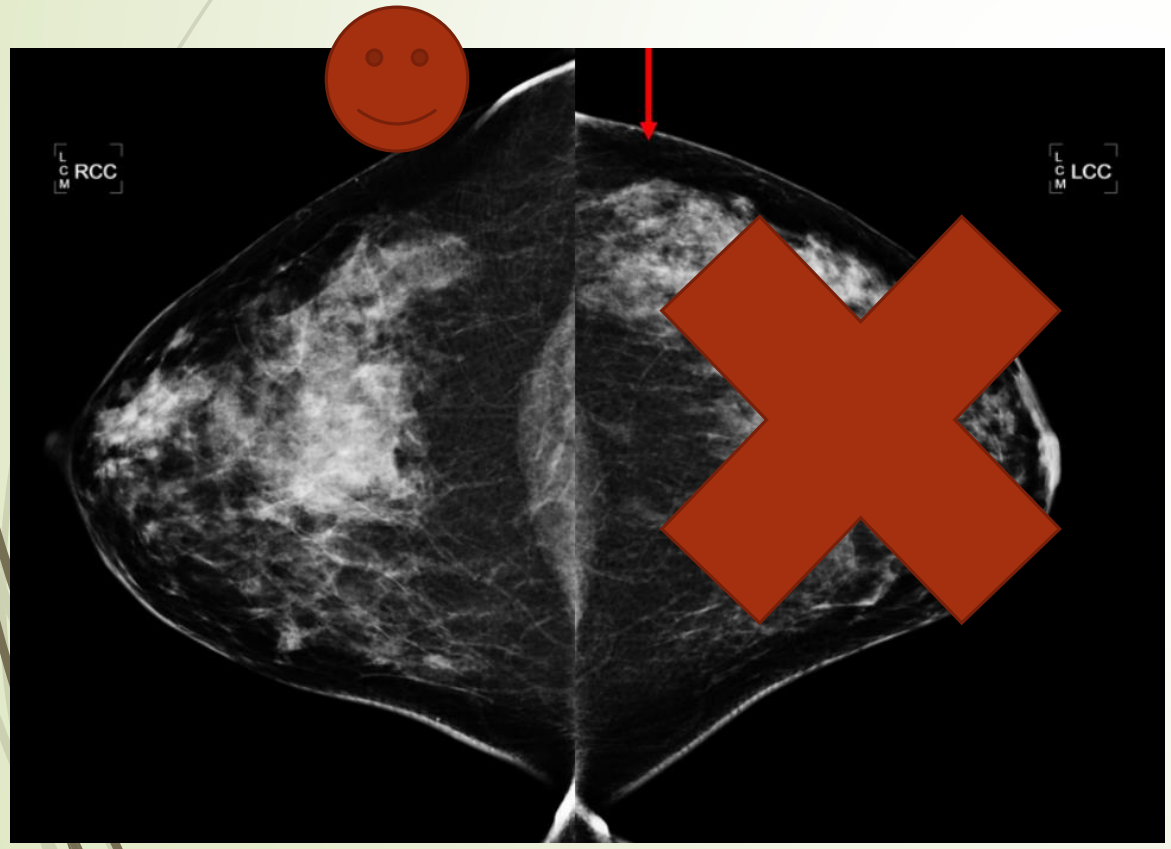


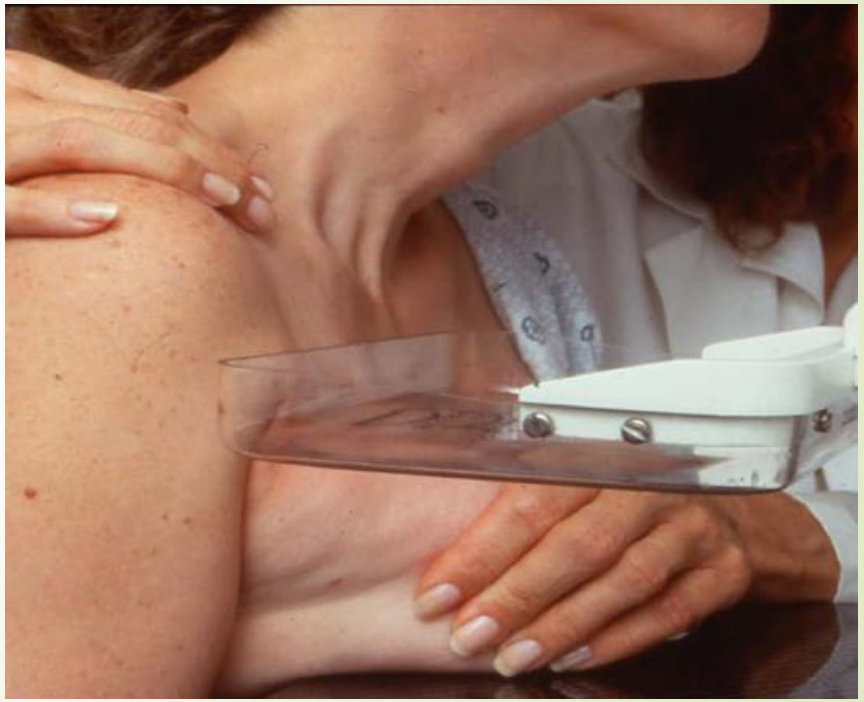


Lateralni dio dojke **uvući pod kompresijsku ploču**

Dobar prikaz lateralnog dijela dojke

Lateralni dio nije privučen

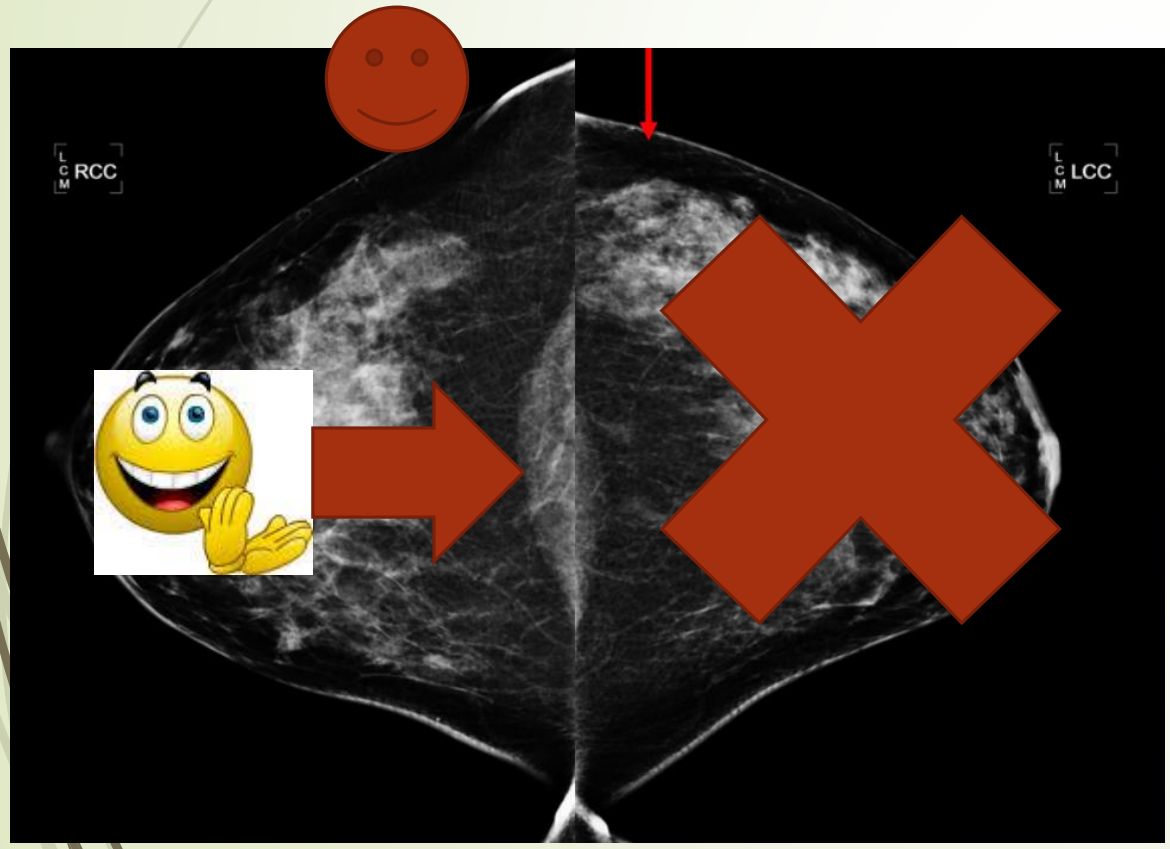


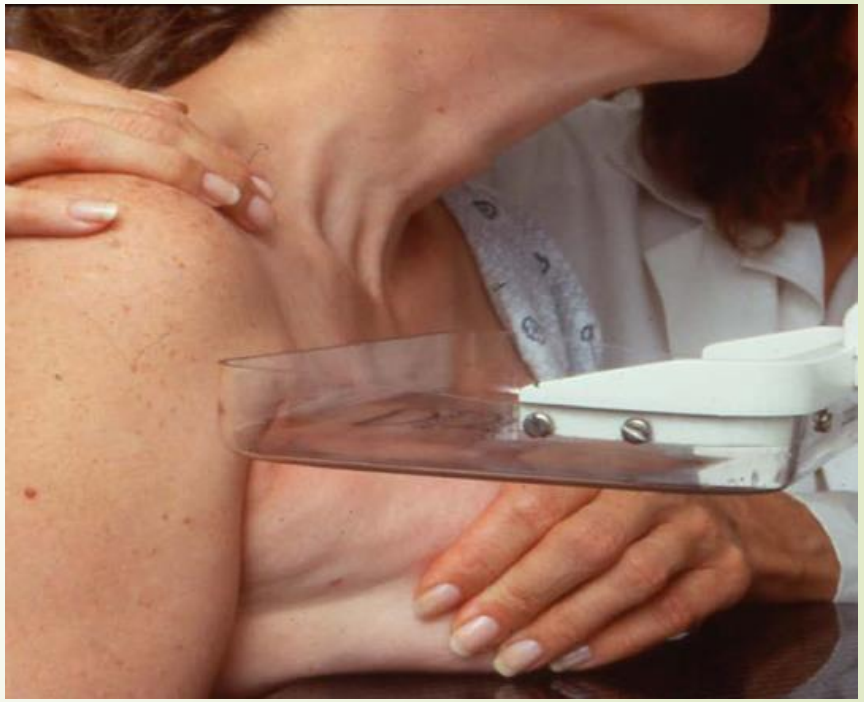


Lateralni dio dojke **uvući pod kompresijsku ploču**

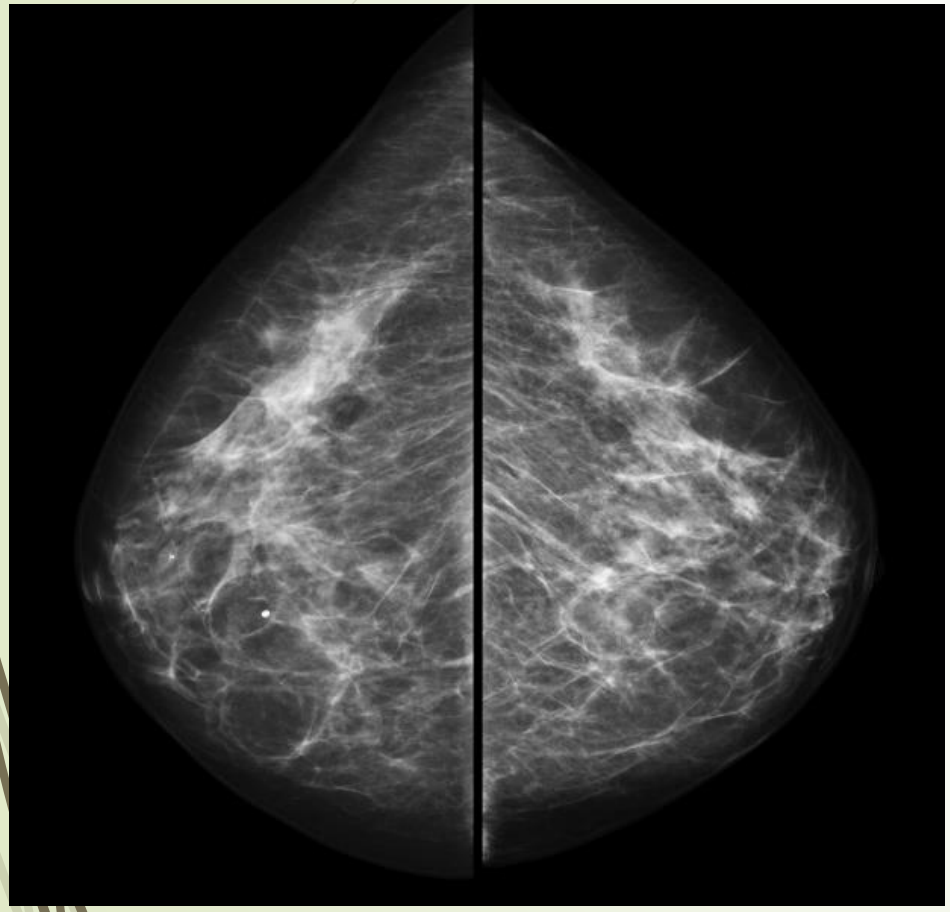
Dobar prikaz lateralnog dijela dojke

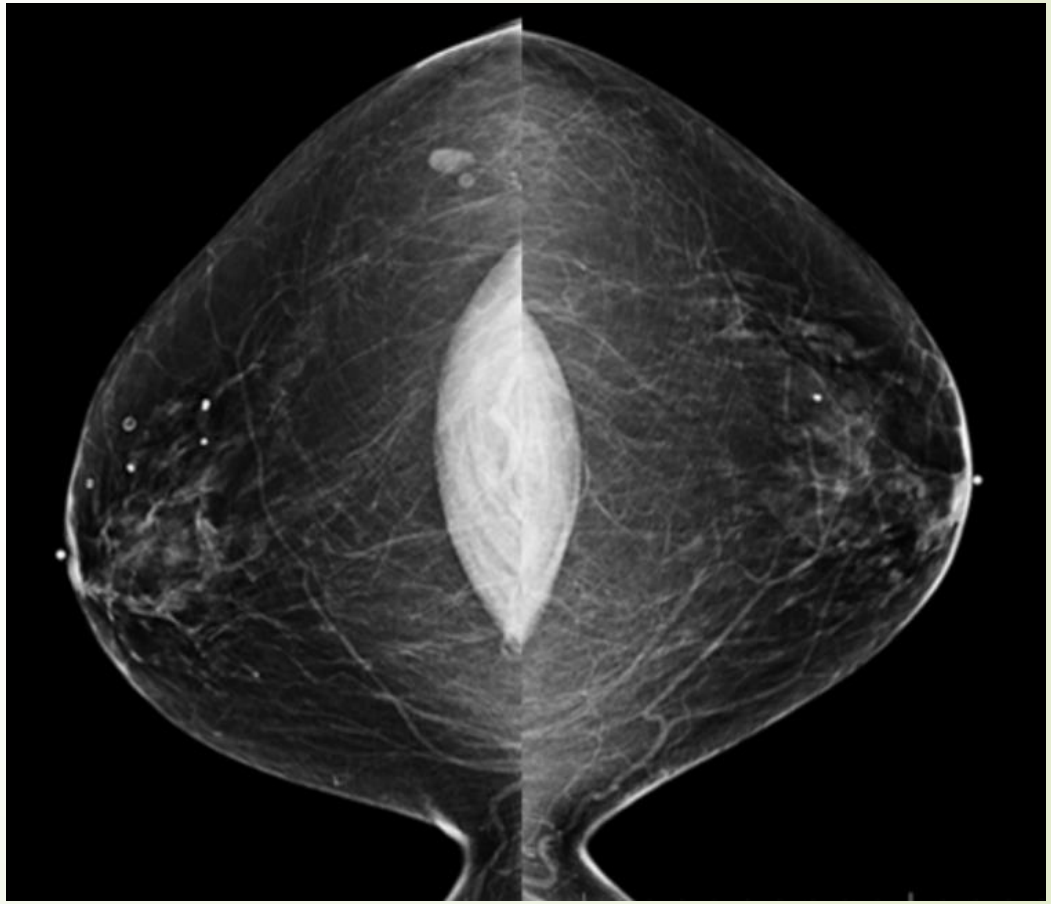
Lateralni dio nije privučen



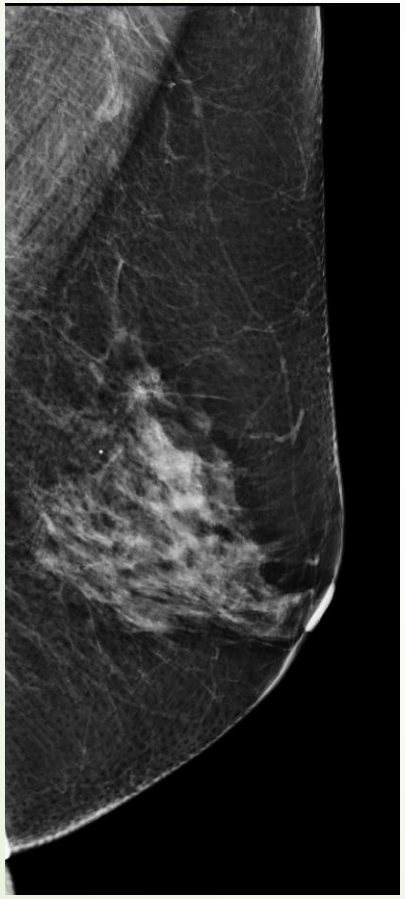


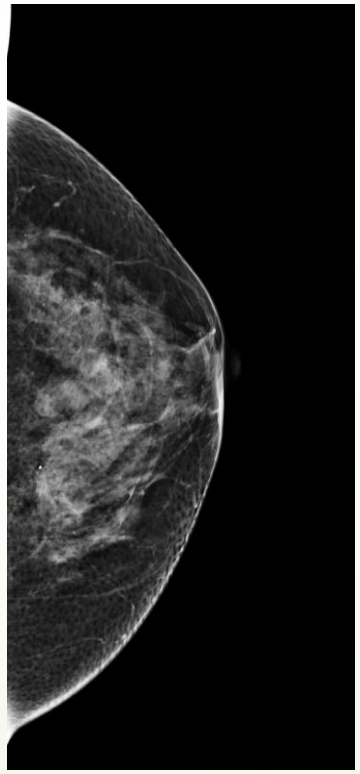
Dobar prikaz lateralnog dijela



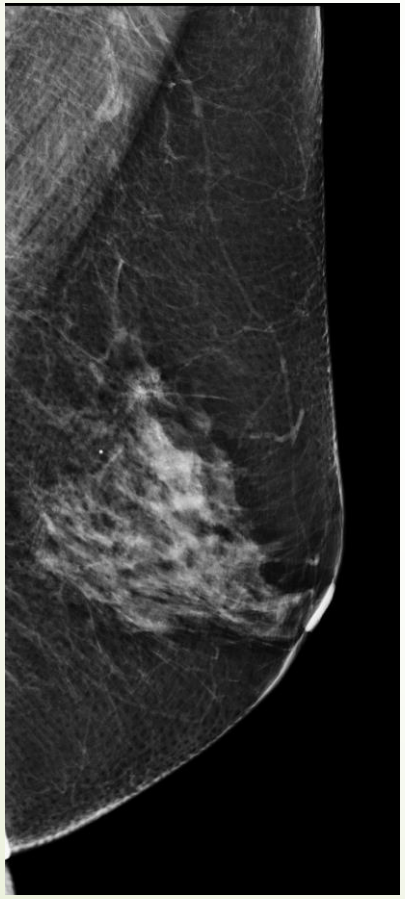


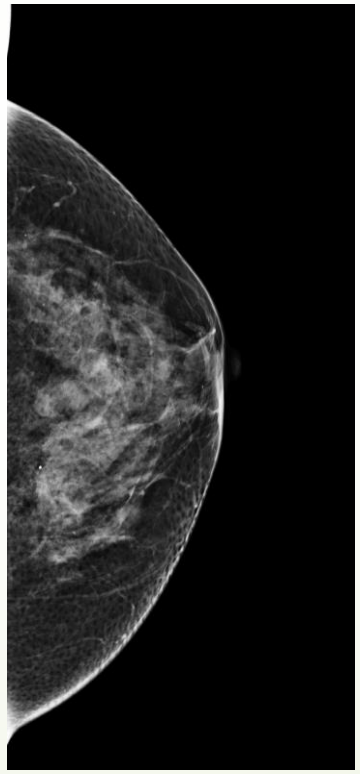
karcinom prikazan tek na naknadnoj CC snimci s uvlačenjem lateralnog dijela dojke



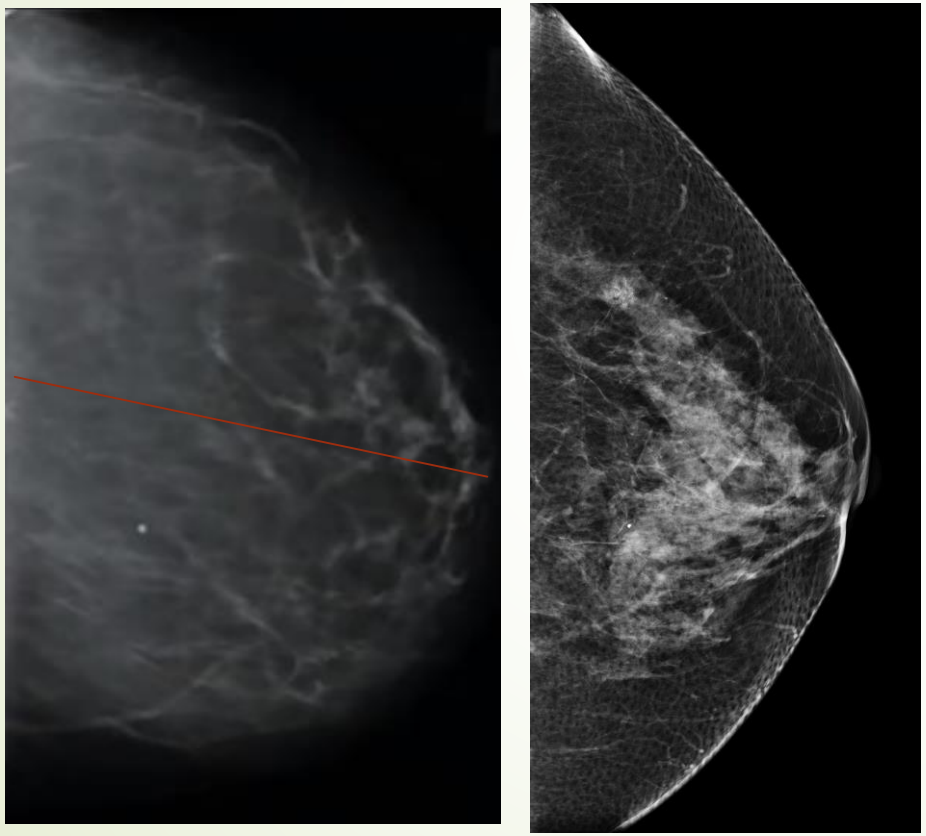


karcinom prikazan tek na naknadnoj CC snimci s uvlačenjem lateralnog dijela dojke



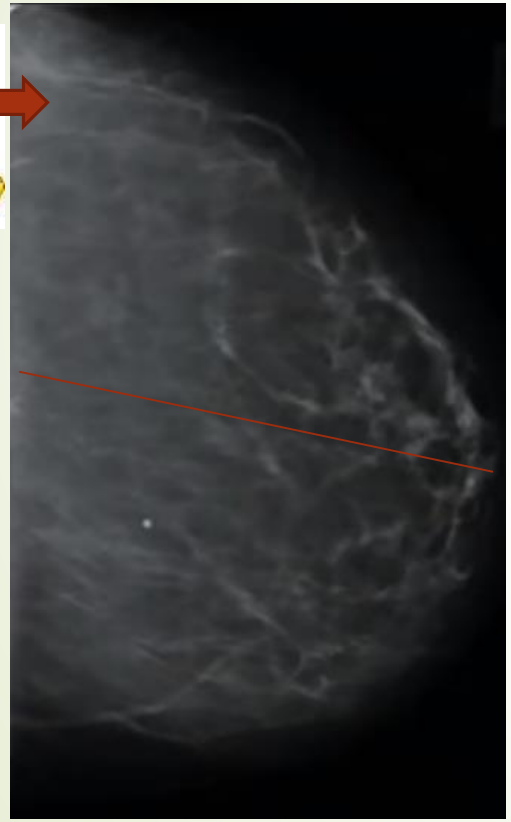


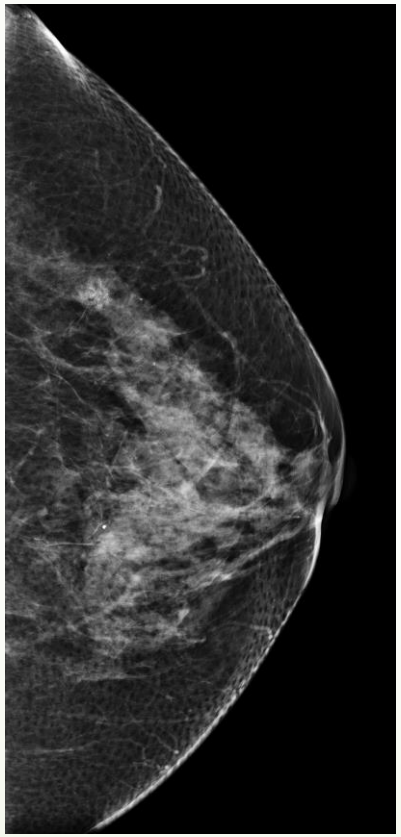
Prikaz lateralnog dijela dojke na CC-snimci ne smije biti na račun prikaza medijalnog dijela dojke



- Nema prikaza pektoralisa
- Nema medijalnog nabora

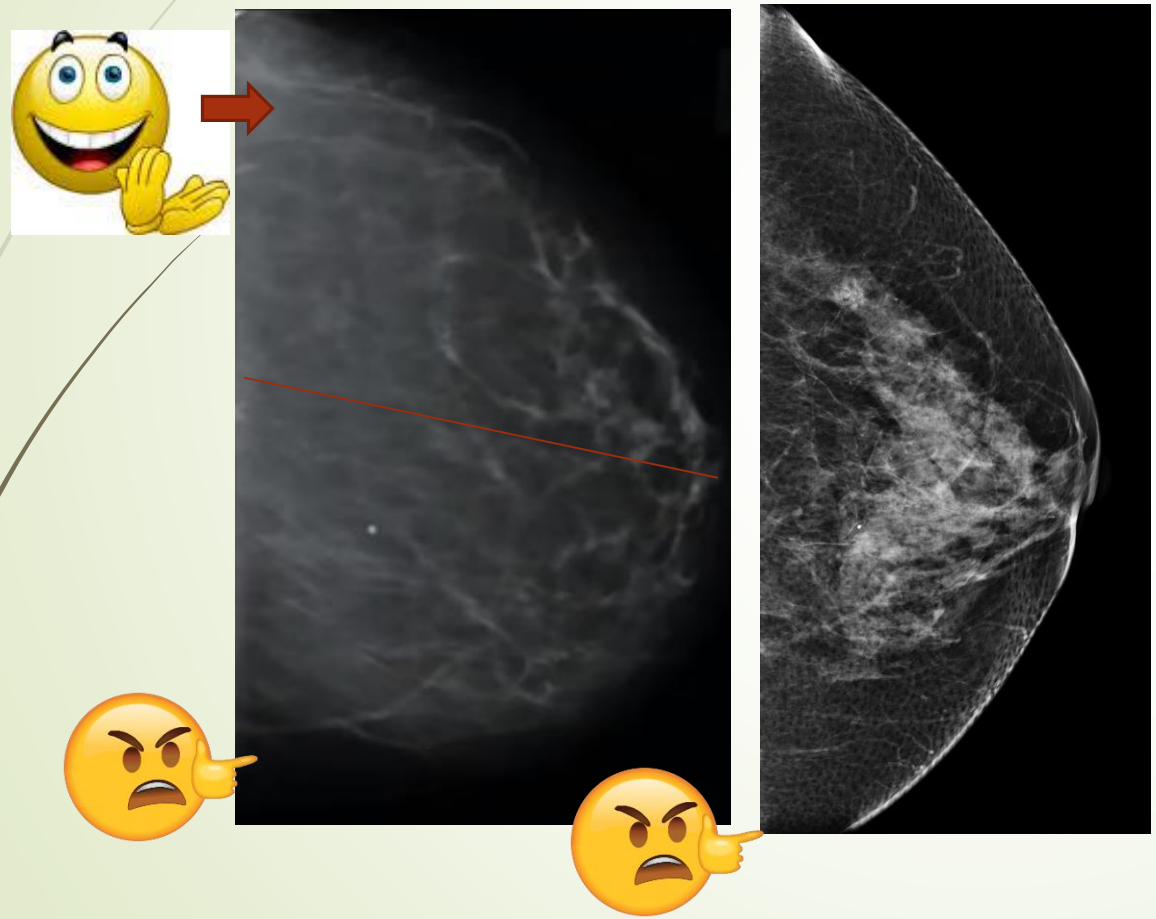
Prikaz lateralnog dijela dojke na CC-snimci ne smije biti na račun prikaza medijalnog dijela dojke





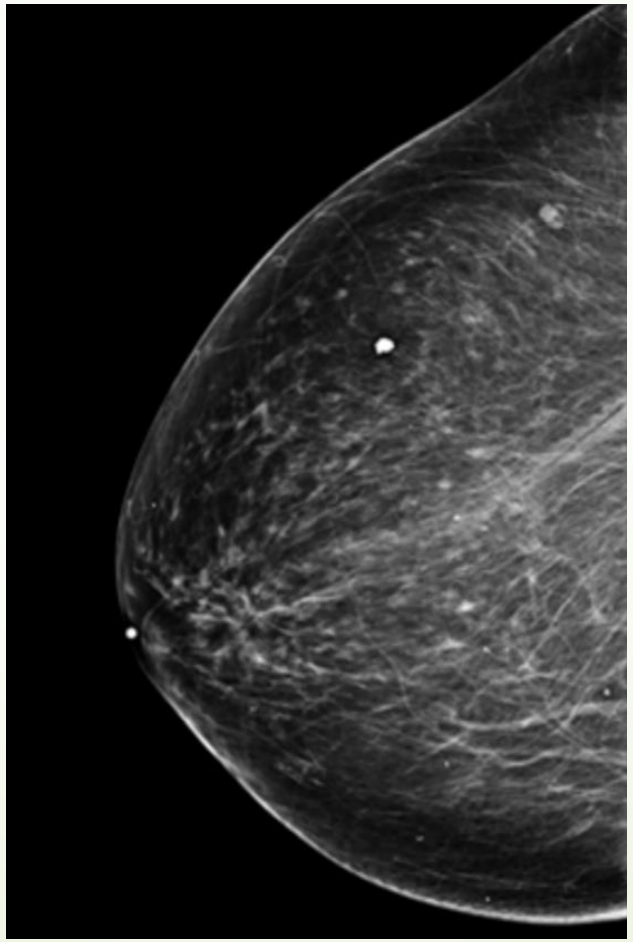
- Nema prikaza pektoralisa
- Nema medijalnog nabora

Prikaz lateralnog dijela dojke na CC-snimci ne smije biti na račun prikaza medijalnog dijela dojke



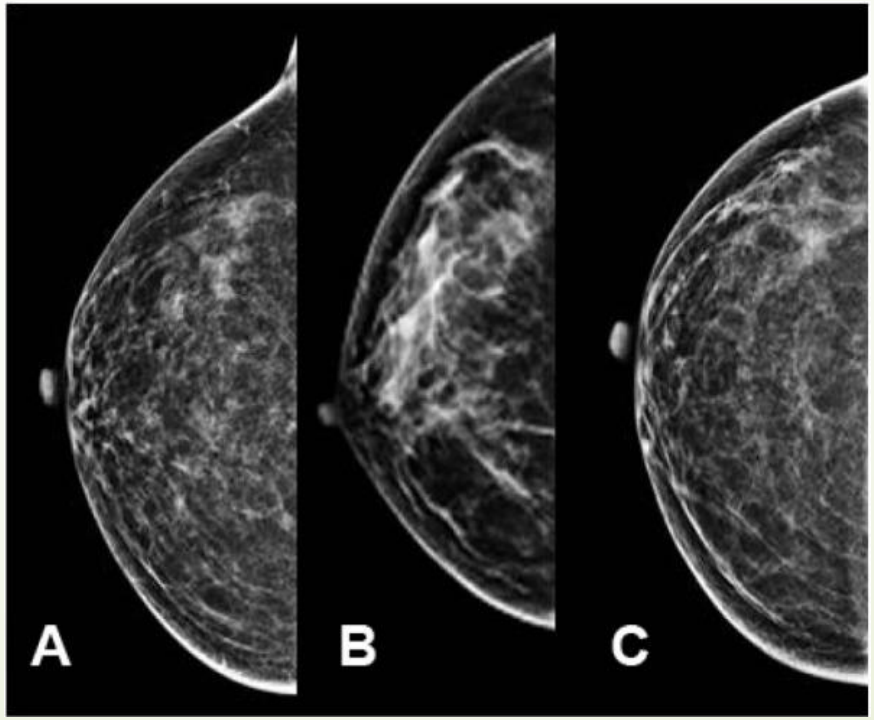
- Nema prikaza pektoralisa
- Nema medijalnog nabora

Prikaz lateralnog dijela dojke na štetu medijalnog + nabor kože



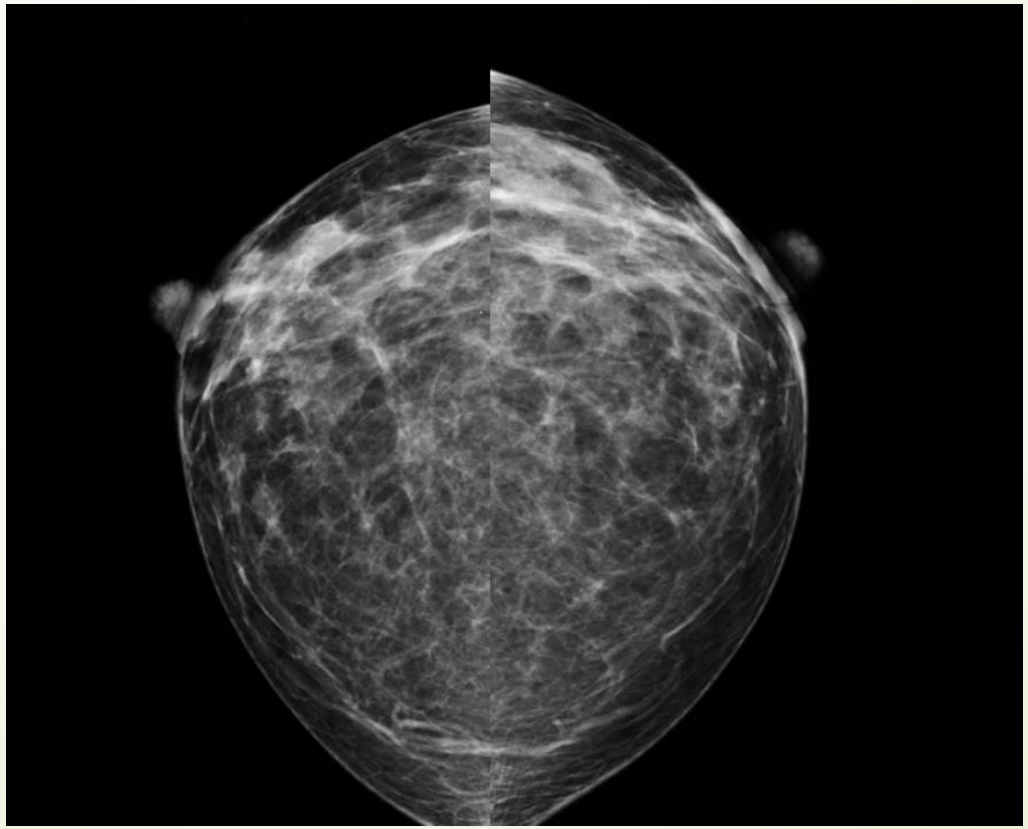
Mamila na CC-snimci treba biti **centrirana** i prikazana **u profilu**

- Mamila centrirana (A), usmjerena prema medijalno (B) i lateralno (C)
- Ako je *visina receptora slike* neadekvatna, mamila se može okrenuti **prema gore i superponirati s parenhimom**



Mamila na CC-snimci treba biti **centrirana** i prikazana **u profilu**

- Ako su medijalni ili lateralni dio dojke „puniji" tada mamila ne mora biti centrirana, ali to treba evidentirati u popratnoj dokumentaciji uz snimku



Mamila na CC-snimci treba biti **centrirana** i prikazana **u profilu**

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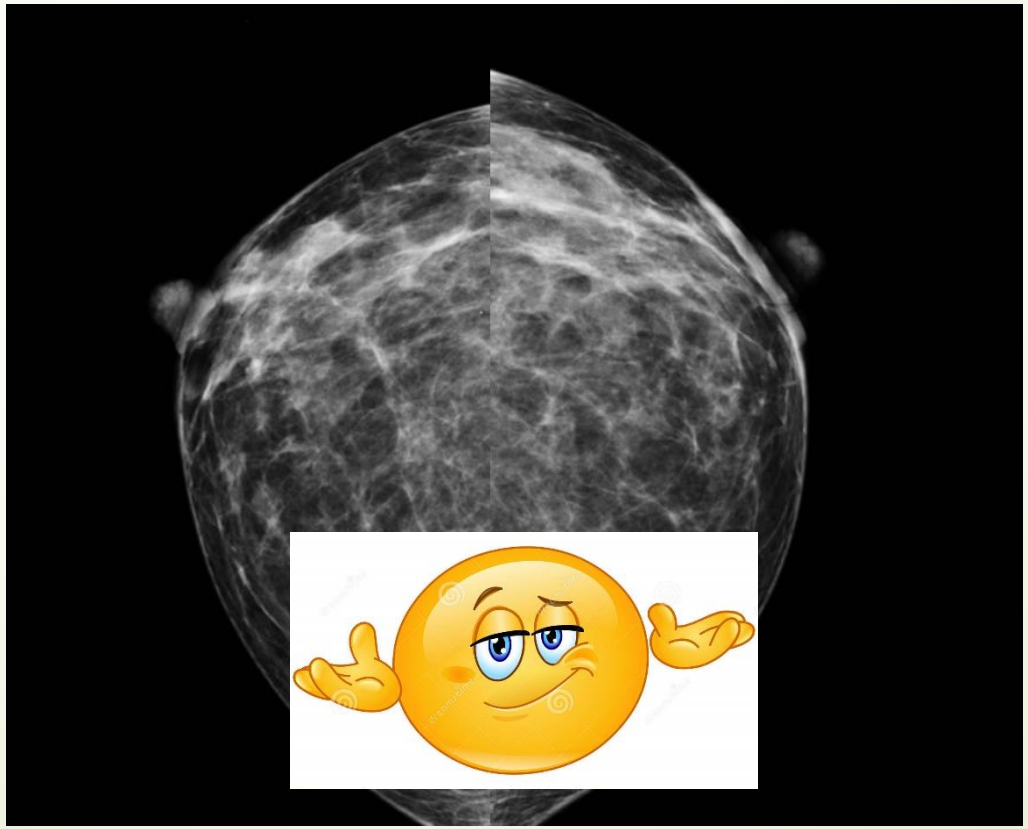
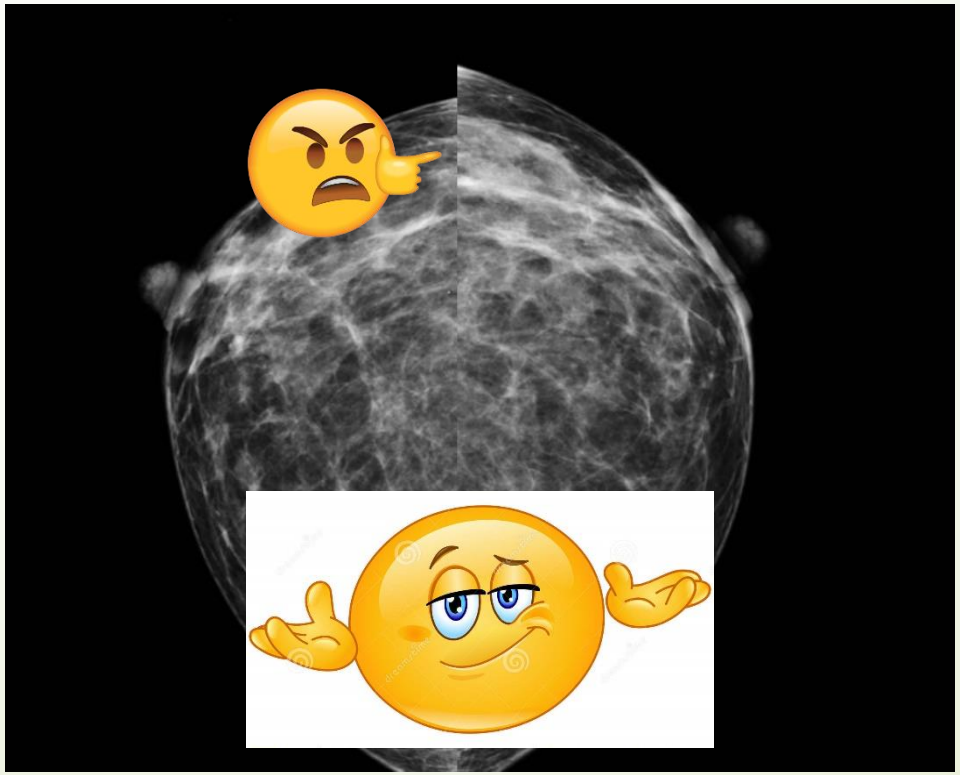


Mamila na CC-snimci treba biti **centrirana** i prikazana **u profilu**

- Ako su medijalni ili lateralni dio dojke „puniji" tada mamila ne mora biti centrirana, ali to treba evidentirati u popratnoj dokumentaciji uz snimku

Nije prihvatljivo žrtvovati prikaz dijela tkiva dojke radi idealnog prikaza mamile…

Bolje je učiniti dodatnu snimku ako je ona zaista opravdana…



Minimalni zahtjev: Mamila prikazana u profilu ***barem na jednoj projekciji dojke*** CC ili MLO

Mamila nije u profilu

- Uzrok može biti prenisko postavljen receptor slike

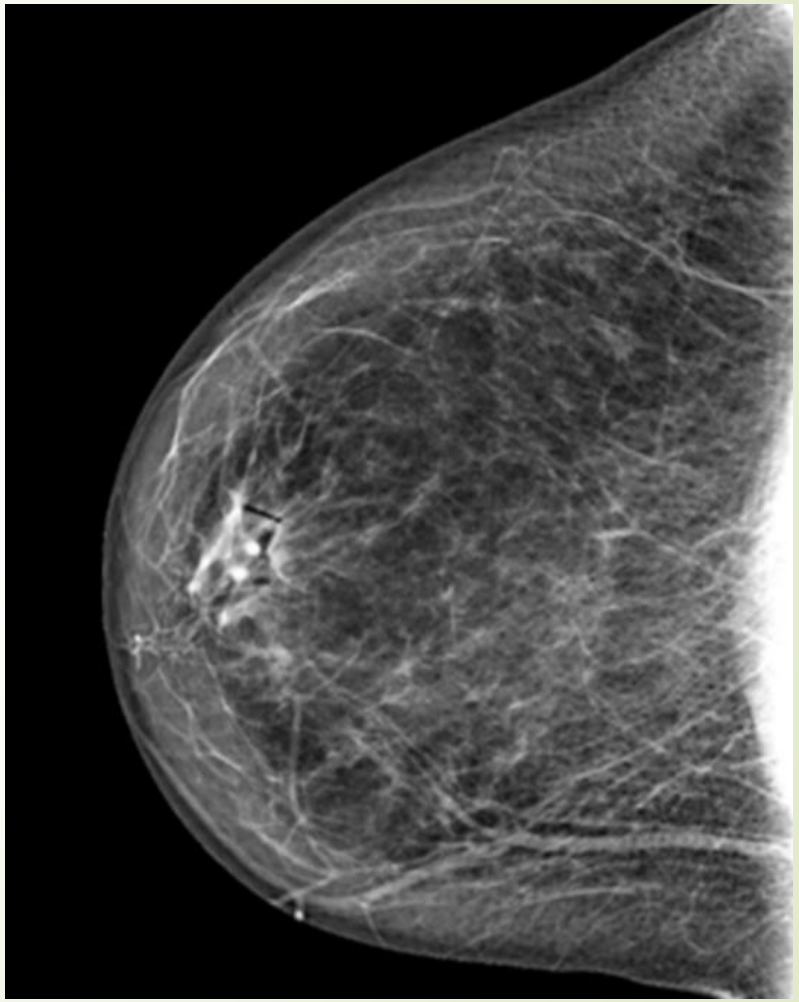
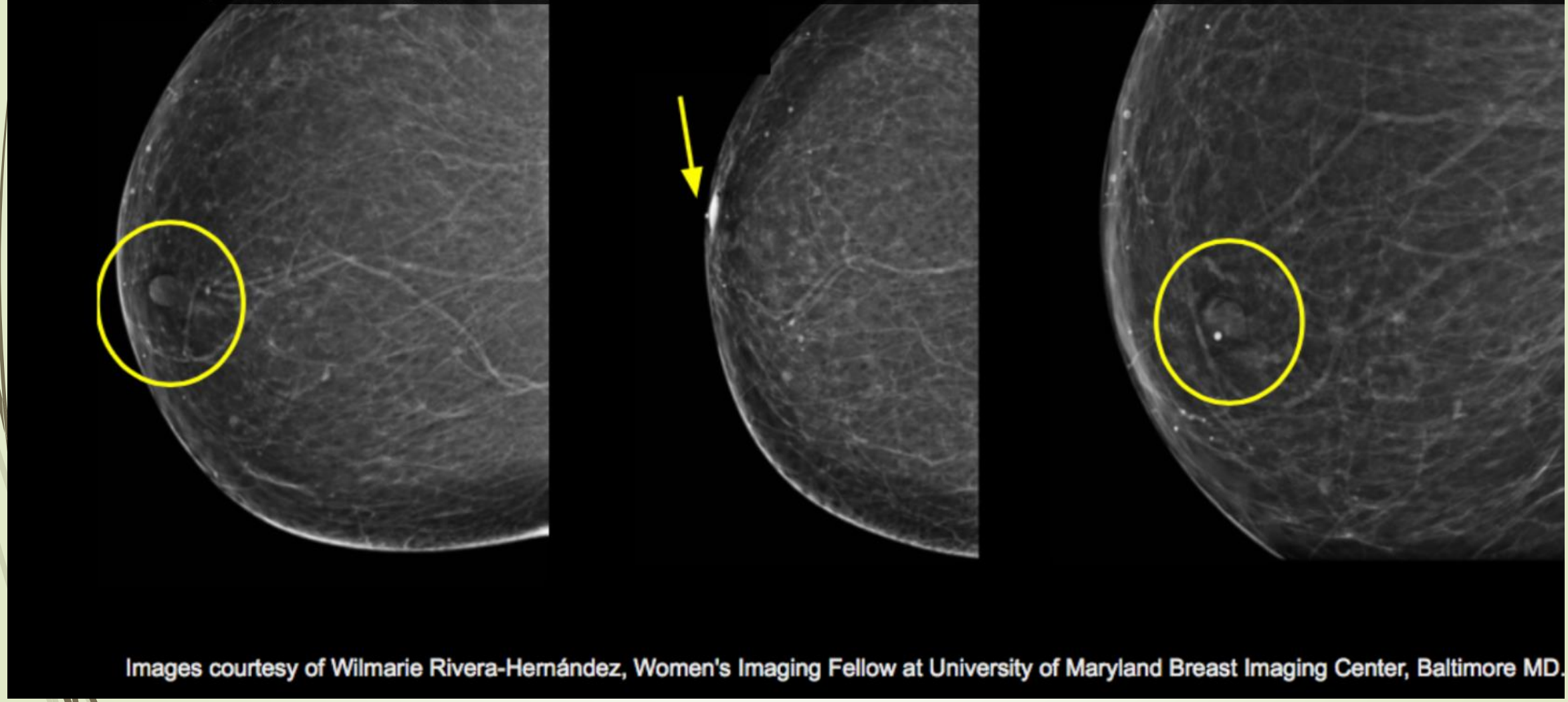
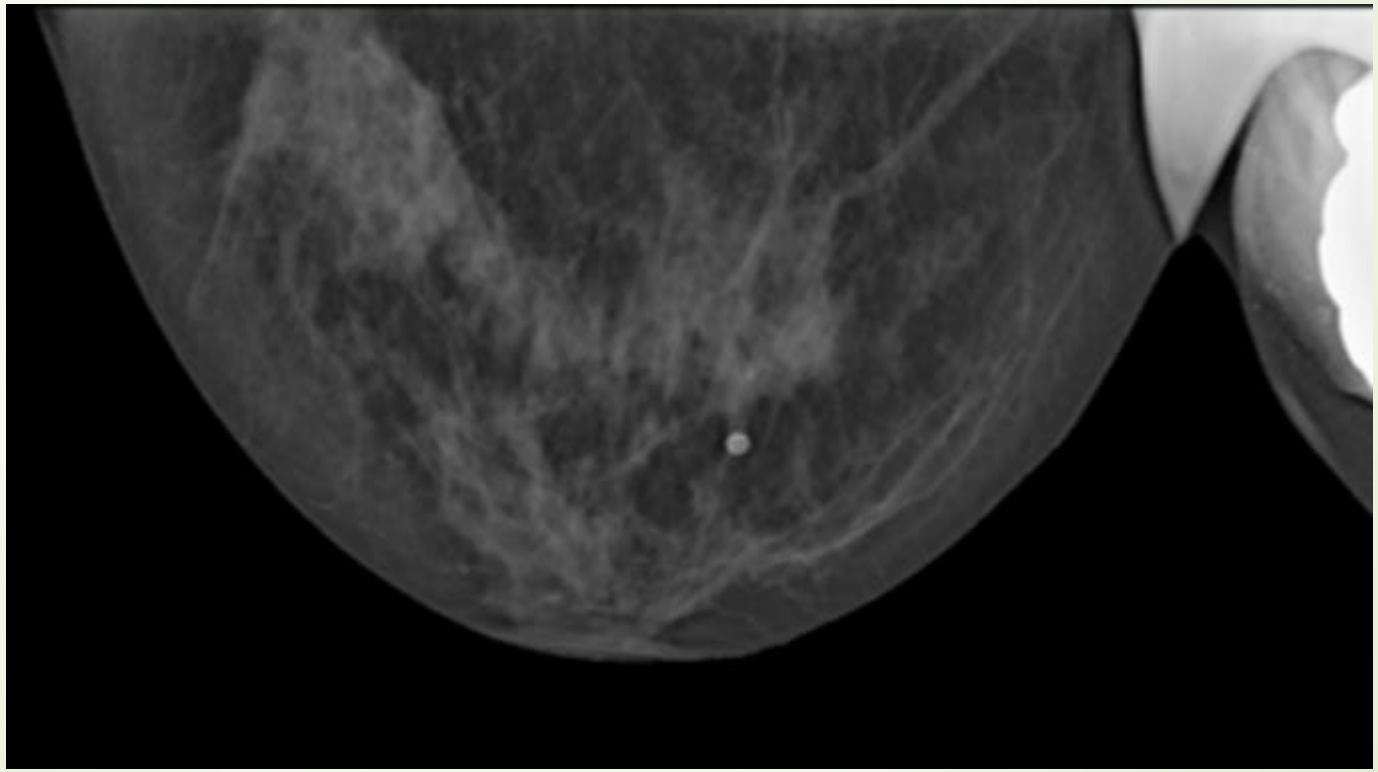


Fig. 18: Adequate Nipple Positioning. In some patients, positioning the nipple in profile can be technically challenging. In order to prevent misdiagnosis of a nipple projecting over the breast pa
a mass, the technologist have several options. The first one should be obtaining a nipple in profile dedicated view; however, if technically not possible, additional CC and MLO views should be c
BB marker placed over the nipple. This case shows a technically inadequate MLO view (left) with the two possible solutions: dedicated nipple in profile view with BB marker (middle) and placem
marker in the nipple before repeating the MLO view (far right).
References: University of Maryland Breast Imaging Center



Images courtesy of Wilmarie Rivera-Hernández, Women's Imaging Fellow at University of Maryland Breast Imaging Center, Baltimore MD.

Superpozicija dijelova glave pacijentice



MaxView® system, PlanMed

- Sustav motorizirane kompresije s dvije pokretne radiotransparentne vrpce iznad i ispod dojke koje uvlače dojku pod kompresijsku ploču
- Naročito korisno za bolje pozicioniranje malih i gustih dojki, koje se često izvuku iz polja snimanja kod kompresije

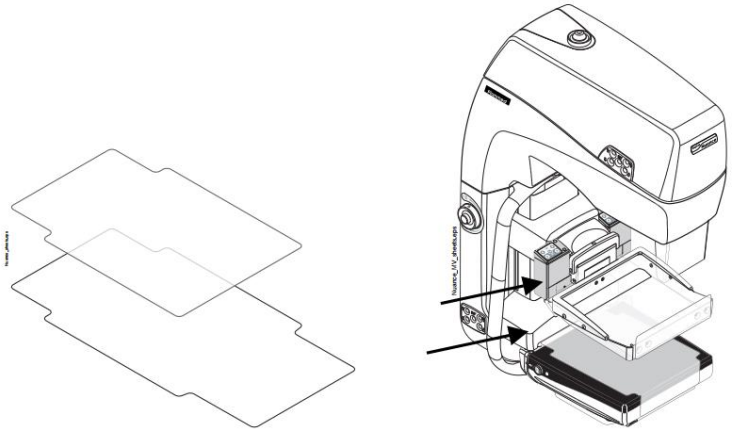
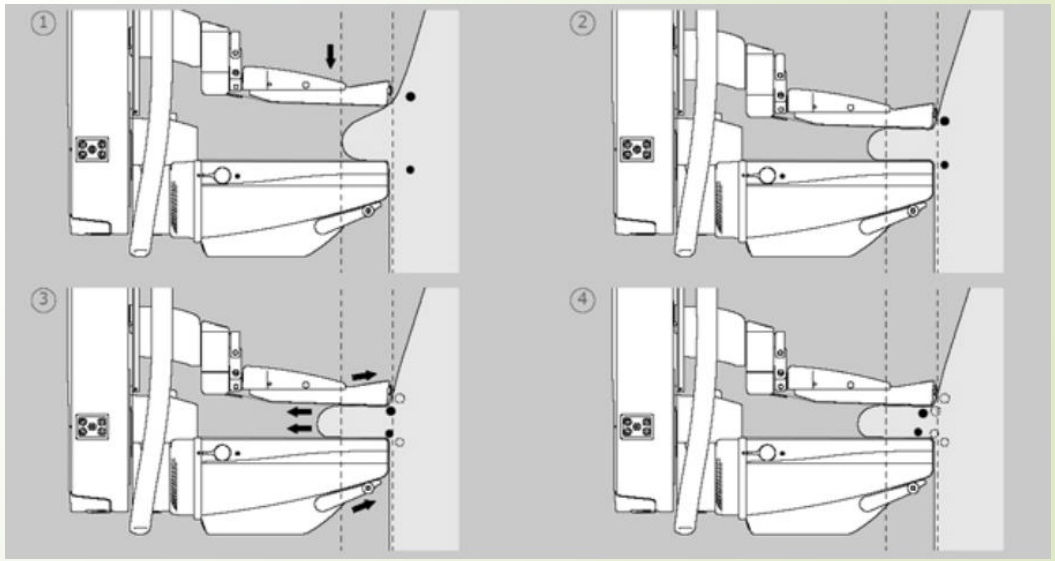
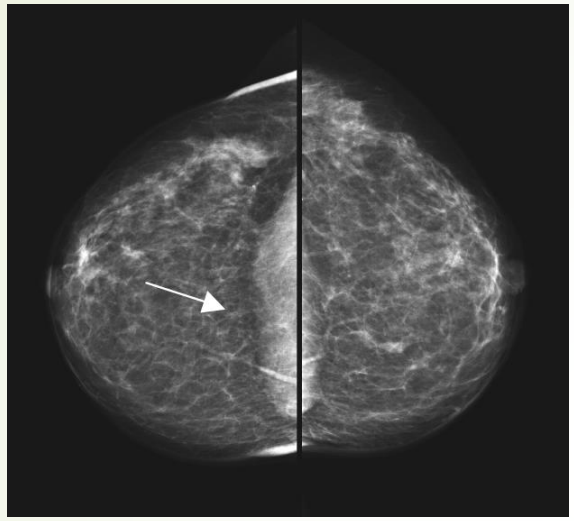


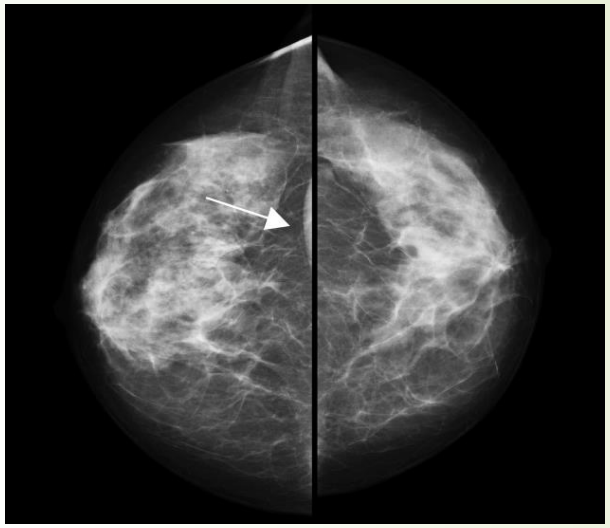
Figure 3a. Breast positioning system's hygienic radiolucent sheets (upper and lower sheet). Sheets can be moved together or separately[7].

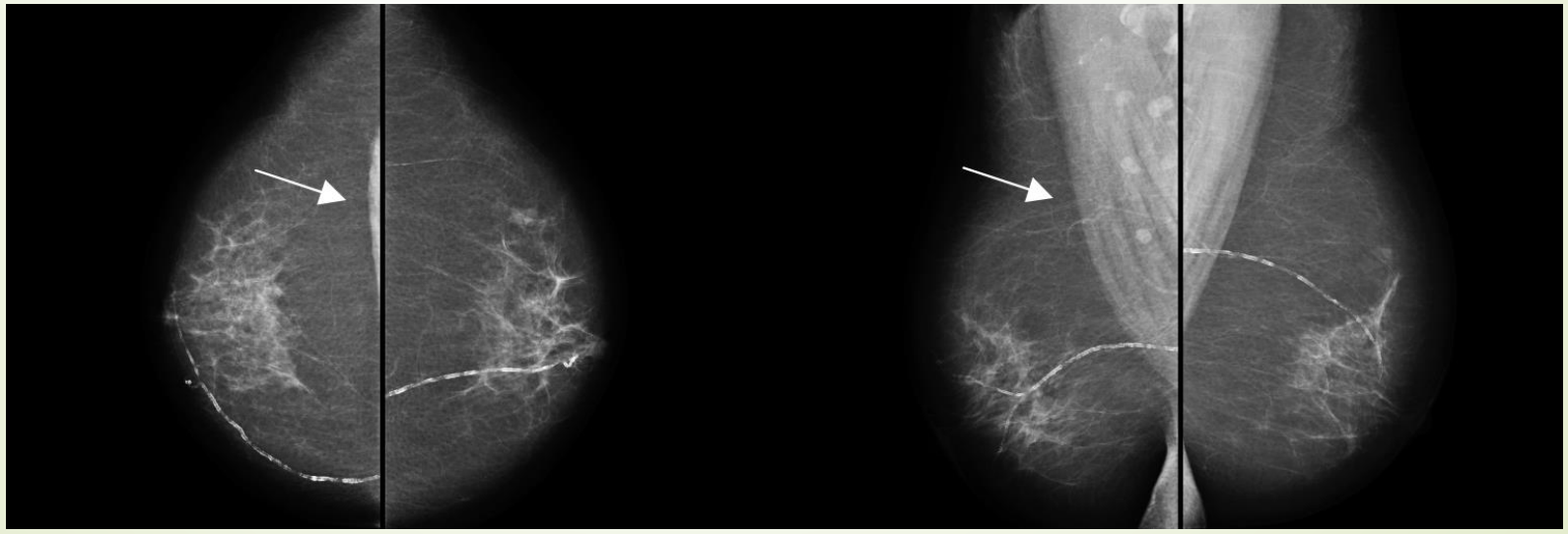
Figure 3b. Breast positioning system has two traction modules, upper and lower. The upper module is fitted with a compression paddle and the lower module is integrated to the FFDM system[7].



Motorised vs standard compression paddle







Zadnja velika studija pozicioniranja konvencionalne film-folija mamografije (1993)

Radiology. 1993 Sep;188(3):803-6.

Mammographic positioning: evaluation from the view box.

Bassett LW[1], Hirbawi IA, DeBruhl N, Hayes MK.

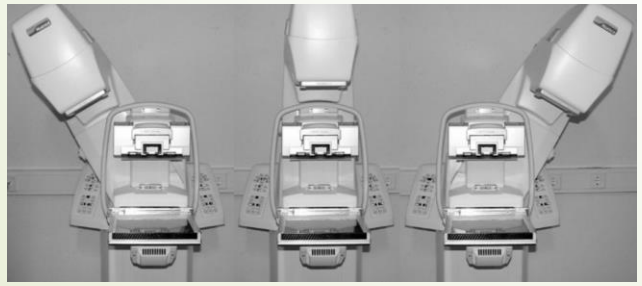
Author information

Abstract

To evaluate the quality of breast positioning for mediolateral oblique (MLO) and craniocaudal (CC) views, a prospective study of 1,000 consecutive bilateral screening mammographic examinations was performed. Six criteria were tested, including depth of tissue seen, inferior extent of the pectoral muscle relative to the posterior nipple line, presence of fibroglandular tissue at the posterior edge of the film, and whether the nipple was in profile. Pectoral muscle was depicted to within 1 cm of the nipple line or below it on 1,612 of the 2,000 MLO mammograms (81%); all fibroglandular tissue was depicted on 1,532 MLO mammograms (77%). The depth of tissue depicted on the CC mammogram was within 1 cm greater or less than the depth on the MLO mammogram on 1,586 CC mammograms (79%); the pectoral muscle was seen on 646 CC mammograms (32%). The nipple was in profile in 1,769 MLO mammograms (88%) and 1,783 CC mammograms (89%) but not in profile in either view in 83 cases (4%). Overall improvement was seen in 400 of 587 examinations (68%) when new mammograms were compared with previous mammograms. These criteria can be used to evaluate positioning performance and for quality control.

Pozicioniranje – što novo donosi FFDM/DBT
Huppe et al AJR 2017

- Ranije ustanovljeni kriteriji kvalitete primjenjivi su i kod FFDM / DBT uređaja, koji u usporedbi s konvencionalnim FSM uređajima imaju drukčije gabarite sklopa detektora slike i štitova za lice – pozicioniranje postaje zahtjevnije
- Detektori slike kod DBT su 49% dulji i 80% deblji u usporedbi s analognim Buckyjem



Mammography Positioning Standards in the Digital Era: Is the Status Quo Acceptable?

Ashley I. Huppe[1]
Kelly L. Overman[2]
Jason B. Gatewood[1]
Jacqueline D. Hill[1]
Louise C. Miller[3]
Marc F. Inciardi[1]

OBJECTIVE. The objective of our study was to evaluate positioning of full-field digital mammography (FFDM) and digital breast tomosynthesis (DBT) compared with film-screen (FS) mammography positioning standards.

MATERIALS AND METHODS. A retrospective study was conducted of consecutive patients who underwent screening FFDM in 2010–2012 and DBT in 2012–2013 at an academic institution. Examinations were performed by five experienced technologists who underwent updated standardized positioning training. Positioning criteria were assessed by consensus reads among three breast radiologists and compared with FS mammography data from a 1993 study by Bassett and colleagues.

RESULTS. One hundred seventy patients ($n = 340$ examinations) were analyzed, showing significant differences between FFDM and DBT examinations ($p < 0.05$) for medial or inferior skin folds (FFDM vs DBT: craniocaudal [CC] view, 16% [$n = 56$] vs 23% [$n = 77$]; mediolateral oblique [MLO] view, 35% [$n = 118$] vs 45% [$n = 154$]), inclusion of lateral glandular tissue on CC view (FFDM vs DBT, 73% [$n = 247$] vs 81% [$n = 274$]), and concave pectoralis muscle shape (FFDM vs DBT, 36% [$n = 121$] vs 28% [$n = 95$]). In comparison with Bassett et al. data, all positioning criteria for both FFDM and DBT examinations were significantly different ($p < 0.05$). The largest differences were found in visualization of the pectoralis muscle on CC views and the inframammary fold on MLO views, inclusion of posterior or lateral glandular tissue, and inclusion of skin folds, with DBT and FFDM more frequently exhibiting all criteria than originally reported Bassett et al. findings.

CONCLUSION. DBT and FFDM mammograms more frequently include posterior or lateral tissue, the inframammary fold on MLO views, the pectoralis muscle on CC views, and skin folds than FS mammograms. Inclusion of more breast tissue with newer technologies suggests traditional positioning standards, in conjunction with updated standardized positioning training, are still applicable at the expense of including more skin folds.

Keywords: digital breast tomosynthesis, mammography,

Rijetke studije pozicioniranja FFDM i DBT

Breast Positioning during Mammography: Mistakes to be Avoided

Manju Bala Popli, Rahul Teotia, Meenakshi Narang and Hare Krishna

Department of Radiological Imaging, Institute of Nuclear Medicine and Allied Sciences, Delhi, India.

2014

ABSTRACT

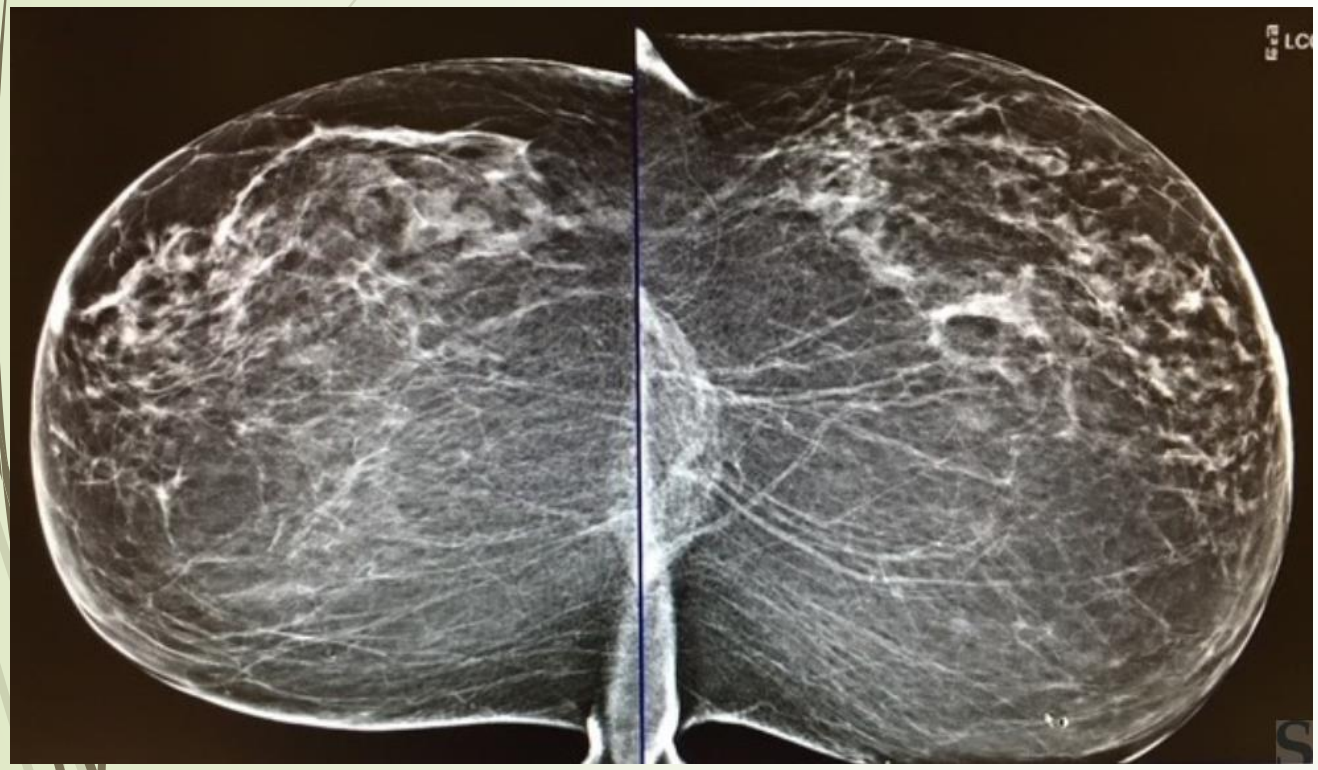
AIMS AND OBJECTIVES: Breast positioning is the key factor affecting a mammogram. If care is taken during positioning, it maximizes the amount of breast tissue being imaged, eliminates most of the artifacts, and increases sensitivity of the mammogram. This retrospective study was carried out in our department to assess correctness, and also the incorrectness of breast positioning, which need to be avoided to obtain an ideal mammogram.

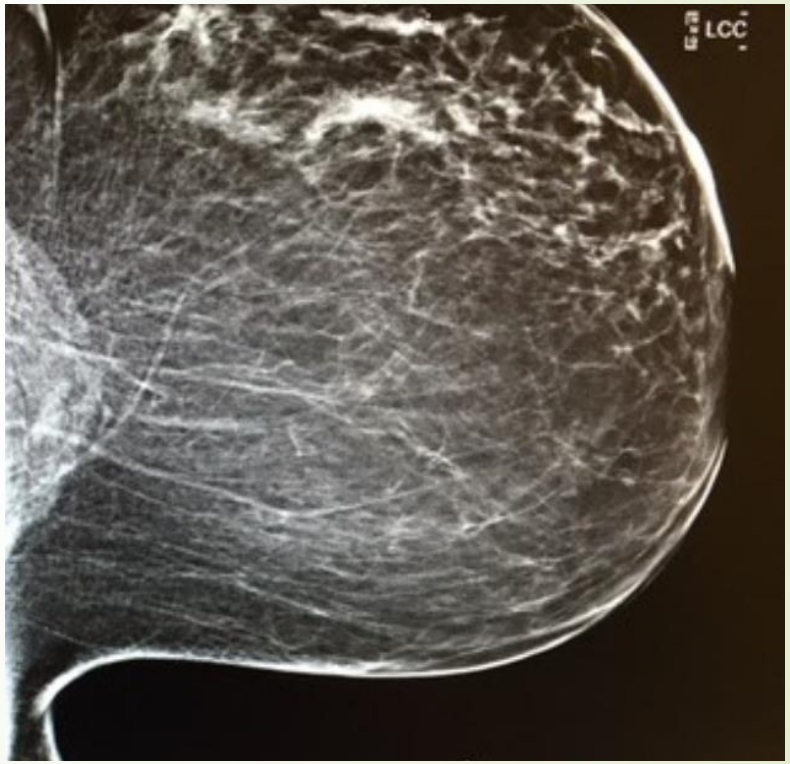
- 1369 žena, FFDM, CC + MLO
- Greške pozicioniranja nađene su u **2.9% mamograma**
  - Malpozicija mamile u 3.8% CC-snimci bila je najčešći problem
  - MLO-snimke: pektoralis nije viđen u 0.5%, konkavan u 0.7%, iznad PNL u 2.1%, nema inframamarnog nabora u 1.2%, nedostatan prikaz donjih kvadranata u 2.7%, neadekvatan PND u 3.8%.

Pozicioniranje
Posebne situacije

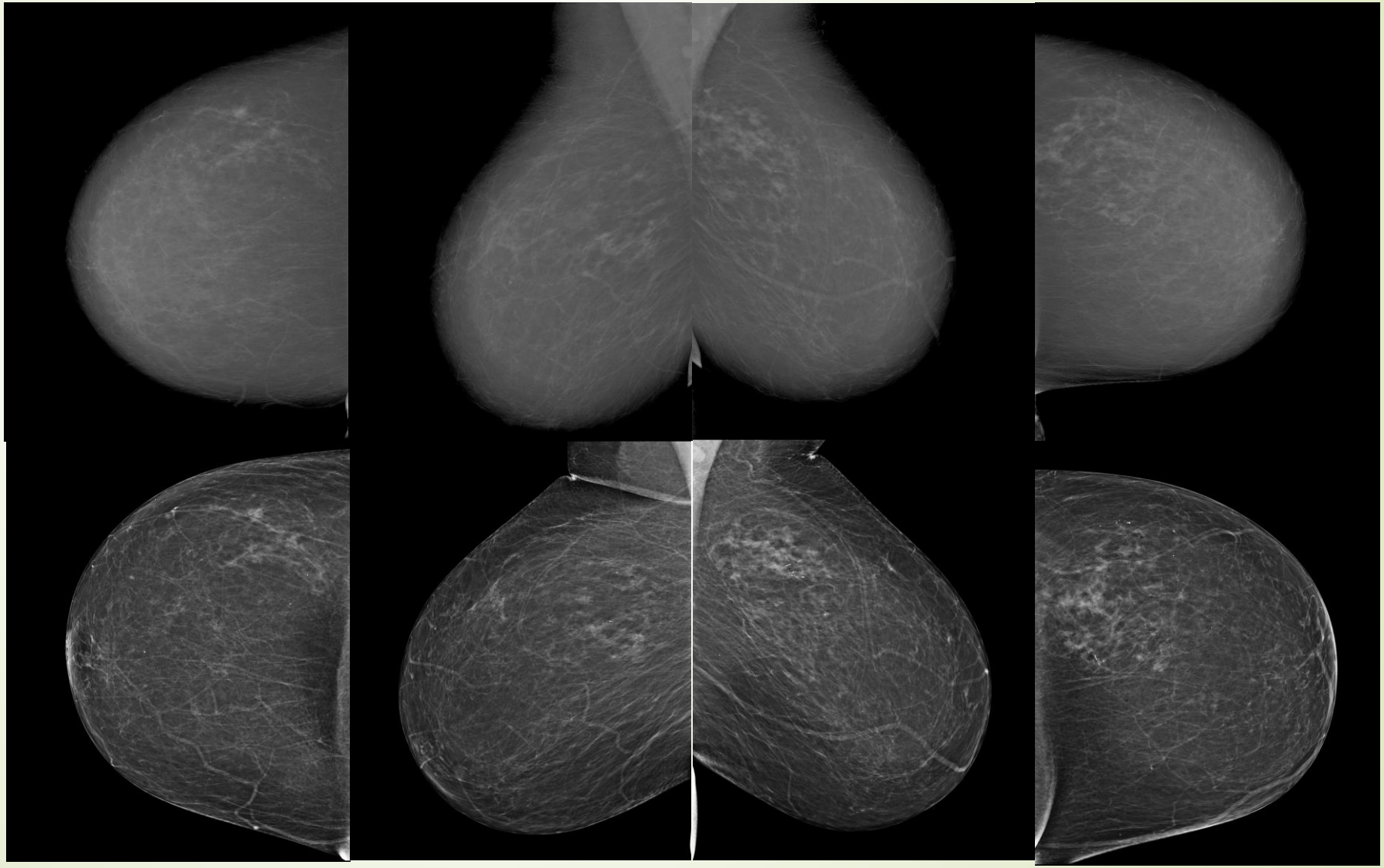
- Velike dojke
- Pretile pacijentice
- Male dojke
- Deformirane dojke
- Teška kifoza/skolioza
- Snimanje u kolicima
- Nesuradljivi pacijent

Velike dojke



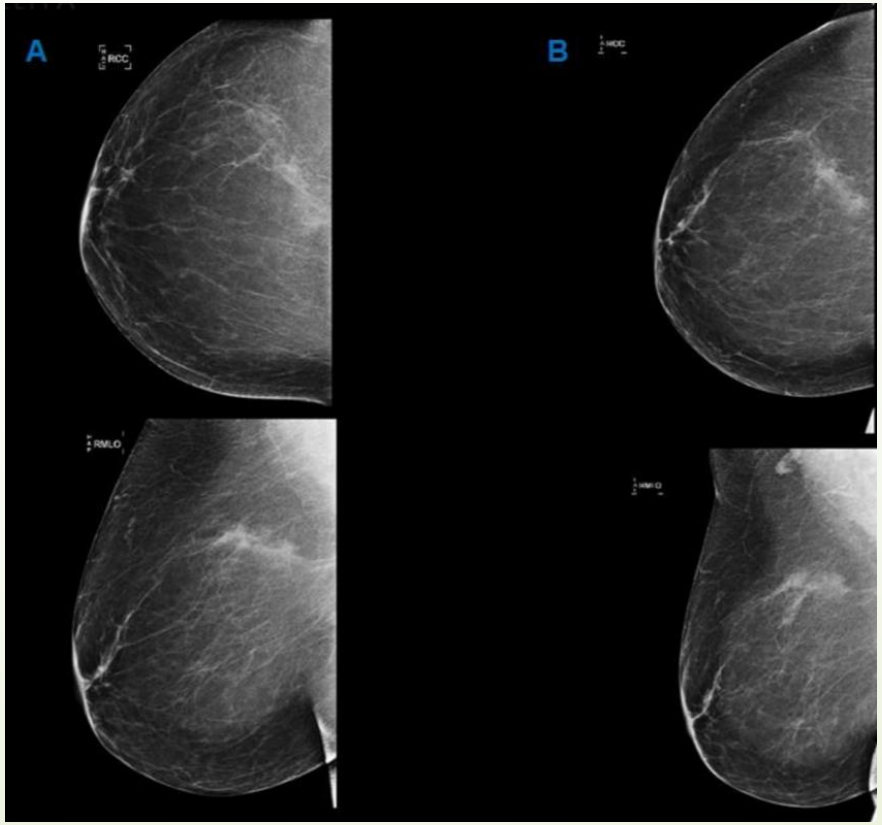


Velike dojke



Uporaba neadekvatnog formata receptora slike

- Dovodi do isključenja tkiva GLK

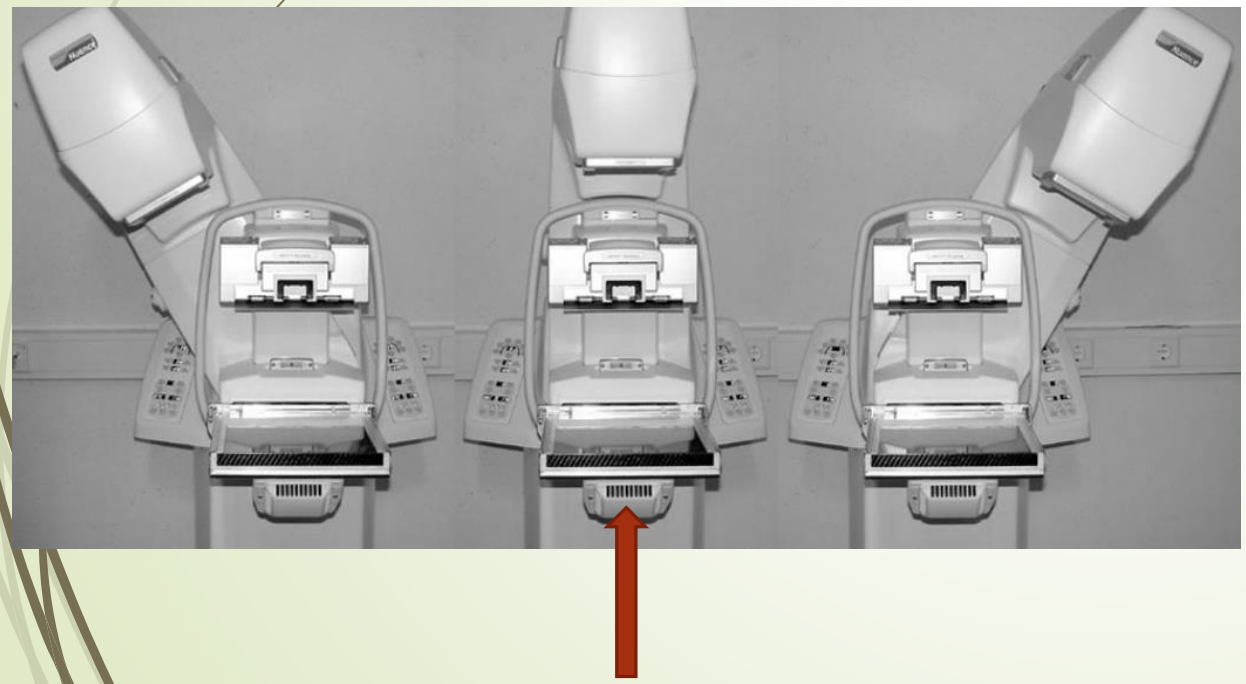


Matching breast and detector size (large Bucky availability)

- mismatch in breast and detector size (lack of large size image detector) results in
  - higher MGD and
  - number of views, especially in screening
  - image cutoff may result in missing cancer
- large breast imaged on small vs large detector
  - MGD: 4.9 vs 3.3 mGy
  - number of views: 5.9 vs 4.6 (Wells et al Acad Radiol 2014)

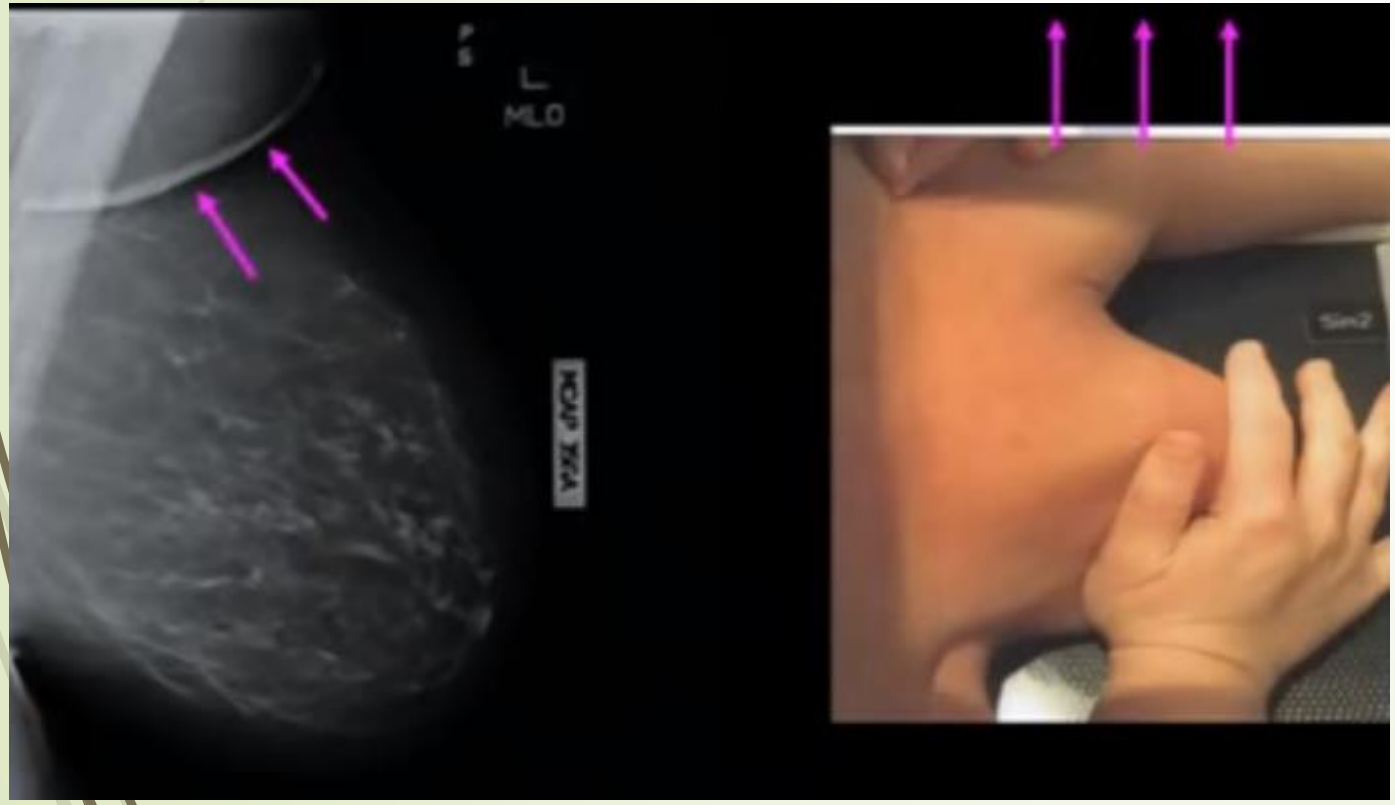
Problem trbuha

- Abdomen može ometati prikaz medijalnog nabora dojke



Nadlaktični nabor

- Potkožno masno tkivo nadlaktice kod pretilih žena koje se preklapa preko elevirane dojke treba pokušati povući prema kranijalno



ELSEVIER

CrossMark

Canadian Association of Radiologists Journal 65 (2014) 199–206

CANADIAN ASSOCIATION OF RADIOLOGISTS JOURNAL

www.carjonline.org

Thoracic and Cardiac Imaging / Imagerie cardiaque et imagerie thoracique

Clinical Image Quality in Daily Practice of Breast Cancer Mammography Screening

Marie-Hélène Guertin, MSc[a,*], Isabelle Théberge, MSc[a], Michel-Pierre Dufresne, MD, FRCP[b], Hervé Tchala Vignon Zomahoun, MSc[c], Diane Major, PhD[a], Richard Tremblay, MSc[d], Carmen Ricard, TIM[e], Rene Shumak, MD, FRCP(C)[f], Nancy Wadden, FRCP[g], Éric Pelletier, MSc[a], Jacques Brisson, MD, DSc[h,i]

Table 4
Associations of overall image quality and positioning failures with BMI and breast density

	No. of mammograms	Radiologist 1		Radiologist 2		Final score[a]	
		% Fail	Adjusted RR (95% CI)[b]	% Fail	Adjusted RR (95 % CI)[b]	% Fail	Adjusted RR(95 CI)[b]
Overall quality failure							
Total	197	67.0		48.7		49.7	
BMI							
<25 kg/m^2	86	58.1	1.0	30.2	1.0	34.9	1.0
25 to < 30 kg/m^2	71	71.8	1.3 (1.0-1.7)	54.9	1.7 (1.2-2.5)	57.7	1.8 (1.2-2.5)
≥30 kg/m^2	40	77.5	1.5 (1.2-1.9)	77.5	2.3 (1.6-3.4)	67.5	2.1 (1.5-3.0)
Breast density							
<25%	46	65.2	1.0	73.9	1.0	54.3	1.0
25% to < 50%	83	61.4	1.0 (0.8-1.3)	48.2	0.7 (0.6-0.9)	50.6	1.0 (0.7-1.4)
50% to < 75%	53	71.7	1.3 (1.0-1.8)	30.2	0.6 (0.4-0.9)	41.5	1.0 (0.7-1.6)
≥75%	15	86.7	1.5 (1.1-2.2)	40.0	0.8 (0.4-1.5)	60.0	1.4 (0.8-2.4)
Positioning failure[c]							
Total	197	58.4		44.2		37.2	
BMI							
<25 kg/m^2	86	51.2	1.0	32.6	1.0	27.9	1.0
25 to < 30 kg/m^2	71	62.0	1.3 (1.0-1.7)	47.9	1.5 (1.0-2.1)	39.4	1.4 (0.9-2.2)
≥30 kg/m^2	40	67.5	1.5 (1.1-2.0)	62.5	1.8 (1.2-2.7)	53.8	1.9 (1.2-3.1)
Breast density							
<25%	46	60.9	1.0	65.2	1.0	51.1	1.0
25% to < 50%	83	50.6	0.9 (0.6-1.2)	39.8	0.7 (0.5-0.9)	31.3	0.6 (0.4-1.0)
50% to < 75%	53	64.2	1.3 (0.9-1.8)	34.0	0.7 (0.4-1.1)	34.0	0.8 (0.5-1.2)
≥75%	15	73.3	1.4 (0.9-2.1)	40.0	0.8 (0.4-1.4)	40.0	0.9 (0.4-1.8)

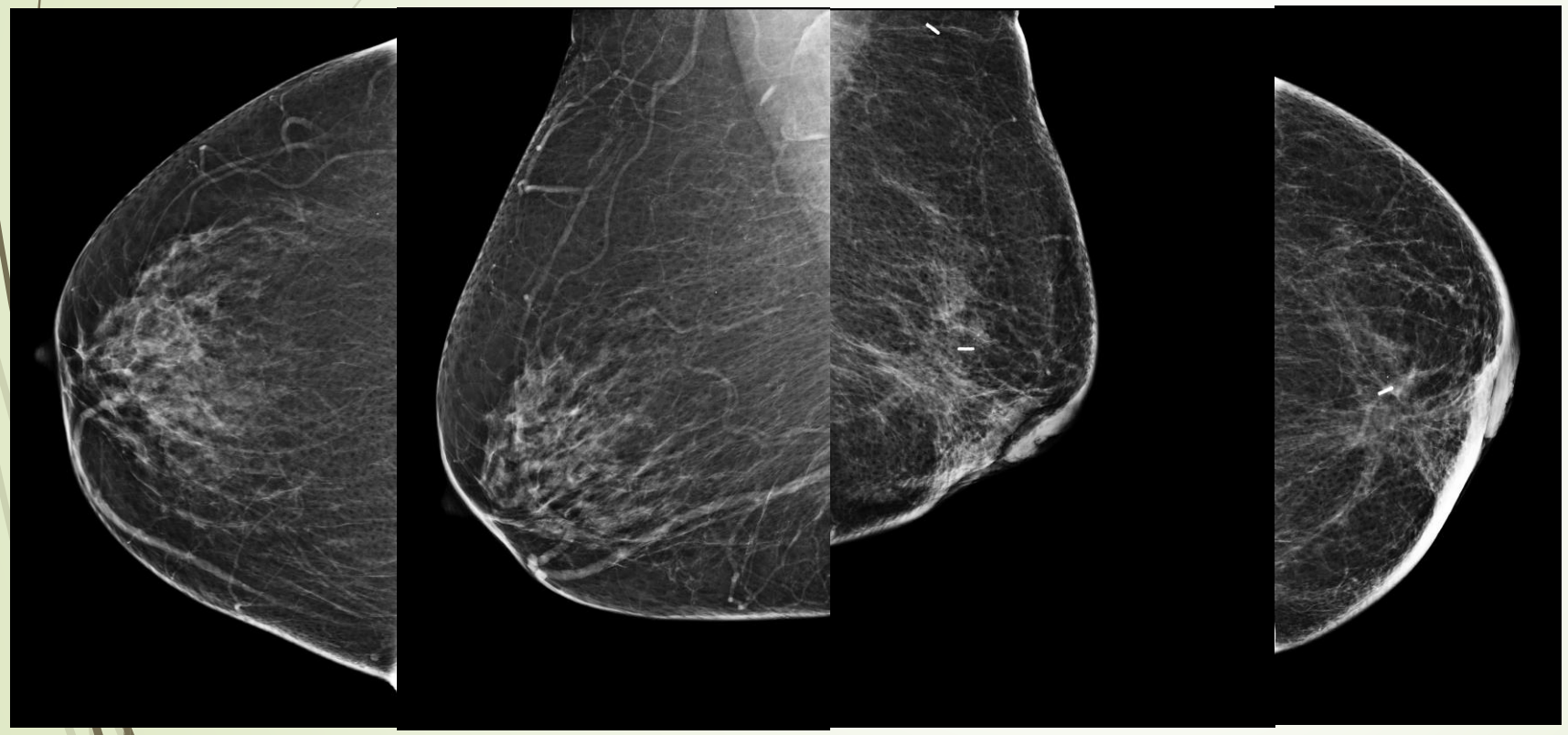
BMI = body mass index; CI = confidence interval; RR = risk ratio.

[a] The final score for positioning was missing for 1 mammogram; these analyses are based on 196 mammograms.

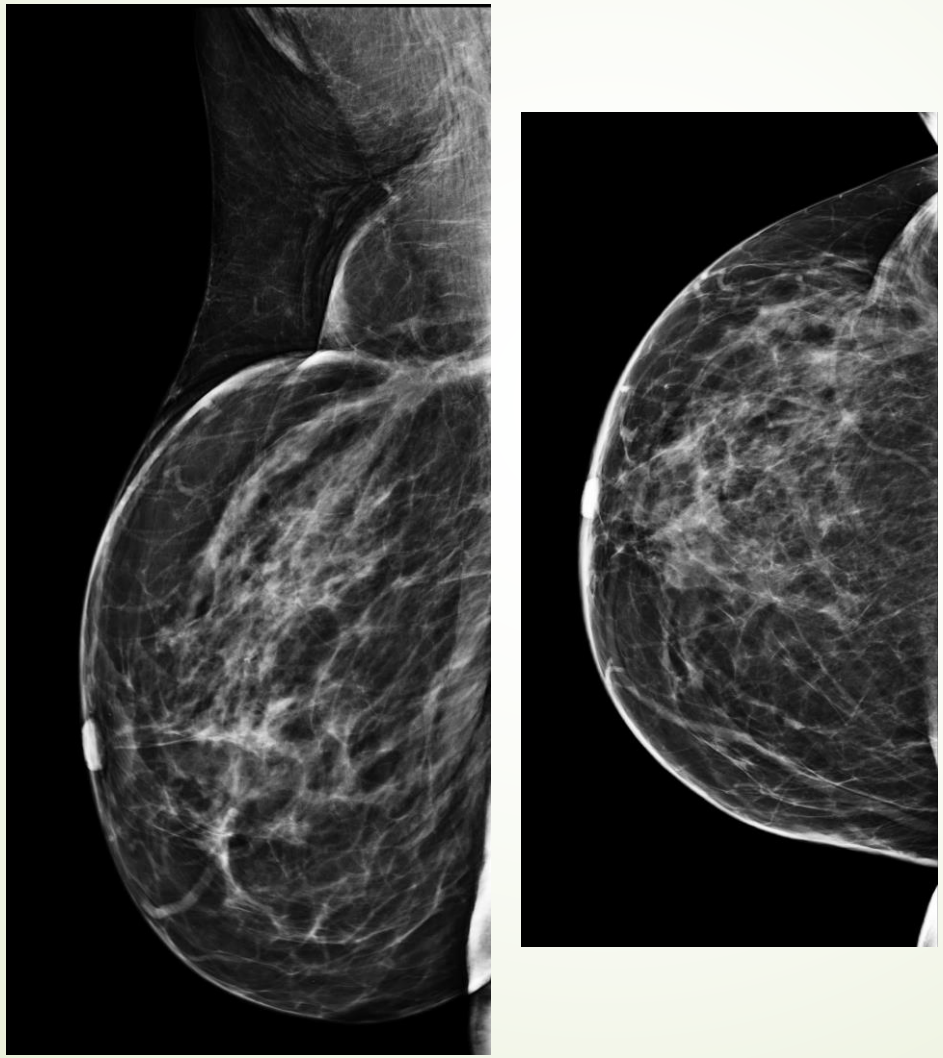
[b] Multivariate analyses include BMI, breast density, hormonal therapy use (current, past, or never), parity (yes, no), menopausal status, and age (50-54, 55-59, 60-64, 65-69 y).

Musculus latissimus dorsi

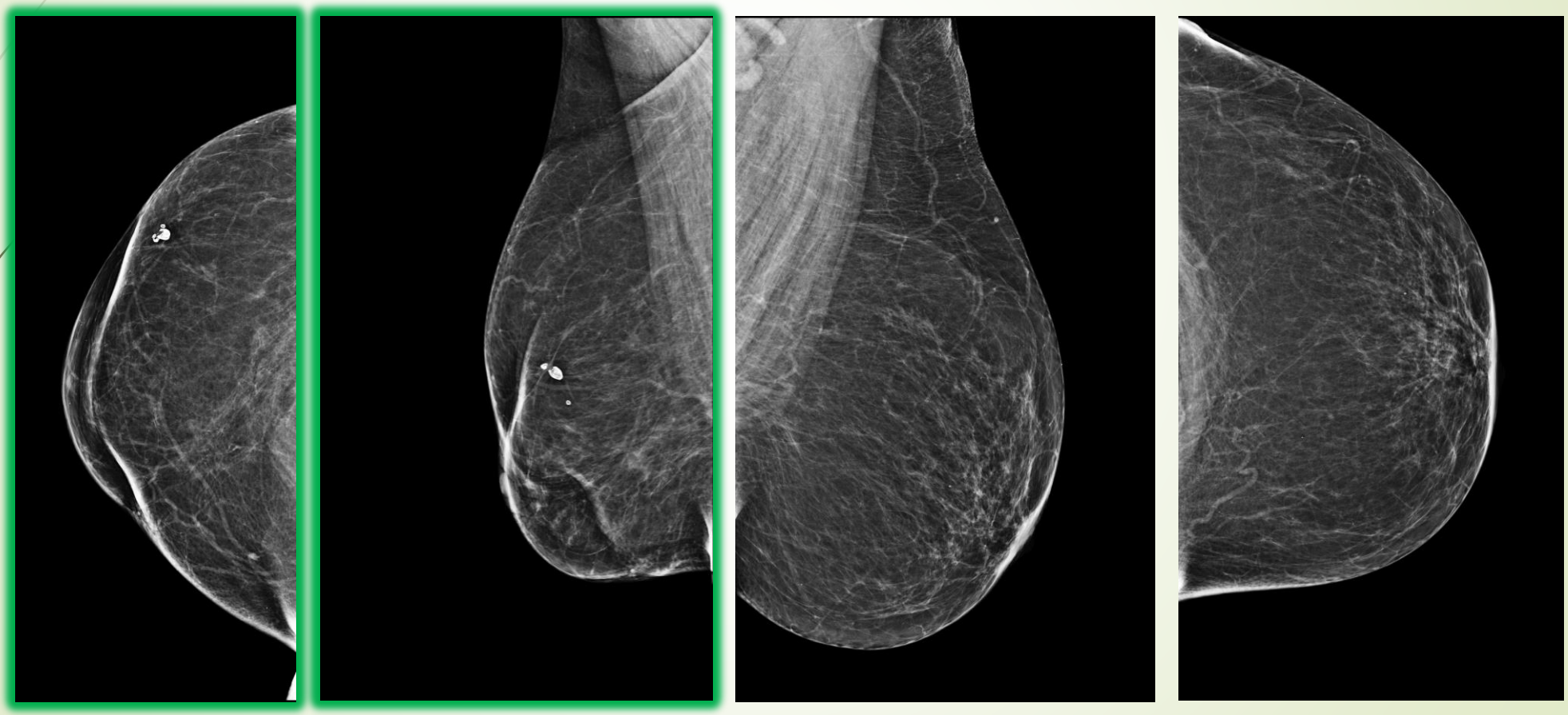
Postoperativno deformirana dojka



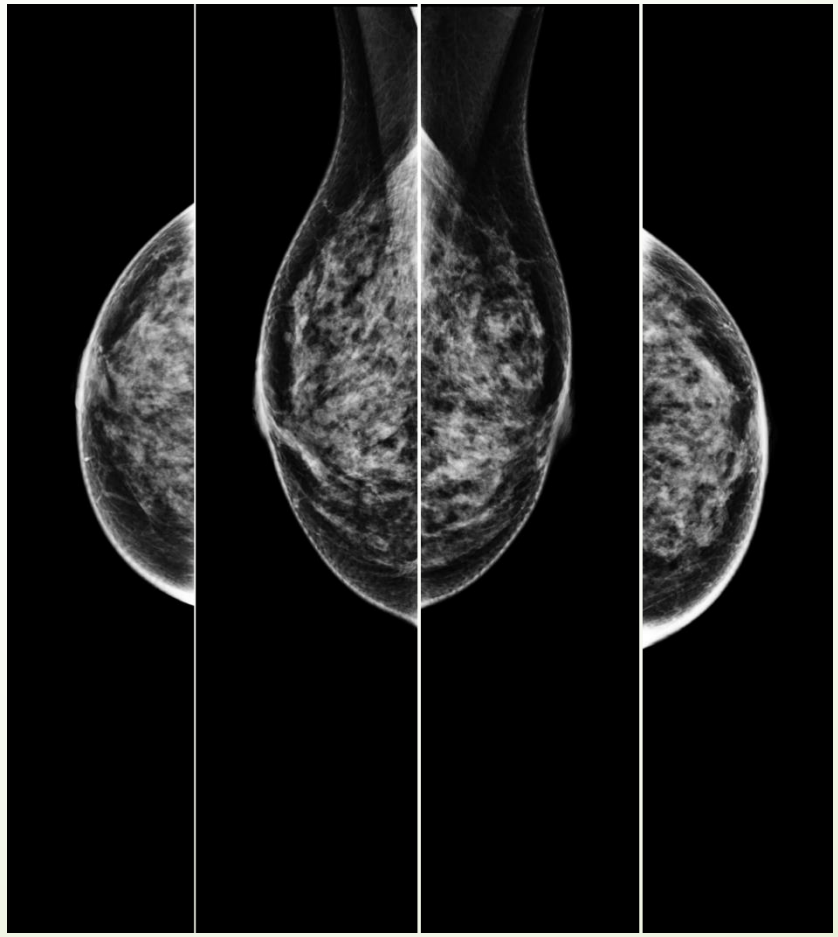
Postoperativno deformirana dojka



Dobar prikaz postoperativno deformirane dojke s obostrano prikazanim pektoralisom



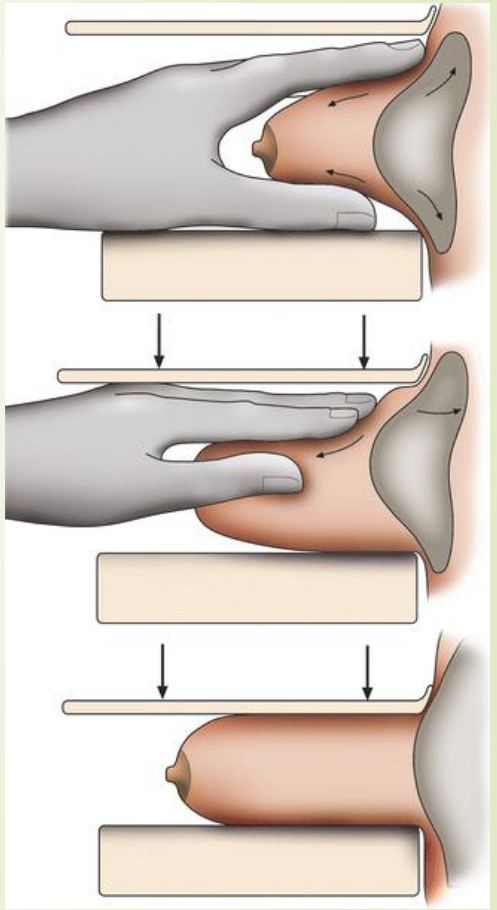
Male dojke



Dojke s implantatima – snimke po Eklundu

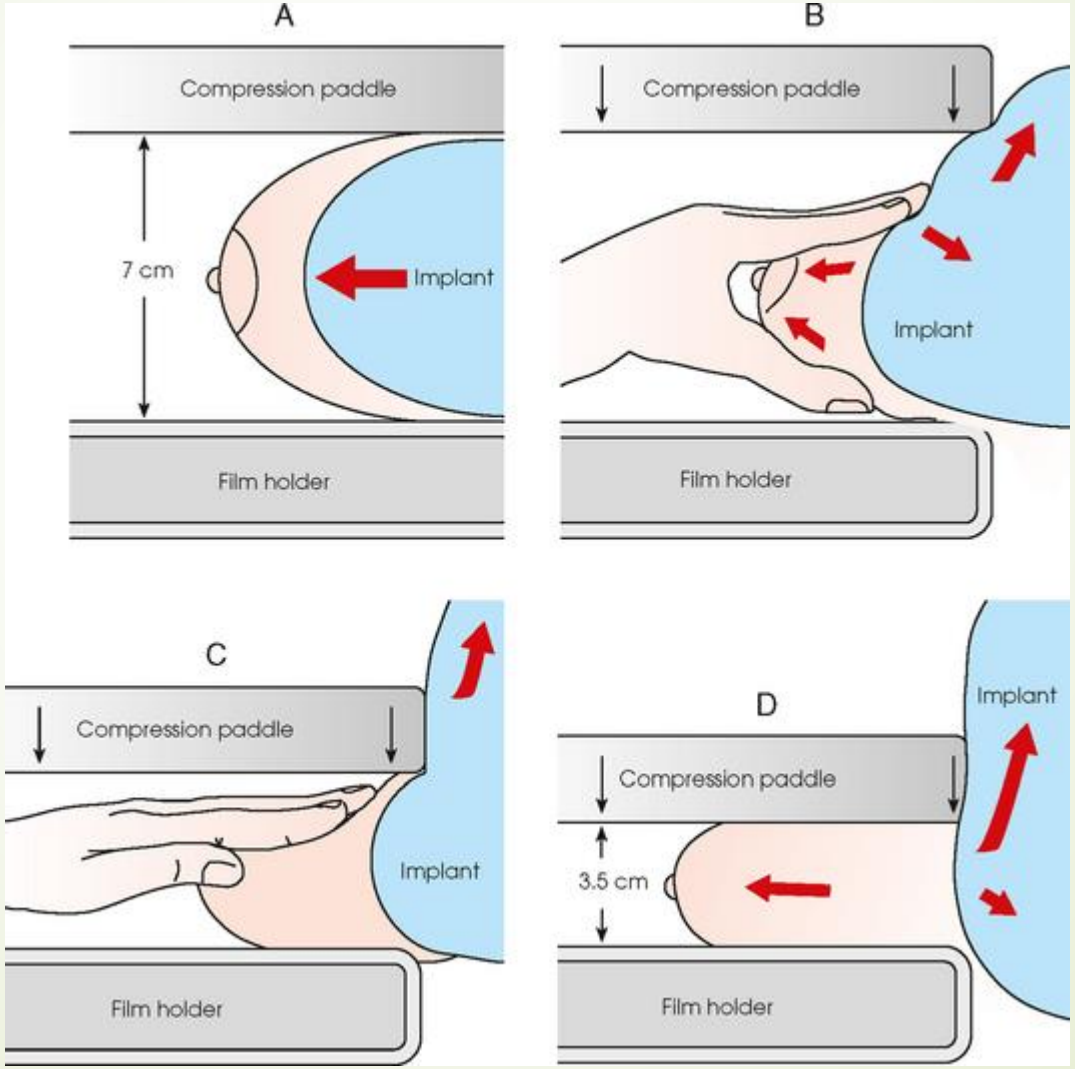
- *Eklundov namještaj:* tkivo dojke izvući naprijed uz istovremenu kompresiju, pri čemu implantat bude odgurnut prema natrag, druga snimka se snima uz minimalnu kompresiju cijele dojke s implantatom; kod inkapsuliranog implantata Eklund nije uvijek moguć

- *dilema!* što ako se dogodi ruptura implanta pri MG a pacijentica nije upozorila radiografera na implante? Pacijentica se ne mora izjasniti a radiografer ih mora prepoznati, i postupiti pri slikanju tako da ih ne ošteti!



Dojke s implantatima
displaced views + non-displaced standard views

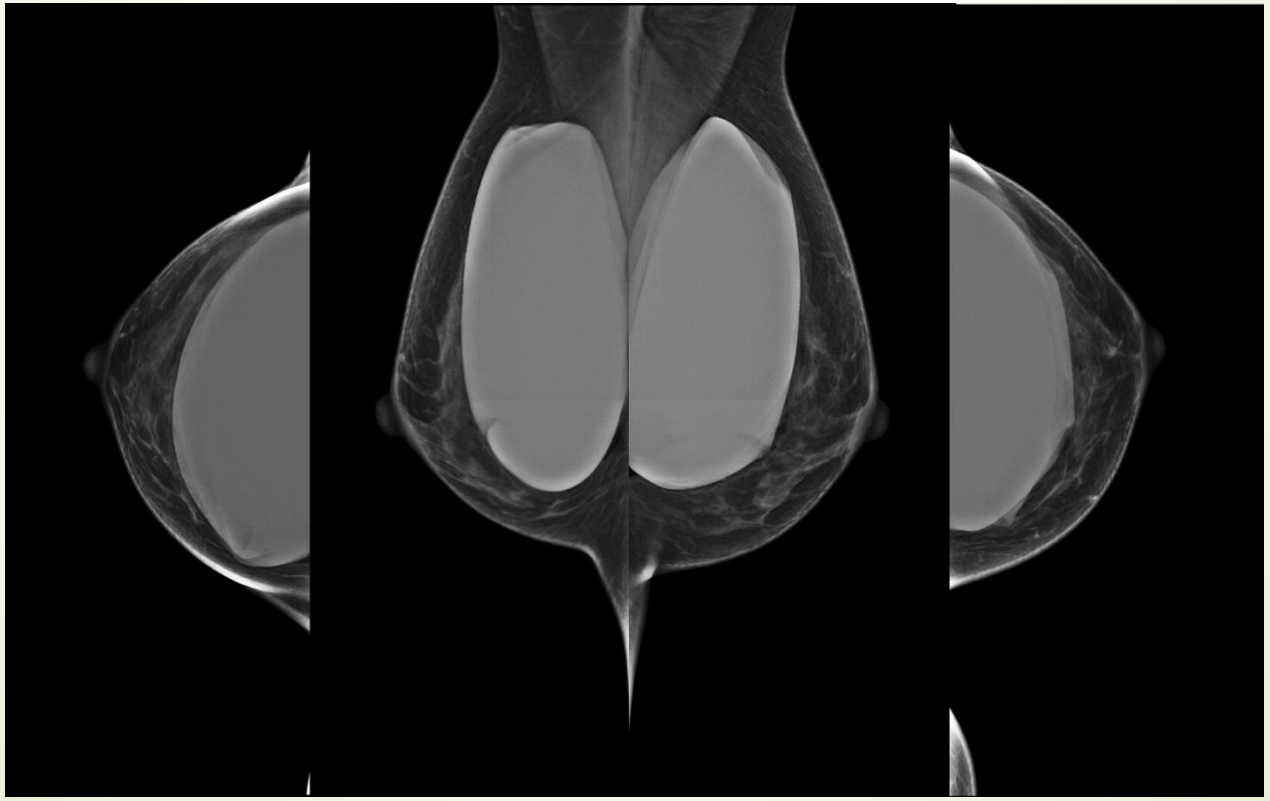
svaka dojka 4 snimke: cc + mlo + ccEklund + mloEklund



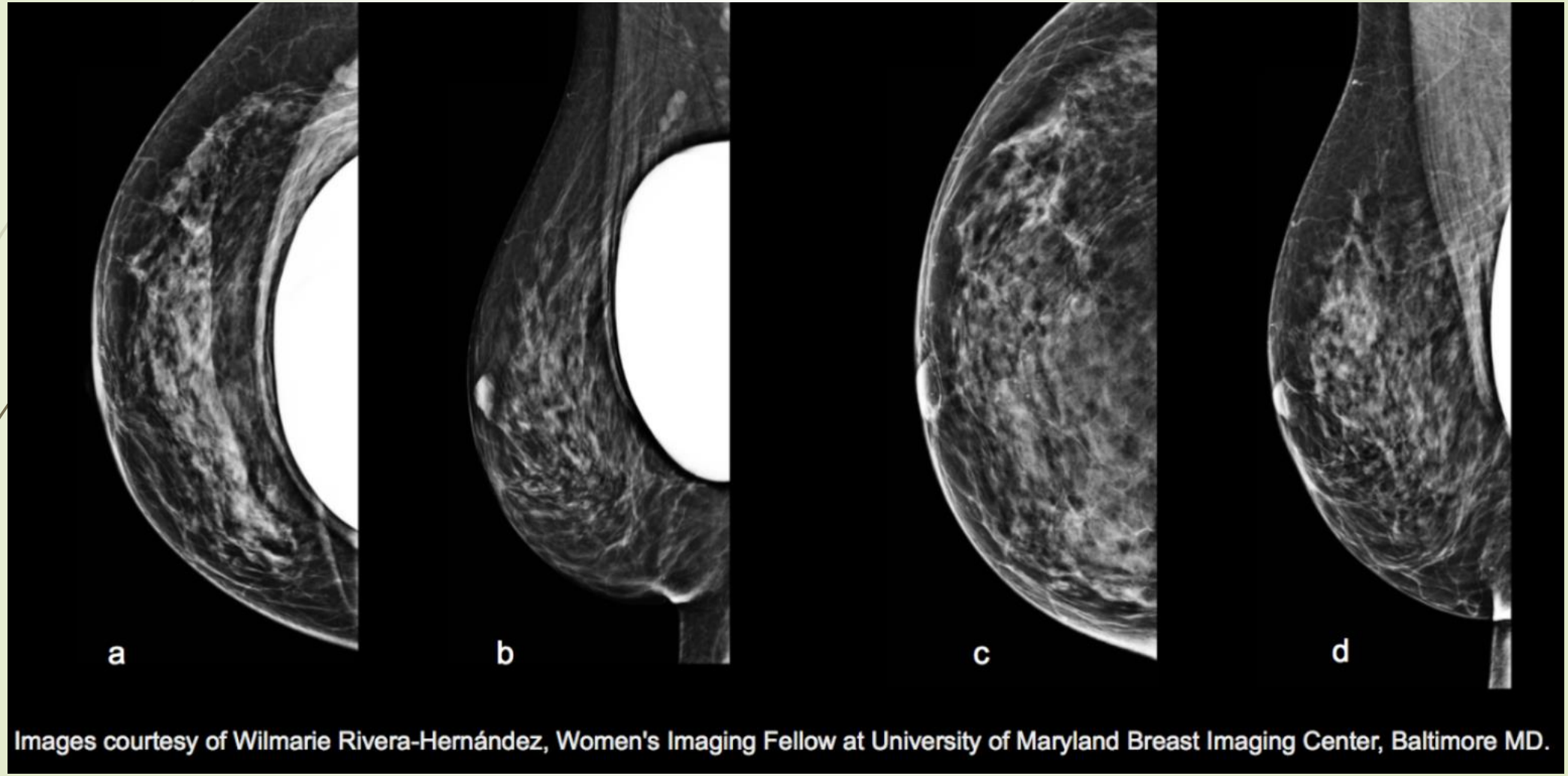
Retropectoral Saline Implants vs. Subglandular/Prepectoral Silicone Implants

Primjer pacijentice s implantatima

28 kV fix, 65 mAs fix, compression force 0



Primjer pacijentice s implantatima



Images courtesy of Wilmarie Rivera-Hernández, Women's Imaging Fellow at University of Maryland Breast Imaging Center, Baltimore MD.

FILMS REJECT/REPEAT ANALYSIS
a quarterly QA/QC task

- Repeat Rate = $\frac{\#\ of\ repeated\ films}{total\ \#\ of\ films} \times 100$
- General diagnostic radiology = less than 5%
  - Students = less than 10 %
- In mammography retake rate should be **less than 2%**
- ***Retake policy in mammography***
  - **Retake the film** only when critical defficiency occurs (no PM at all, motion blur, exposure…)
  - **Do not retake** films with non-critical positioning defficiencies (slight asymmetry, skinfolds…)
  - The importance of communication radiologist - technologist – RTs must be informed of the defficiencies in technique, RTs with poor technique should be **additionaly trained**

Feedback mammographer - radiologist

- A recent study of 350 mammography technologists showed that the level of training and experience of the technologists and their interactions with radiologists signifcantly affected radiologists' recall rate, sensitivity, specificity, and cancer detection rate.

Henderson LM, Benefeld T, Marsh MW, et al.
The influence of mammographic technologists on radiologists' ability to interpret screening mammograms in community practice. *Acad Radiol* 2015; 22:278–289

Ergonomija i problemi profesionalnog (pre)opterećenja

Insights Imaging (2017) 8:429–438
DOI 10.1007/s13244-017-0560-7

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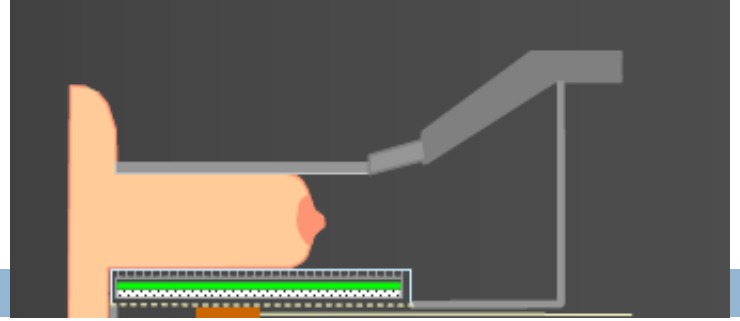
ORIGINAL ARTICLE

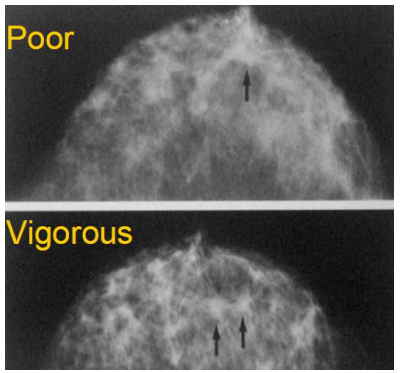
Ergonomic strategies to improve radiographers' posture during mammography activities

Nicolai Cernean[1] · Florentino Serranheira[1,2,3] · Pedro Gonçalves[1] · Cláudia Sá dos Reis[1,3,4]

Pozicioniranje dojki, tijela pacijentice i mamografera kod mamografije

Breast compression





INCREASES THE IMAGE QUALITY

- *Increases sharpness* through
  - *Immobilization*
  - *decrease of geometric blur*
  - *decrease of superimposition*
- *Increases contrast* through
  - *Reduction of scatter*
  - *Evening out breast thickness*
  - *incompressible tumor emerge by its density*

DECREASES THE DOSE

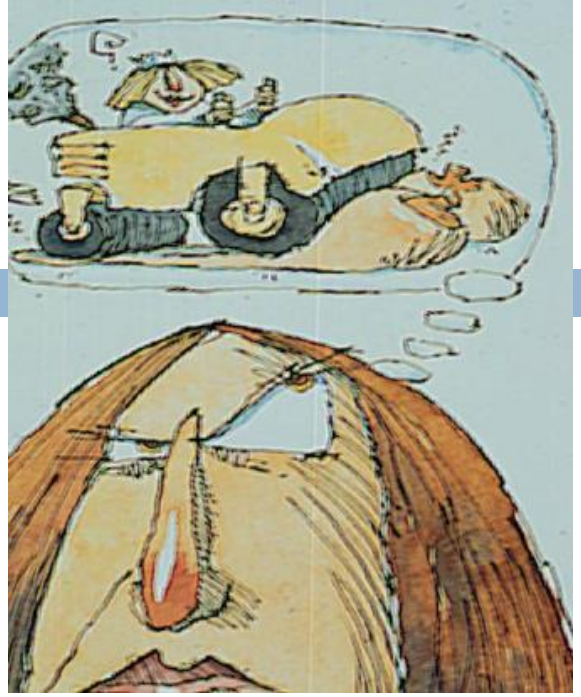
- *Decrease of breast radiation dose*
  - *Better penetration with lower kVp – decrease of exposure (mAs) – lower radiation dose*

Compressed Breast	Entrance Exposure	Mean Glandular Dose
2 cm	260 mR	0.69 mGy
4 cm	1080 mR	1.79 mGy
6 cm	1450 mR	2.37 mGy

Kompresija dojke kod snimanja

- *imobilizacija dojke* => manje **neoštrina zbog pokreta** (vrijeme ekspozicije kod MG je dugačko!)
- *stanjenje dojke* => manja ekspozicija (mAs) – manja **doza zračenja na pacijenta**, manje raspršenja – bolji **kontrast**
- *povećanje površine* na koju se projicira žljezdano tkivo => **manje superpozicije** pojedinih dijelova žljezdanog tkiva
- *približenje parenhima filmu* => manje geometrijskih neoštrina tj. penumbre – bolja **prostorna rezolucija**
- **ujednačavanje gustoće dojke** u svim dijelovima => bolja procjena odnosa pojedinih denziteta, sprječavanje preeksponiranja tanjeg prednjeg i podeksponiranja stražnjeg dijela dojke
- **karcinom je tvrd/nekompresibilan** - u tijeku kompresije se *okolno tkivo stanji i razmakne,* a karcinom se istakne gustoćom

Breast compression



- Advise women before MG of the importance of proper compression
- Inform woman when compression starts
- Communicate with women whether can tolerate more force

Compression force

minimal 11 kp

desirable 13-20 kp

The slide originating from 2001

- QC of compression device
  - Check of integrity of compressor
  - Must remain parallel during compression
  - Compression force display
  - Automatic release after exposure

Kompresija dojke kod snimanja

- objasniti pacijentu potrebu izdašne kompresije zbog smanjenja doze te bolje vidljivosti malog karcinoma
- kontrola kompresora pedalom da ruke budu slobodne za pravilno pozicioniranje dojke: kompresija se lakše podnosi ako dojka nije zgužvana i ako je korektno namještena
- kompresija se lakše podnosi ako se snimanje vrši u prvoj fazi ciklusa (tada je zbog manjeg edema dojke i rezolucija bolja)
- prikaz komprimirane debljine i sile kompresije na aparatu
- minimalna kompresija 8-10 kp, poželjna **10-15 kp**

BOLNOST KOMPRESIJE DOJKE

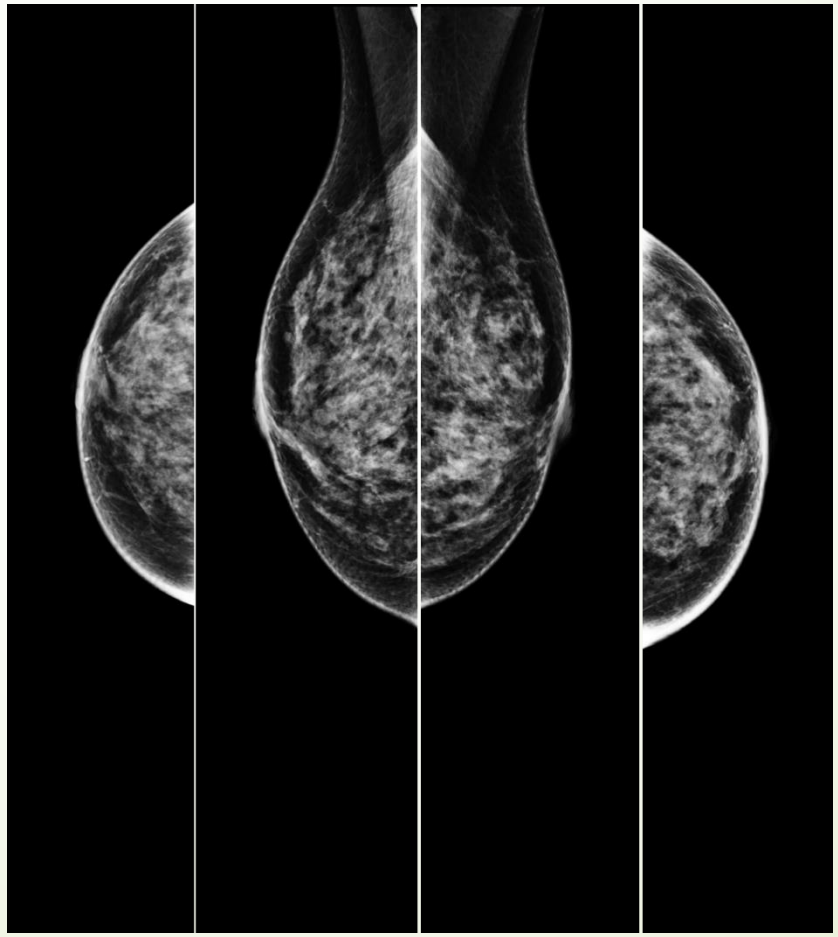
- **<u>BOLNOST KOMPRESIJE</u>** povećava se:
- u drugoj fazi ciklusa (edem dojke, dojka je deblja - kompresija lošija)
- kod lošeg namještaja pri snimanju, nabiranja i natezanja kože
- kod neadekvatnog psihosocijalnog pristupa - kad je pacijentica ustrašena, nervozna, nemotivirana, kad se radi u prevelikoj žurbi, tehničar je nespretan i ne ulijeva povjerenje, pacijentici treba objasniti da kompresija ne može naškoditi dojci
- Analgetski gel može pomoću u smanjivanju bolnosti kompresije

dobro pozicioniranje ⇔ manje bolna kompresija

Vrlo bolne male dojke snimljene bez ikakve kompresije

MRI nalaz: jaka FCD
Ob.an: majka i baka

30 kV
170 mAs
Anoda W
Filter Rh
Compression force 0 daN
Thickness 57 mm



Za usporedbu

Mamografija prethodne godine učinjena na analognom mamografu

29 kVp
Anoda Mo
Filter Mo
uz normalnu kompresiju

Ekspozicija 52 mAs

Vrlo bolne male dojke snimljene bez ikakve kompresije

MRI nalaz: jaka FCD
Ob.an: majka i baka

30 kV
170 mAs
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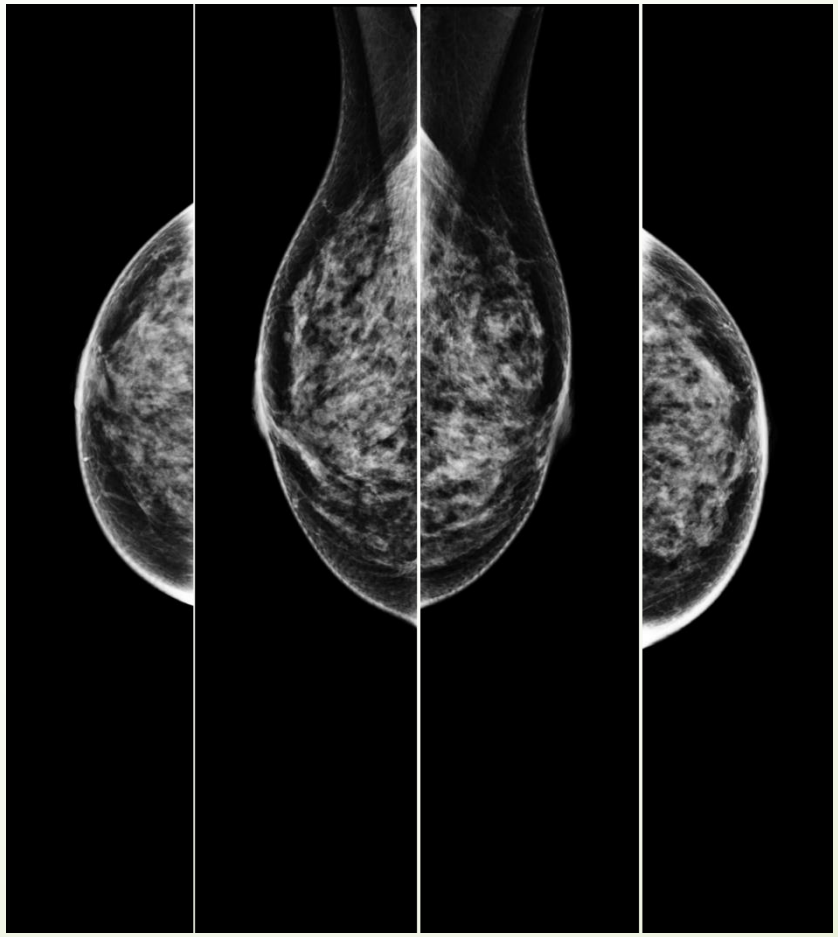
Filter Rh
Compression force 0 daN
Thickness 57 mm



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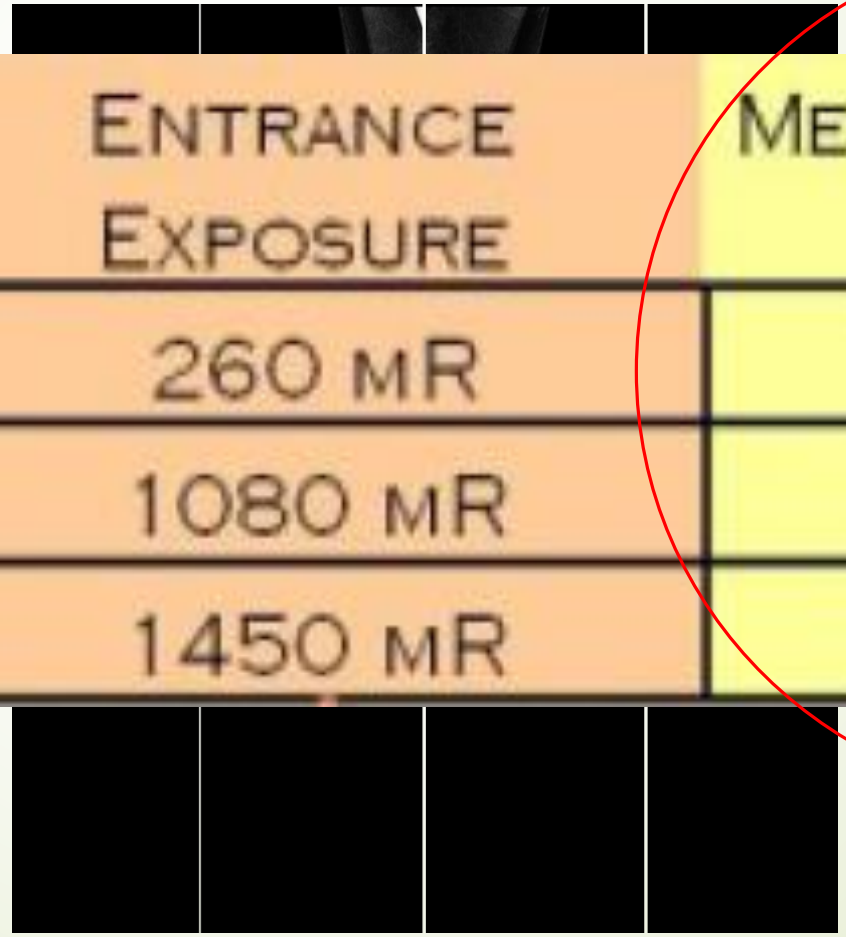


Compressed Breast	Entrance Exposure	Mean Glandular Dose
2 cm	260 mR	0.69 mGy
4 cm	1080 mR	1.79 mGy
6 cm	1450 mR	2.37 mGy

Filter Rh
Compression force 0 daN
Thickness 57 mm

kompresiju

Ekspozicija 52 mAs

How many kp (or daN)?

Is the compression so important as considered until recently?

??? **minimal 11 kp** ???
desirable 13-20 kp

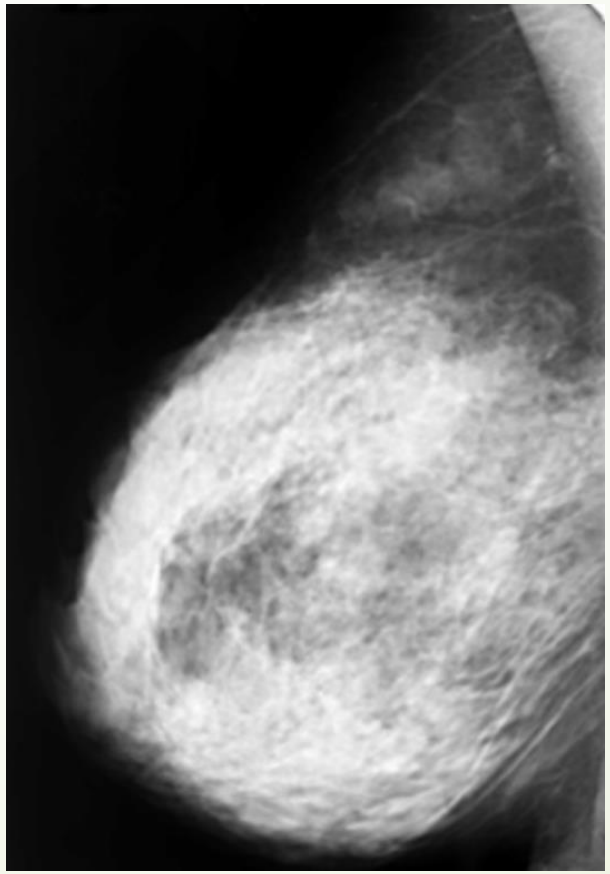
no evidence-based recommendations regarding the optimal compression force

*

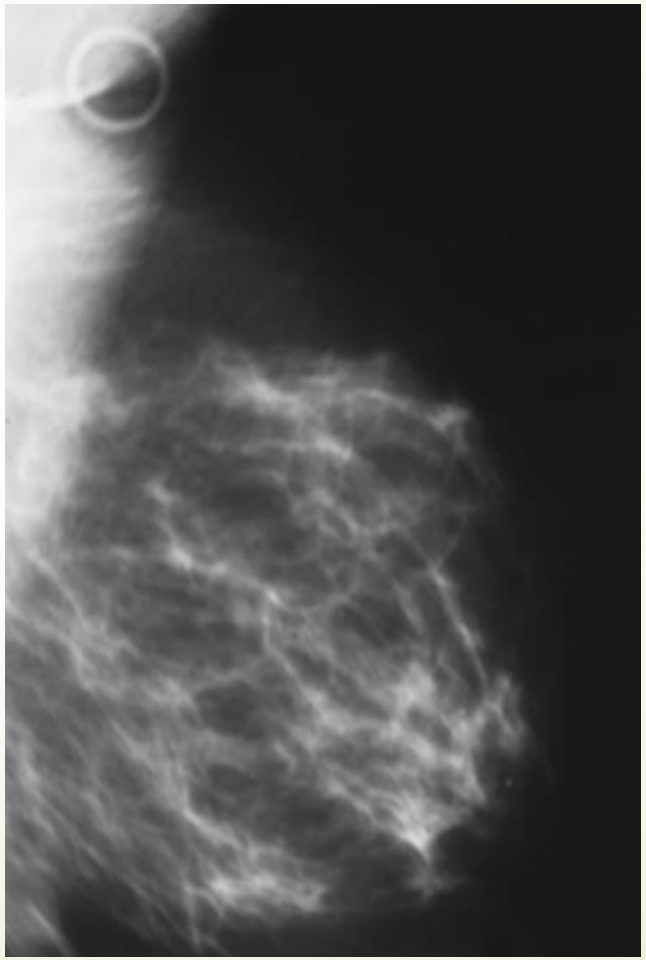
- a large study in Norwegian BCSP revealed mean compression force of 11.6 daN, with large variation between centres, and that compresion force alone had a negligible impact on radiation dose (Waade et al EJR 2016)
- reduction of compression from 18 daN to 10 daN resulted in moderate rise in breast thickness, minimal loss of image quality and no impact on radiation dose (De Groot JE et al. Med Phys 2013)
- women with smaller breasts experienced more pain, breast compression should be **individualy balanced** with possible negative influence of pain during procedure, which can discourage woman from attending screening in the future
- In Croatian national screening program mammographers mainly refuse to compress the breast with >10kp for years (and maybe they're right !!!).

Brnić Z et al. Patient Satisfaction in Croatian Mammography Screening Program. Int J Clin Med 2017

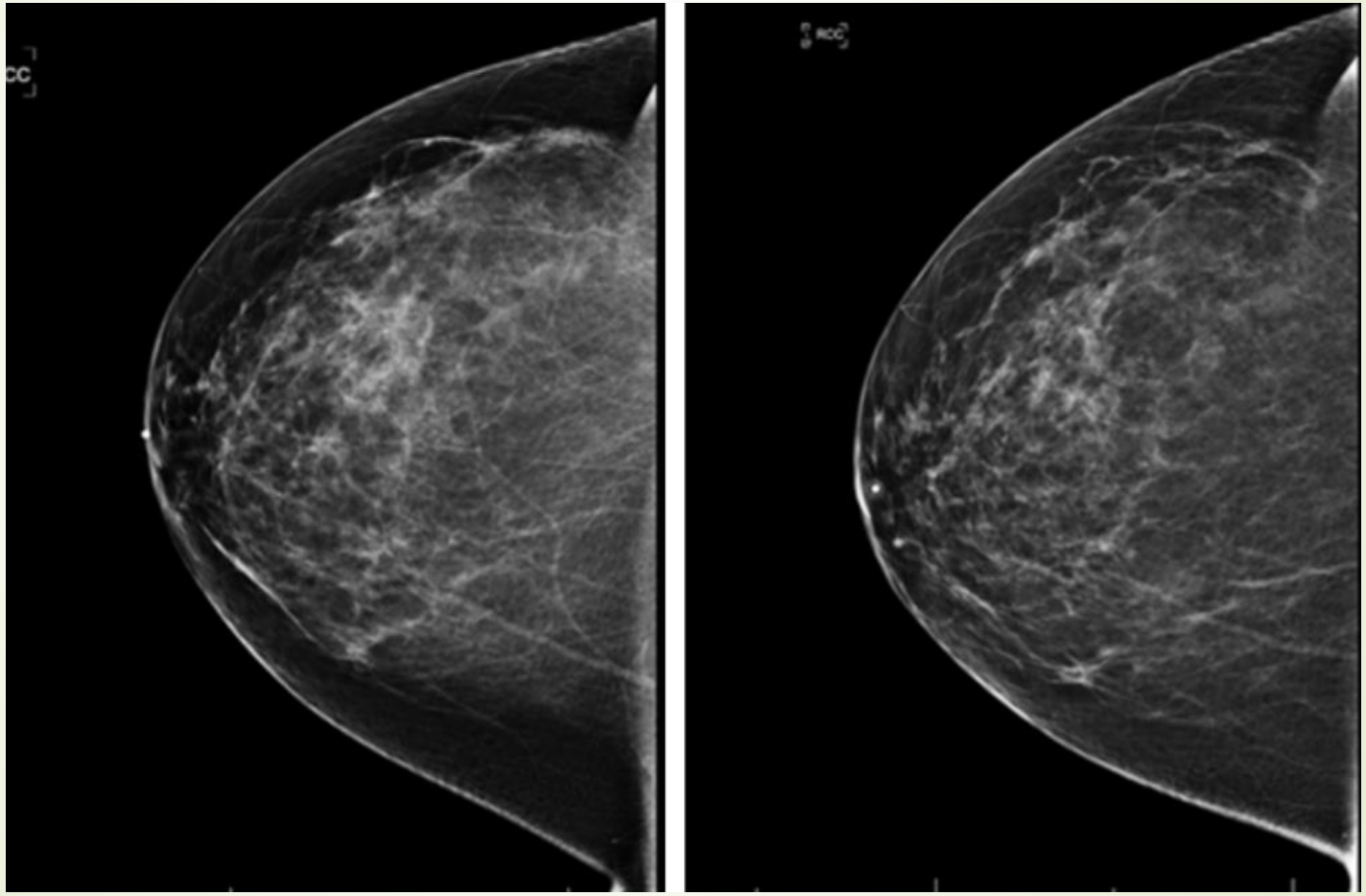
Preslaba kompresija s lošom separacijom parenhima



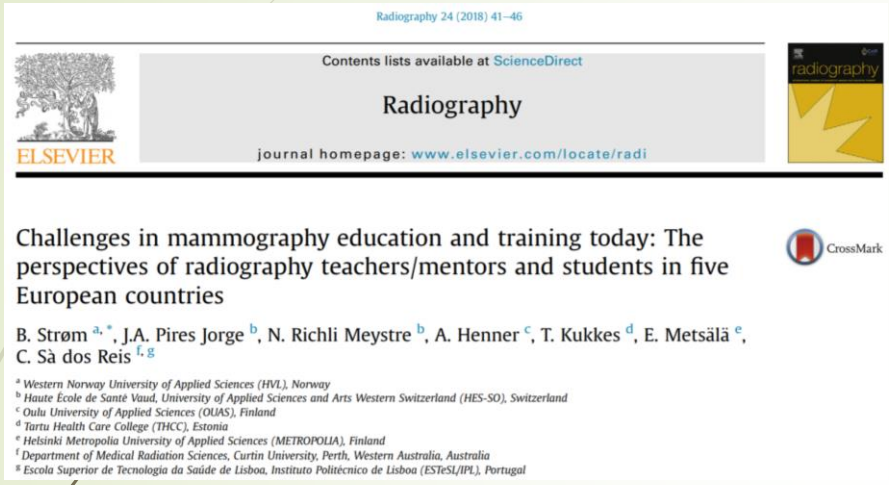
Pacijentica se pomaknula tijekom eksponiranja snimke



Snimke s različitom kompresijom



Edukacija mamografskog pozicioniranja



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Challenges in mammography education and training today: The perspectives of radiography teachers/mentors and students in five European countries

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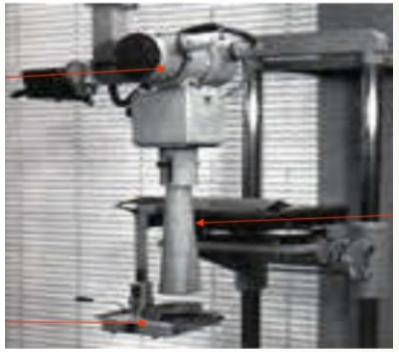
- Mammography education can be a challenge according to the participants. The short period allocated to this discipline and the lack of material resources are the main limitations in mammography education impacting on the development of students' skills
- Breast positioning, patient communication and quality control were considered the key factors that can affect mammography performance, patient experience and diagnostic outcome, they ought therefore to be emphasized more in mammography education.

Suboptimalno pozicioniranje može biti zbog

- Uređaja
- Pacijenta
- Snimanog dijela tijela
- Načina pozicioniranja

Griješiti je ljudski!



Zaključci

- Visoka kvaliteta pozicioniranja u mamografskom probiru jedan je od najvažnijih preduvjeta za postizanje osnovnog cilja probira – ranog otkrivanja raka dojke i smanjenja mortaliteta
- Pozicioniranje i kompresija dojke traži standardizaciju, uvježbanost, učinkovitost, dobru organizacija rada i poštivanje ergonomskih zahtjeva
- Na pozicioniranje utječu objektivni i subjektivni čimbenici, a edukacija i uvježbavanje osoblja je neizostavni dio svakog sustava probira