Original Article

Dermoglandular rotation flap with Burow's triangle: an oncoplastic breast conserving technique for upper inner quadrant breast cancer

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ABSTRACT

Background: *In breast conserving surgery (BCS), large defects in the upper inner quadrant, named the no man's land of the breast, causes shift of the nipple in an unnatural upward or medial fashion. There is every possibility to develop an untoward deformity. There are many oncoplastic options but lumps distant from nipple areolar complex (NAC) are challenging to tackle. Here we are report 2-year follow-up result after dermoglandular rotation flap (DGRF) with a Burows triangle technique in managing upper inner quadrant breast cancer.*

Methods: *This prospective observational study was done at BIRDEM General Hospital. Over a period of three years (August 2020 to July 2023), seven patients were selected for DGRF technique, depending on location and size of lump, distance from NAC and skin, breast ptosis and breast size. The lump was resected with a full thickness skin to pectoral fascia, rectangle or isosceles triangle with its apex towards NAC. Dermoglandular flap was released by a curvilinear lateral extension of the base of the triangle upto mid-axillary line. A small triangular tissue was excised in axilla to facilitate flap advancement. This also provides access to axilla. Axilla was dealt with sentinel lymph node biopsy (SLNB) or axillary lymph node dissection (ALND) procedures as needed. Patients were discharged after 48 hours and followed according to a standard follow-up schedule.*

Results: *Total patients were 7 with age between 42 and 59 years. Tumours were located 7-11 cm from NAC. One patient received neoadjuvant chemotherapy (NACT) before surgery. Four patients were negative for SLNB on frozen biopsy. Time of operation was 90 to 120 minutes. All received post-operative chemo-radiation and hormone therapy as indicated. One patient died five months after surgery, while getting her 4th cycle of chemotherapy. Six patients remained disease free with good cosmetic outcome after 2 years follow-up.*

Conclusion: *For upper inner quadrant breast cancer, DGRF (with or without donut), is an easily reproducible oncoplastic breast conserving technique. It also gives easy access to axilla and results in a very good symmetry. Considering our social circumstances, in carefully selected cases, DGRF is a practical technique in Bangladesh.*

Key words: *breast conserving surgery, dermoglandular rotation flap, Burows triangle, sentinel lymph node biopsy, oncoplastic.*

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INTRODUCTION

Upper inner quadrant breast cancer is a difficult to approach location for surgical management. Breast conservative options include Benelli round block, Batwing mastopexy, inferior pedicle inverted–T mammoplasty or some volume replacement procedure like latissimus dorsi technique.[1-6] But these are comfortably applicable to lesions close to nipple areolar complex (NAC). There are many challenges in tackling distant tumours. In these cases, dermoglandular rotation flap (DGRF) with Burow's triangle, also called matrix rotation, is a technically good option, that provides

excellent symmetry without contralateral breast symmetrization.[7] Here we are reporting, two-years follow-up of seven cases managed by this technique.

METHODS

This was a prospective observational study of seven patients of breast cancer who were selected for DGRF technique, over a period of three years (August 2020 - July 2023). The procedures were done by same surgeon in BIRDEM General Hospital, in Dhaka. All the patients were scheduled for follow-up according to standard protocol: 3 monthly in first year, 6 monthly in second year and yearly for 10 years. Initially, early breast cancer patients were scrutinized strictly irrespective of type of surgical plan. In addition to clinical finding, imaging like ultrasonography, mammography and magnetic resonance imaging (MRI) were done as appropriate. Diagnosis was confirmed by core biopsy, immunohistochemistry (IHC) and dual in-situ hybridization (DISH) test as indicated. Distant metastases were excluded by chest X-ray, ultrasonogram of abdomen, computed tomography (CT) scan of chest, CT abdomen and bone scan as required. Inclusion criteria for DGRF technique were (1) breast cancer patients who were candidates for breast conservative surgery (BCS), (2) tumor size <5 cm in transverse diameter in a moderate to large sized breast (3), the tumors were located in the upper/upper inner quadrant and (4) tumors away from NAC and close to skin. Exclusion criteria were (1) small breast, (2) large lump and (3) lump near NAC. Pre-operative marking was done in sitting posture and patients photographed (Figure 1), after taking informed verbal and written consent. The lump was resected with a full thickness skin to pectoral fascia, rectangle or isosceles triangle with its apex towards NAC (Figure 2). Peri-areolar de-epithelialization (donut) was done where a rectangular area was excised for lump removal. Dermoglandular flap was released by a curvilinear lateral extension of the base of the triangle upto mid-axillary line (Figure 3). A small triangular tissue (Burow's triangle) was excised in axilla to facilitate flap advancement (Figure 3). This also provided access to axilla. Axilla was dealt with sentinel lymph node biopsy (SLNB) with 5 ml blue dye which subsequently led to axillary lymph node dissection (ALND) procedure, if positive. Negative suction drain was kept in axilla and removed when output was <30 ml/24 hours. For all patients, frozen section biopsy was done to determine marginal clearance. Per-operative specimen ultrasonogram was an alternative technique. There was no margin positivity during per-operative frozen section or subsequent paraffin section. Patients were discharged after 48 hours. All patients were followed according to standard schedule. We are presenting results of 2-year follow-up after completion of treatment. In each follow-up visit, in addition to detail history and thorough clinical examination, ultrasonogram of breast, mammogram, MRI and positron emission tomography (PET) scan were done as appropriate. Aesthetic outcome was assessed subjectively with Harvard scale breast (Figure 4), by patients and by surgeon using photographs taken in the per-operative (Figure 5), initial post-operative (10-15 days after surgery) (Figure 6) and late post-operative (>30 days after the end of radiotherapy)(Figure 7) stages.

Figure 1. Pre-operative skin marking

Figure 2. Per-operative incision

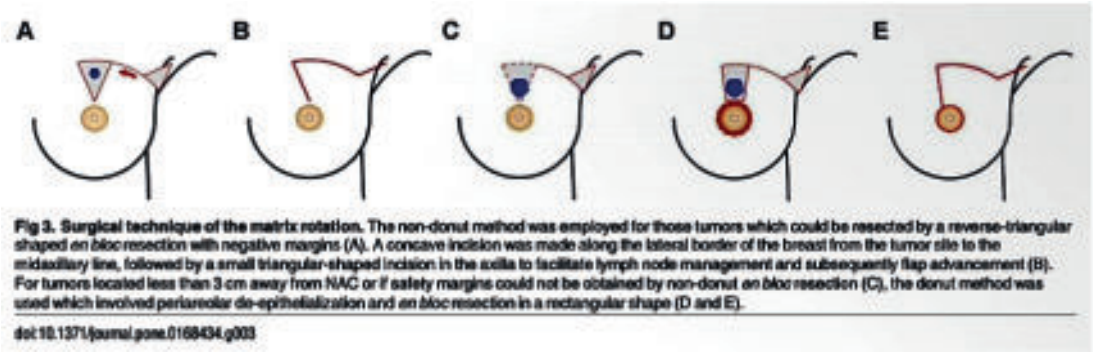

Fig 3. Surgical technique of the matrix rotation. The non-donut method was employed for those tumors which could be resected by a reverse-triangular shaped *en bloc* resection with negative margins (A). A concave incision was made along the lateral border of the breast from the tumor site to the midaxillary line, followed by a small triangular-shaped incision in the axilla to facilitate lymph node management and subsequently flap advancement (B). For tumors located less than 3 cm away from NAC or if safety margins could not be obtained by non-donut *en bloc* resection (C), the donut method was used which involved periareolar de-epithelialization and *en bloc* resection in a rectangular shape (D and E).

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Figure 3. Schematic drawing of surgical technique (dio:10.1371/journal.pone.0168434.g003)

Excellent	Treated breast nearly identical to untreated breast
Good	Treated breast slightly different to untreated breast
Fair	Treated breast clearly different from untreated but not seriously distorted
Poor	Treated breast seriously distorted

Figure 4. Harvard scale breast (4 point Likert Scale)

Figure 5. Wound closure (immediate post-operative)

Figure 6. Aesthetic outcome with doughnut (14th post-operative day)

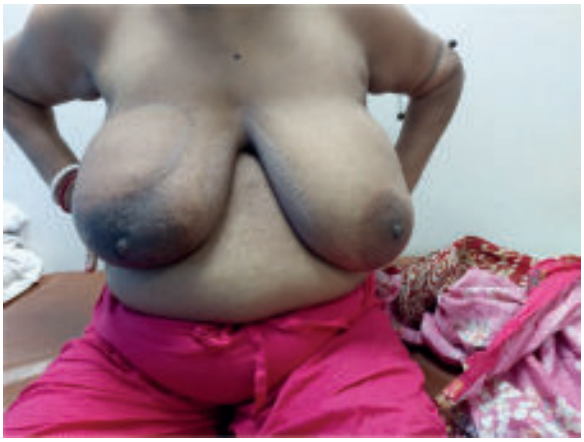

Figure 7. Aesthetic outcome (45 days after completion of radiotherapy)

RESULTS

Total patients were 7 and they were between 42 and 59 years of age, three were premenopausal (Table I). Five patients presented with left breast lump; three patients at 11 o'clock and three at 12 o'clock position. One patient presented with right breast lump at 1 o'clock position. All the lesions were located near the upper limit of breast, 7-11 cm from NAC (Table II). All had grade II-III breast ptosis, two patients had C cup, three D cup and two E cup breasts. Histologically, all were invasive duct cell carcinoma, G1-3, one was triple negative but the rest

were ER+, PR+, HER-2 –ve and Tumor Node Metastasis (TNM) staging was as shown in Table II. One patient received neoadjuvant chemotherapy (NACT) due to being triple negative and G3. One patient had DGRF with donut. Three patients required ALND. Time of operation was 90-120 minutes (Table III). No post-operative seroma, haematoma, surgical site infection, marginal necrosis or nipple areolar necrosis was encountered. One patient died five months after surgery during 4th cycle of chemotherapy. Six patients had completed chemotherapy and radiotherapy and are on hormone therapy, except one. None developed locoregional recurrence or distant metastasis. Cosmetic outcome in most of the patients were good (Table IV).

Table I. Demographics of patients with breast cancer

Case	Age	Sex	Diabetic status	Menstrual status	BreastCup size	Breast Ptosis
1	42y	Female	DM	premenopausal	D cup	Grade II
2	43y	Female	ND	premenopausal	E cup	Grade II
3	50y	Female	ND	postmenopausal	D cup	Grade III
4	59y	Female	DM	postmenopausal	E cup	Grade III
5	51y	Female	ND	postmenopausal	D cup	Grade II
6	39y	Female	ND	premenopausal	C cup	Grade II
7	49y	Female	DM	postmenopausal	C cup	Grade II

Table II. Tumour characteristics of patients with breast cancer

Case	Size	Location	Distance from NAC	Distance from skin	Histology	Grade	Clinical TNM	ER/PR/HER2
1	2cm	Lt breast11 o'clock	7cm	6mm	DCC	G2	T1N1M0	ER+,PR+,HER2-
2	3cm	Lt breast12 o'clock	10cm	5mm	DCC	G3	T2N1M0	ER-,PR-,HER2-
3	2.5cm	Rt breast1 o'clock	9cm	5mm	DCC	G2	T2N0M0	ER+,PR+,HER2-
4	2cm	Lt breast11 o'clock	11cm	Skin infiltration	DCC	G1	T4bN1M0	ER+,PR+HER2-
5	3cm	Rt breast12 O'clock	9cm	5mm	DCC	G1	T2N0M0	ER+,PR+HER2-
6	2cm	Lt breast11 O'clock	8cm	6mm	DCC	G2	T1N0M0	ER+,PR+HER2-
7	2.5cm	Lt breast12 o'clock	7cm	5mm	DCC	G3	T2N0M0	ER+,PR+HER2-

Table III. Management of patients with breast cancer

Case	+/-neoadjuvant chemotherapy	DGRF +/_ doughnut	SLNB	Axilla management	Procedure time (min)
1	No NACT	-doughnut	+ve	ALND	110
2	NACT	-doughnut	+ve	ALND	120
3	No NACT	+ doughnut	-ve	No ALND	100
4	No NACT	-doughnut	+ve	ALND	110
5	No NACT	-doughnut	-ve	No ALND	90
6	No NACT	-doughnut	-ve	No ALND	100
7	No NACT	-doughnut	-ve	No ALND	90

Table IV. Oncological and aesthetic outcome of patients with breast cancer

Case	Locoregional Recurrence	Distant Metastases	Aesthetic Perception (Patient)	Aesthetic Perception (Surgeon)
1	None	None	Good	Good
2	None	None	Good	Good
3	None	None	Excellent	Good
4	None	None	Good	Good
5	None	None	Good	Good
6	None	None	Good	Good
7	None	None	Excellent	Good

DISCUSSION

BCS combined with postoperative radiotherapy is currently the standard treatment for early breast cancer.[8,9] Validation of BCS took almost 30 years, after several randomized studies [9,-11] showed that BCS has an overall survival rate equivalent to that of mastectomy. Moreover, BCS offered higher quality of life by improving psychosocial health, body image and sexual function compared to mastectomy.[12] This success of BCS was based upon the foundation of wide excision of the tumor with adequate margins combined with post-operative radiotherapy. However, several studies showed approximately 5%-18% of conventional BCS procedures had positive margins. This leads to high re-excision rates.[13,14] In addition, another new challenge for BCS was deformity.[15,16] Cosmetic outcome depends on various factors such as breast size, tumor location, resection volume, surgical technique and post-operative radiation.[17] These, high re-excision rate and deformity, again shifted the surgeon as well as the patient to choose mastectomy over BCS. To address these drawbacks the term 'oncoplastic' was first introduced in 1997 by Gabka et al. Oncoplastic surgery (OPS) involved the combination of oncologic principles with plastic surgical techniques.[13] Using various mammaplastic methods, after wide excision of tumour with free margins, surgeons can now remodel the remaining breast tissue. Thereby the rate of re-excision[19] is reduced and a much better aesthetic outcome is achieved.

According to Grisotti et al, the upper inner quadrant is the 'no man's land' as BCS in this quadrant can cause upward displacement of NAC.[20] This results in distortion of the visible breast line. Dermoglandular advancement by local flaps into the resection site is one method for distant lesions.[7] Burow's Triangle technique was first described in 1855 by Karl August von Burow as a procedure for facial reconstructions.[21] This technique consists in releasing a full-thickness flap from adjacent tissues for large-size advancements. This principle can also be used for breast remodeling surgeries after quadrantectomies. It involves the advancement-rotation of a full-thickness flap with its pivot centered on the nipple-areola complex. This approach uses adjacent breast tissue to fill up the resected region, minimizing the nipple's position distortion.[1,21] We are reporting a series of DGRF with Burow's triangle. Despite our small series, we found good aesthetic results with oncological safety. It proved to be an effective technique to avoid mastectomy as also found in many studies.[22] This technique is equally effective for post NACT patients.[23] It gives good access for ALND.[1,7,22-24] Several other techniques are also practiced, each with its own advantages and limitations. Batwing mastopexy is one such procedure for upper inner quadrant tumors.[3] This approach is reproducible; however, the procedure causes some lifting of the nipple, which leads to asymmetry. Often it also leads to nipple necrosis if the dissection extends up to a higher position behind the nipple. The modified round block mammoplasty introduced by Chen in 2014[4] is another technique which gives excellent results for lesions in the upper quadrant. It is a particularly a good surgical choice for small-to-medium-sized breasts with mild-to-moderate ptosis. The crescent mastopexy resection is a technique ideal for lesions located in between the 10 and 1 o'clock at the peri-areolar position. Lesions that are more medial or lateral would cause

deviation of NAC.[5] The inferior pedicle mammoplasty via an inverted-T incision can be also be used for tumors located within the superior aspect of the breast. In this procedure tumor is removed en bloc with an inverted-T incision followed by elevation of the de-epithelialized inferior pedicle and re-approximation of the medial and lateral glandular flaps. This procedure causes a volume asymmetry without contralateral symmetrizition.[6] All these thoughts, prompted us to choose Burows triangle technique over the others.

In our study there is no locoregional or distant metastasis within 2 years follow-up. However, documented local recurrence rate is 10-15% after mastectomy or BCS plus radiotherapy in long (>10 years) follow-up studies and 8.5%-18% for distant metastasis.[8,9,25-29]

In our study, we used subjective evaluation on the appearance of the treated breast, using the Harvard scale as is used in some studies.[22,30] However, the objective tool for symmetry evaluation (Breast Cancer Conservative Treatment Cosmetic results - BCCT.core) was recommended in other studies.[31-37] In our series, patient and surgeon aesthetic perception matched and there was no difference in early and late post-operative aesthetic outcome. However, some studies suggest that patients are likely to rate their own aesthetic results higher than the software or the expert panel.[37] It is because patients' self-assessments provide important information not only with respect to the aesthetic results of the breast but also its functional aspects. One study found no statistically significant differences between the early and late post-operative results, whether using the Harvard scale or the BCCT core software.[7]

While performing the procedure, we perceived similar advantages as is also documented in various literatures.[1,7,21-24] These include – (1) full-thickness excision and removal of overlying skin can be easily performed even by a general surgeon, (2) relatively large tumors can be removed safely, (3) axillary dissection can be performed easily by same incision, (4) equally applicable to breast that is mostly composed of fatty tissue (BIRADS 1/2), (5) no need for contralateral breast intervention, (6) multiple teams working closely during the entire process are not required, (7) blood loss is minimal (approximately 30 mL on average) and (8) wound complications such as hematoma or seroma formation are not observed. The only drawback of this procedure is a relatively long scar that extends into visible area. However, most of those scars fade significantly after some years.[24] But some studies show, this point of view seems to be the expert perception, not the patients. Volume discrepancy and bilateral symmetry are much more concerning to patients than length of scar.[22,23]

Conclusion

DGRF with Burows triangle, with or without donut, is an oncologically safe and good cosmetic outcome oncoplastic technique for upper outer quadrant breast cancer in medium to large ptotic breasts. It is a level one oncoplastic breast conserving technique. It has a short learning curve and provides easy access to axilla. It provides good symmetry and allows patients to undergo unilateral breast conservative surgery without contralateral symmetrization. It may be aesthetically unacceptable to many patients due to the long post-operative scar that extents into the visible area. However, considering our social circumstances and the fact that unilateral surgery is faster with less morbidity- it is an option that is especially beneficial for elderly women, patients with comorbidities, and women who prefer to avoid contralateral symmetrization.

Author's contribution: HA, MEHR planned the research. HA drafted the manuscript. All authors read and approved the final version.

Consent : Informed consent was taken from patients for publishing the photographs.

Conflicts of interest: Nothing to declare.

REFERENCES

1. Lin J, Chen D-R, Wang Y-F, Lai H-W. Oncoplastic Surgery for Upper/Upper Inner Quadrant Breast Cancer. PLoS ONE 2016; 11(12):e0168434.
2. A. Baildam, H. Bishop, G. Boland, M Dalgish, L Davis, F Fatah et al. Oncoplastic breast surgery—a guide to good practice. European Journal of Surgical Oncology 2007; 33(1):1-23.
3. Anderson BO, Masetti R, Silverstein MJ. Oncoplastic approaches to partial mastectomy: an overview of volume-displacement techniques. Lancet Oncol 2005; 6(3):145-57.
4. Chen DR. An optimized technique for all quadrant oncoplasty in women with small- to medium-sized breasts. Eur Rev Med Pharmacol Sci 2014; 18(12):1748-54.
5. Holmes DR, Schooler W, Smith R. Oncoplastic approaches to breast conservation. Int J Breast Cancer. 2011; 2011:303879.

6. Robbins TH. A reduction mammaplasty with the areola-nipple based on an inferior dermal pedicle. Plast Reconstr Surg 1977; 59(1):64-7.

7. Soliani Bastos MC, Bagnoli F, Rinaldi JF, João TBF, de Oliveira VM. Dermoglandular advancement-rotation flap for conservative treatment of breast cancer – description of technique, objective and subjective assessments. Front Oncol 2023;13:1137924.

8. B Fisher, S Anderson, J Bryant, R G Margolese, M Deutsch, E R Fisher, et al. Twenty-year follow up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. The New England Journal of Medicine 2002; 347(16):1233-41.

9. U. Veronesi, N. Cascinelli, L. Mariani , M Greco, R Saccozzi, A Luini, et al. Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. The New England Journal of Medicine 2002; 347(16):1227-32.

10. Veronesi U, Banfi A, Saccozzi R, Salvadori B, Zucali R, Uslenghi C, et al. Conservative treatment of breast cancer. A trial in progress at the Cancer Institute of Milan. Cancer 1977; 39(6 Suppl):2822-6.

11. Veronesi U, Saccozzi R, Del Vecchio M, Banfi A, Clemente C, De Lena M, et al. Comparing radical mastectomy with quadrantectomy, axillary dissection, and radiotherapy in patients with small cancers of the breast. N Engl J Med 1981; 305(1):6-11.

12. Schover LR, Yetman RJ, Tuason LJ, Meisler E, Esselstyn CB, Hermann RE, et al. Partial mastectomy and breast reconstruction. A comparison of their effects on psychosocial adjustment, body image, and sexuality. Cancer 1995; 75(1):54-64.

13. Kaur N, Petit JY, Rietjens M, Maffini F, Luini A, Gatti G, et al. Comparative study of surgical margins in oncoplastic surgery and quadrantectomy in breast cancer. Ann Surg Oncol 2005; 12(7):539-45.

14. Clough KB, Lewis JS, Couturaud B, Fitoussi A, Nos C, Falcou MC. Oncoplastic techniques allow extensive resections for breast-conserving therapy of breast carcinomas. Ann Surg 2003; 237(1):26-34.

15. P Berrino, E Campora, S Leone, P Santi. Correction of type II breast deformities following conservative cancer surgery. Plastic and Reconstructive Surgery 1992;90(5):846-53.

16. S Kr¨amer, S K¨ummel, O Camara, R Große, M Friedrich, JU Blohmer. Partial mastectomy reconstruction with local and distant tissue flaps. Breast Care 2007;2(5):299-306.

17. W Yeo, WH Kwan, PML Teo, WT Leung, W King, PJ Johnson. Cosmetic outcome of breast-conserving therapy in Chinese patients with early breast cancer. Australian and New Zealand Journal of Surgery 1997;67(11):771-4.

18. Gabka CJ, Maiwald G, Baumeister RG. Expanding the indications spectrum for breast saving therapy of breast carcinoma by oncoplastic operations. Langenbecks Arch Chir Suppl Kongressbd 1997;114:1224-7.

19. von Smitten K. Margin status after breast-conserving treatment of breast cancer: how much free margin is enough? J Surg Oncol 2008;98(8):585-7.

20. Grisotti A, Calabrese C. Conservation treatment of breast cancer: Reconstructive problems. In: Spear SL, editor. Surgery of the Breast: Principles and Art. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2006; 147-78.

21. Gormley DE. A brief analysis of the Burow's wedge/tri angle principle. J Dermatol Surg Oncol 1985;11(2):121-3.

22. Ursula HB, Bernhard V, Helga H, Philipp S, Sudip K, Lars M, et al. Dermoglandular Rotation Flaps for Breast-Conserving Therapy: Aesthetic Results, Patient Satisfaction, and Morbidity in Comparison to Standard Segmentectomy International Journal of Breast Cancer 2014; Article ID 152451, 9 pages http://dx.doi.org/10.1155/2014/152451.

23. Paula S D O, André V S, Douglas M P, Tayra D H, Luciana J B A. Use of dermoglandular flap (burow's triangle) after neoadjuvance in upper quadrant tumors of the breast. Mastology 2018;28(2):102-5.

24. SL Spear, JW Little, ME Lippmann, WV Wood. Surgery of the Breast: Principles and Art, Lippincott-Raven, Philadelphia, Pa, USA, 1998.

25. Freedman GM, Fowble BL. Local recurrence after mastectomy or breast-conserving surgery and radiation. Oncology 2000;14(11):1561-84.

26. Fodor J. Breast-conservation treatment for early invasive breast cancer: prognostic factors for survival after salvage treatment of local recurrence. Magy Onkol 2007;51(2):127-31. Hungarian. Epub 2007 Jul 29. PMID: 17660868.37.

27. Fodor J, Mózsa E, Zaka Z, Polgár C, Major T. Local relapse in young (< or = 40 years) women with breast cancer after mastectomy or breast conserving surgery: 15-year results. Magy Onkol. 2005;49(3):205-8. Hungarian. Epub 2005 Oct 25. PMID: 16249814.

28. Veronesi U, Marubini E, Del Vecchio M, Manzari A, Andreola S, Greco M, et al. Local recurrences and distant metastases after conservative breast cancer treatments: partly independent events. J Natl Cancer Inst. 1995;87(1):19-27.

29. Touboul E, Buffat L, Belkacémi Y, Lefranc JP, Uzan S, Lhuillier P, et al. Local recurrences and distant metastases after breast-conserving surgery and radiation therapy for early breast cancer. Int J Radiat Oncol Biol Phys. 1999;43(1):25-38.

30. Bayeh HA, Paulinelli RR, Soares LR, Prates AL, Morais PC, Albuquerque ICS, et al. The cosmetic outcome of breast reconstruction: reproducibility of different methods assessed by different professionals. Mastology 2019;29(4):173-9.

31. Cardoso MJ, Cardoso J, Amaral N, Azevedo I, Barreau L, Bernardo M, et al. Turning subjective into objective: the BCCT.core software for evaluation of cosmetic results in breast cancer conservative treatment. Breast 2007;16(5):456-61.

32. Cardoso MJ, Santos AC, Cardoso J, Barros H, Cardoso De Oliveira M. Choosing observers for evaluation of aesthetic results in breast cancer conservative treatment. Int J Radiat Oncol Biol Phys 2005;61(3):879-81.

33. Cardoso MJ, Cardoso JS, Vrieling C, Macmillan D, Rainsbury D, Heil J, et al. Recommendations for the aesthetic evaluation of breast cancer conservative treatment. Breast Cancer Res Treat 2012;135(3):629-37.

34. Cardoso MJ, Cardoso JS, Wild T, Krois W, Fitzal F. Comparing two objective methods for the aesthetic evaluation of breast cancer conservative treatment. Breast Cancer Res Treat 2009; 116(1):149-52.

35. Cardoso JS, Cardoso MJ. Towards an intelligent medical system for the aesthetic evaluation of breast cancer conservative treatment. Artif Intell Med 2007;40(2): 115-26.

36. Trakis S, Lord H, Graham P, Fernandez R. Reliability of the BCCT.core software in evaluation of breast cosmesis - a systematic review. J Med Imaging Radiat Oncol 2021; 65(6):817-25.

37. Heil J, Dahlkamp J, Golatta M, Rom J, Domschke C, Rauch G, et al. Aesthetics in breast conserving therapy: do objectively measured results match patients' evaluations? Ann Surg Oncol 2011;18(1):134-8.