



Retrospective analysis of the effects of radiotherapy on the areolas reconstructed with a total skin graft

Análise retrospectiva dos efeitos da radioterapia sobre as aréolas reconstruídas com enxerto de pele total

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■ ABSTRACT

Introduction: Breast cancer has increased progressively in recent years, and with this, the need for diagnosis and earlier treatment has also increased. Currently, in Brazil, breast cancer accounts for 29.7% of cancer cases in women. The reconstruction of the nipple-areolar complex (NAC) has focused on greater attention due to the search for symmetry and naturalness, which is the final stage of this whole process. The objective is **to** evaluate the maintenance of the size, contour, color, symmetry and shape change of reconstructed NAC after mastectomies associated with radiotherapy.

Methods: A retrospective study was conducted analyzing the evolution of reconstructed areolas after total mastectomy associated with adjuvant treatment with radiotherapy. Two groups were selected: group 1 (unilateral reconstruction) and group 2 (bilateral reconstruction). Comparisons were made between the reconstructed NAC areola, group 1, with that of the contralateral NAC and in group 2, between the two reconstructed areolas. **Results:** After the inclusion of 56 patients in the study, 71 reconstructed areolar complexes were included. Symmetry was classified as good in 77.46% of all cases ($p=0.706$). Twenty-five reconstructions were performed in areas under the effect of radiotherapy, and only 9 cases showed decreased areola size ($p=0.050$), evolving with an asymmetry in 8 cases, 4 in the radiotherapy region ($p=0.706$). The areolar contour showed a similarity between cases treated with radiotherapy and untreated ($p=0.918$). **Conclusion:** Adjuvant radiotherapy was a predisposing factor for changes that may arise during the postoperative period of reconstruction of the nipple-areolar complex, according to statistical analysis.

Keywords: Mammoplasty; Areola; Areolar graft; Nipple-areolar complex; Radiotherapy.

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■ RESUMO

Introdução: O câncer de mama aumentou progressivamente nos últimos anos e com isso a necessidade de diagnóstico e tratamento mais precoce também aumentaram. Atualmente, no Brasil, o câncer de mama corresponde há 29,7% dos casos de câncer nas mulheres. A reconstrução do complexo areolopapilar (CAP) tem sido foco de maior atenção devido à busca pela simetria e naturalidade, sendo a etapa final de todo esse processo. O objetivo é avaliar a manutenção do tamanho, contorno, coloração, simetria e mudança de formato do CAP reconstruído após mastectomias associadas à radioterapia.

Métodos: Foi realizado um estudo retrospectivo analisando a evolução das aréolas reconstruídas, após mastectomia total associada ao tratamento adjuvante com radioterapia. Dois grupos foram selecionados: grupo 1 (reconstrução unilateral) e grupo 2 (reconstrução bilateral). Foram realizadas comparações entre aréola do CAP reconstruído, grupo 1, com a do CAP contralateral e no grupo 2, entre as duas aréolas reconstruídas.

Resultados: Após inclusão de 56 paciente no estudo, foi totalizando 71 complexos areolares reconstruídos. A simetria foi classificada como boa em 77,46% de todos os casos ($p=0,706$). 25 reconstruções realizadas em áreas sob efeito da radioterapia e apenas 9 casos apresentaram diminuição do tamanho da aréola ($p=0,050$), evoluindo com uma assimetria em 8 casos, sendo 4 em região de radioterapia ($p=0,706$). O contorno areolar apresentou uma similaridade entre casos tratados com radioterapia e não tratados ($p=0,918$).

Conclusão: A radioterapia adjuvante se mostrou como um fator predisponente para as alterações que possam surgir no transcorrer do pós-operatório de reconstrução do complexo areolopapilar, conforme a análise estatística.

Descritores: Mamoplastia; Aréola; Enxerto areolar; Complexo areolopapilar; Radioterapia.

INTRODUCTION

Breast cancer is now a relevant public health problem, and malignant neoplasia is the most common in women (except for non-melanoma skin cancers). According to the latest Globocan 2018 world statistics (BRAY, 2018)¹, 2.1 million new cases of breast cancer and 627,000 deaths from the disease were estimated. In Brazil alone, it corresponds to 29.7% of cancer cases in women, making it the second most prevalent cancer type in females².

Surgery is an indispensable part of treatment, often being necessary mastectomy with removal of the nipple-areolar complex (NAC), resulting in aesthetic and psychological consequences for women^{3,4}.

If we consider its significance in the breast's anatomical and aesthetic composition, the CAP's reconstruction becomes a fundamental part of the reparative treatment since it reduces the sequela's perception and increases the level of patient satisfaction.

For this reason, it is the final milestone of the breast reconstruction process⁵.

The reconstruction of the NAC is a challenge that has been a scenario of studies and the creation of various surgical techniques that seek to improve it. Color, size, symmetry, shape and maintenance of the result are variable and influence patient satisfaction⁵.

Several CAP reconstruction methods have been detailed in the literature, and, even so, there is a great difficulty in maintaining the result over time related to the nipple and areola. When we observe the results of reconstructions, the areolas may undergo changes related to size, shape, color and symmetry. Local flaps, nipple structuring with fats and dermal matrix, in addition to 3D pigmentation techniques, aim to improve results⁶⁻¹⁵. Comparisons of results and maintenance are based on the comparison with the contralateral NAC or between the two reconstructed complexes in bilateral cases¹⁶.

The ideal for areolas reconstructions would be a technique that would promote lasting results concerning color, size, shape, and good maintenance of the result and symmetry. The race for the best treatment option continues due to the technical improvement and the high standard of perfectionism that characterizes modern plastic surgeons¹⁷.

OBJECTIVES

This work aims to evaluate the maintenance of symmetry, size (possible shrinkage), contour, staining, and change of shape of the reconstructed areolar plaque after mastectomies followed by radiotherapy.

METHODS

This is a retrospective study. A review of the medical records of patients undergoing breast reconstruction and the nipple-areolar complex was performed after unilateral or bilateral mastectomy, without NAC's preservation and submitted or not to adjuvant treatment with radiotherapy. The period studied was between January 2017 to December 2019. The study followed the principles of Helsinki.

After the patients had the first stage of breast reconstruction (large dorsal, flap of the rectus abdominal muscle – TRAM, expander or prosthesis) completed and after the completion of adjuvant treatments, when indicated, they were conducted the second stage of reconstruction consisting of the preparation of the new NAC¹⁸. The areola was reconstructed through the autologous graft of skin removed from the groin or contralateral areola.

Patients who underwent a total mastectomy for breast cancer treatment with NAC removal and finished the surgical stage of making areola and nipple were included in the study. The signing of the consent form was used as an inclusion criterion in the study. Patients whose data were incomplete in medical records, including photographic documentation and who did not sign the consent form, were excluded.

The patients were divided into two groups, group 1 (unilateral reconstructions with or without radiotherapy) and group 2 (bilateral reconstructions with or without radiotherapy).

The data studied were: bilaterality, radiotherapy and symmetry with the contralateral side in the unilateral and between the areolas in bilateral cases. In the symmetry variable, the following were evaluated: color and may be similar or different, size classified as similar, smaller or larger and round and

elongated shape. These data were evaluated by an observer (plastic surgeon) through photographic analysis five days after surgery (at the time brown's dressing was removed), 30 days and six months postoperatively. The minimum follow-up of the patients was six months.

Statistical analysis was performed, the *odds ratio* was analyzed, and a *p*-value of 0.05 was admitted.

RESULTS

From January 2017 to December 2019, 56 patients, with a mean age of 52.5 years ranging from 23 to 82 years, underwent a mastectomy, of which 41 were unilateral, and 15 were bilateral, totaling 71 NAC reconstructions. The mean follow-up time was six months.

Of the total number of reconstructed areolas, 25 reconstructions were analyzed that had the breast region submitted to radiotherapy, among these cases (Table 1), 80% obtained good evolution regarding symmetry, only eight reconstructions obtained alterations, and the incidence between reconstructions associated with radiotherapy and not associated, equal to 4 for each, with an inadequate significance level.

Table 1. Groups of patients undergoing CAP reconstruction in associated skin whether or not radiotherapy

	Group 1 Breast C/RT	Group 2 Breast S/RT	Total
Right Cap	17	25	42
Left cap	8	21	29
Total	25	46	71

RT: Radiotherapy.

Of the reconstructions without associated radiotherapy, 76.08% ($p=0.706$) presented good symmetry. Despite the good symmetry in the patients' postoperative evolution, a shrinkage of the grafted area for areolar reconstruction was observed of 22.53% (16 cases), and nine patients in this group were submitted to radiotherapy treatment ($p=0.050$), presenting a statistically significant value.

The evaluation of the color of the areolas resulted as similar in 21 NAC submitted to radiotherapy and 42 NAC not submitted to radiotherapy ($p=0.359$), and the contour was evaluated as lengthened 25 cases, being associated with radiotherapy nine areolas and 16 without association with radiotherapy, with a $p=0.918$, without statistical relevance when related to radiotherapy.

Comorbidities (artery hypertension, thyroid alterations, diabetes, asthma, post-bariatric, thrombosis and chemotherapy) were not evaluated as factors that predicted risks for changes in the surgical evolution of the operated areas in this study.

Complications found in the postoperative period were restricted to three partial necrosis/epidermolysis of the areola. No patient was submitted to a new procedure in a surgical center motivated by these complications. The interventions performed on an outpatient basis were condensed in the corrections of areolar contour and treatment of skin suffering.

DISCUSSION

Breast cancer has progressively increased in recent years, and concomitantly, diagnosis and treatment have been performed earlier and earlier. The evolution of treatment by plastic surgery, in the case of breast reconstruction, results, in addition to the reparative treatment, in the best aesthetic result. However, adjuvant treatment with radiotherapy can directly interfere with the result maintenance over time. This is because, clinically, its effects include flaking, erythema, telangiectasias, dermal hyperpigmentation and even skin fibrosis¹⁹⁻²¹.

The data obtained in the study are important and compatible with the literature because the changes in staining may be related to the graft integration process, grafted skin thickness, of melanin concentration in the skin of the donor area. Although breast size was not a data evaluated in the study, it was observed that the alterations related to the shape were linked to the breast volume²²⁻²³ and the positioning of the patient on the operating table.

The change in size showed the greatest importance concerning the reconstructed NAC's symmetry and interfering in maintaining the results over time. In a recent publication, the increased prevalence of adjuvant irradiation in the breasts for breast cancer treatment is described, making it a difficult area for NAC reconstruction and maintaining results that may be unsatisfactory²³. However, despite the publications reporting dermal fibrosis, vascular alteration and pigment in irradiated breasts, this study showed in the reconstruction of NAC in irradiated breasts, the areola presenting a good symmetry, important maintenance of the result over time (follow-up of at least six months), even with deleterious effects of radiotherapy, proven by the reduction of the areolar complex²⁴.

CONCLUSION

After statistical analysis, staining and contour are not directly related to radiotherapy. However, the *odds ratio* (Table 2) analysis between the shrinkage of the areola associated with radiotherapy shows that the chance of presenting a decrease in its diameter is up to 3 times greater concerning the non-shrinkage associated with radiotherapy.

Adjuvant radiotherapy was a predisposing factor for changes that may arise in the postoperative period of reconstruction of the nipple-areolar complex. It was possible to confirm that radiotherapy treatment would cause interference in the results regarding the size/shrinkage of the areolas and with statistical significance. However, even with radiotherapy, good results and good symmetry are observed in operated patients.

Table 2. Analysis of the postoperative evolutions of the reconstructed areolas in skin submitted to radiotherapy and its statistical analysis.

	With RT	No RT	Total	Odds ratio	IC 95%	p
Regular/bad symmetry	5	11	16	0.795	0.2417 ^a	0.706
Good symmetry	20	35	55		2.618	
Different coloring	4	4	8	2.000	0.454 ^a	0.359
Similar coloring	21	42	63		8.800	
Elongated contour	9	16	25	1.054	0.381 ^a	0.918
Round contour	16	30	46		2.917	
Shrinking of the areola yes	9	7	16	3.139	0.995 ^a	0.050
Shrinking of the areola no	16	39	55		9.862	

RT: Radiotherapy. CI: Confidence interval. p: p-value.

COLLABORATIONS

MCC	Conception and design study, Methodology, Supervision, Writing - Review & Editing
AAD	Analysis and/or data interpretation, Conception and design study, Data Curation, Formal Analysis, Writing - Original Draft Preparation
SVS	Supervision
RSCC	Supervision
COPC	Supervision
TMAF	Supervision
JCD	Supervision
PCETT	Supervision

REFERENCES

- Bray, F et al. Global Cancer Statistics 2018: Globocan Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA: a Cancer Journal for Clinicians*, v. 68, n. 6, p. 394-424, 2018.
- Instituto Nacional de Câncer José Alencar Gomes da Silva. A situação do câncer de mama no Brasil: síntese de dados dos sistemas de informação. Instituto Nacional de Câncer José Alencar Gomes da Silva. – Rio de Janeiro: INCA, 2019.
- Jorgensen L, Garne JP, Sogaard M, Laursen BS. The experience of distress in relation to surgical treatment and care for breast cancer: an interview study. *Eur J Oncol Nurs*. 2015 Dec;19(6):612-8.
- Schubart JR, Emerich M, Farnan M, Stanley Smith J, Kauffman GL, Kass RB. Screening for psychological distress in surgical breast cancer patients. *Ann Surg Oncol*. 2014 Oct;21(10):3348-53.
- Brigitte Langelier et al., « Évaluation de la satisfaction des patientes ayant bénéficié d'un tatouage de la plaque aréolomamelonnaire après reconstruction mammaire. Recherche en soins infirmiers 2018/2 (N° 133), p. 37-44. DOI 10.3917/rsi.133.0037.
- Millard DR (1972) Nipple and areola reconstruction by split-skin graft from the normal side. *Plast Reconstr Surg* 50:350-353.
- Wexler MR, Oneal RM (1973) Areola sharing to reconstruct the absent nipple. *Plast Reconstr Surg* 51:176-178.
- Adams VW (1949) Labial transplant for correction of loss of the nipple. *Plast Reconstr Surg* 4:295-298.
- Barton FE Jr (1982) Latissimus dermal-epidermal nipple reconstruction. *Plast Reconstr Surg* 70:234-237.
- Rose EH (1985) Nipple reconstruction with four-lobe composite auricular graft. *Ann Plast Surg* 15:78-81.
- Klatsky SA, Manson PN (1981) Toe pulp free grafts in nipple reconstruction. *Plast Reconstr Surg* 68:245-248.
- Kroll SS (1989) Nipple reconstruction with the double-opposing-tab flap. *Plast Reconstr Surg* 104:520-525.
- Kroll SS, Reece GP, Miller MJ, Evans GR, Robb GL, Baldwin BJ, Wang BG, Schusterman MA (1997) Comparison of nipple projection with the modified double-opposing tab and star flaps. *Plast Reconstr Surg* 99:1602-1605.
- Losken A, Mackay GJ, Bostwick J 3rd (2001) Nipple reconstruction using the C-V flap technique: a long-term evaluation. *Plast Reconstr Surg* 108:361-369.
- Tomita, S., Mori, K. & Miyawaki, T. Color Change After Paramedical Pigmentation of the Nipple-Areola Complex. *Aesth Plast Surg* 42, 656-661 (2018).
- DI LAMARTINE, Jefferson et al . Nipple-areola reconstruction using the double opposing flap technique. *Rev. Bras. Cir. Plást., São Paulo* , v. 28, n. 2, p. 233-240, jun. 2013 .
- Alexander J, Gougoutas, Hakim K, Said, Grace Um, Anne Chapin, PA.-C. David W. Mathes. Nipple-Areola Complex Reconstruction. *Plastic and Reconstructive* 404e - 416e (2018).
- Cammarota, MC, Galgino MCA, Daher LMC, Barcelos LDP, Cosac OM, Peixoto BE, et al. Triangular flap for nipple reconstruction. *Rev. Bras. Cir. Plásti*. 2020; 35(1):28-37.
- Hamdi M, Casaer B, Andrades P, Thiessen F, Dancey A, D'Arpa S, et al. Salvage (tertiary) breast reconstruction after implant failure. *J Plast Reconstr Aesthet Surg*. 2011;64(3):353-9.
- Cosac OM, Camara Filho JPP, Cammarota MC, Lamartine JD, Daher JO, Borgatto MS, et al. Salvage breast reconstruction: the importance of myocutaneous flaps. *Rev. Bras. Cir. Plást*. 2013; 28(1):92-99.
- Cammarota MC, Galdino MCA, Daher LMC, Barcelos LDP, Cosac OM, Peixoto BR, et al. Triangular flap for nipple reconstruction. *Rev. Bras. Cir. Plást*. 2020; 35 (1): 28-37.
- Rezende MCR, Koch HA, Figueiredo JA, Thuler LCS. [Factors leading to delay in obtaining definitive diagnosis of suspicious lesions for breast cancer in a dedicated health unit in Rio de Janeiro]. *Rev Bras Ginecol Obstet*. 2009;31(2):75-81. Portuguese.
- Trufelli DC, Bensi CG, Pane CEV, Ramos E, Otsuda FC, Tannous NG, et al. Onde está o atraso? Avaliação do tempo necessário para o diagnóstico e tratamento do câncer de mama nos serviços de oncologia da Faculdade de Medicina do ABC. *Rev Bras Mastologia*. 2007;17(1):14-7.
- Zenn, Michael R.; Garofalo, Jo Ann. Unilateral Nipple Reconstruction with Nipple Sharing: Time for a Second Look. *Plastic and Reconstructive Surgery*. 123(6):1648-1653, June 2009.

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