

Nipple Areolar Malposition Versus Ideal Position After Nipple-Sparing Mastectomy Reconstruction

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BACKGROUND

Advances in surgical oncology care have demonstrated the safety of nipple-sparing mastectomy (NSM), which has allowed for research-proven efficacy in cancer ablation while also having reconstruction aesthetic benefit^{1,2}. Nipple-sparing mastectomy reconstruction also provides location improvement in post-reconstruction quality of life in comparison to non-nipple-sparing mastectomy reconstruction³. As with any surgery, however, there are possible complications, and one of the most challenging to resolve is nipple malposition, in which the nipples diverge from the original or ideal positioning.

OBJECTIVES

UNDERSTANDING MALPOSITION

This retrospective study aims to understand nipple-areolar complex (NAC) malposition in nipple-sparing mastectomy reconstruction patients.

IDENTIFYING CONTRIBUTING FACTORS

We also hope to identify potential surgical techniques that either increase or decrease the likelihood of NAC malposition to improve surgical standards of care and to achieve better patient outcomes.

METHODS

All patients undergoing NSM reconstruction at Mayo Clinic Florida from January 2020 to May 2023 were assessed. The vertical and horizontal axial proportions associated with NAC location on the breast were calculated using pixel measurements taken from standardized pre-operative and post-operative clinical photographs. Both frontal and lateral views of the patient were considered, with measurements being taken for the frontal view of horizontal axis NAC location and both frontal and lateral views of vertical axis NAC location [Figure 2].

The pre-operative and post-operative NAC position calculated ratios were then respectively compared to those considered "ideal" in existing survey research⁴. According to this research on NAC location and proportions, "ideal" positioning would be:

- 40:60 along the horizontal x-axis in frontal view
- 50:50 along the vertical x-axis in both frontal and lateral views.

Various patient and surgical technique demographics were collected. Variables that could affect NAC malposition (i.e., incision type, plane of placement, acellular dermal matrix (ADM) usage, and type of reconstruction) were analyzed using a linear mixed effects regression model to account for the additional variation in NAC position by these variables. Both univariate models and multivariate models were utilized.

All statistical tests were two-sided. Statistical analyses were performed using R Statistical Software (version 4.1.2; R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

A total of 88 NSM reconstruction patients were assessed. 6 patients were excluded for missing data (e.g., no post-operative photos). The remaining 82 NSM reconstruction patients were included for analysis. Patient demographic information is outlined in [Figure 1]. Patients tended to be middle-aged (mean approximately age 50), the majority had: bilateral mastectomy (82.9%), incision location at the inframammary fold (IMF) (64%), subpectoral implant/tissue expander (TE) placement (67.1%), ADM usage (53.7%), and were staged TE reconstruction type (62.2%).

NAC malposition (in reference to the ideal), was more post-operatively than pre-operatively in both frontal and lateral views of the vertical axis [Table 1]. For both the pre-operative and post-operative groups, the NAC positionings tended to be more inferior and more lateral from midline from the frontal view [Table 1].

From the lateral view, vertical ratios in comparison to ideal ratios, there was a statistically significant effect to NAC position by the variables: time (pre-operative and post-operative) (p=0.013, p=0.013), incision type (p=0.003, p = 0.007), and ADM use (p<0.001, p=0.033), in both univariate and multivariate analysis, respectively [Table 2]. Plane of placement (pre-pectoral vs. sub-pectoral) (p=0.012, p=0.70) and reconstruction type (TE vs. DTI) (p=0.058, p=0.87), had a statistically significant effect to NAC position only in the univariate model but not after controlling for the other variables in the multivariate model, respectively [Table 2]

From the frontal view, vertical ratios in comparison to ideal ratios, there was a statistically significant effect to NAC position by the variables: time (pre-operative and post-operative) (p=0.006, p=0.006) and ADM use (p<0.001, p=0.025), in both univariate and multivariate analysis, respectively [Table 3]. Plane of placement (pre-pectoral vs. sub-pectoral) (p=0.011, p=0.81) and reconstruction type (TE vs. DTI) (p=0.029, p=0.59), had a statistically significant effect to NAC position only in the univariate model but not after controlling for the other variables in the multivariate model, respectively [Table 3].

From the frontal view, horizontal ratios in comparison to ideal, none of the variables had a statistically significant effect to NAC position.

FIGURE 1: Reconstruction Demographics

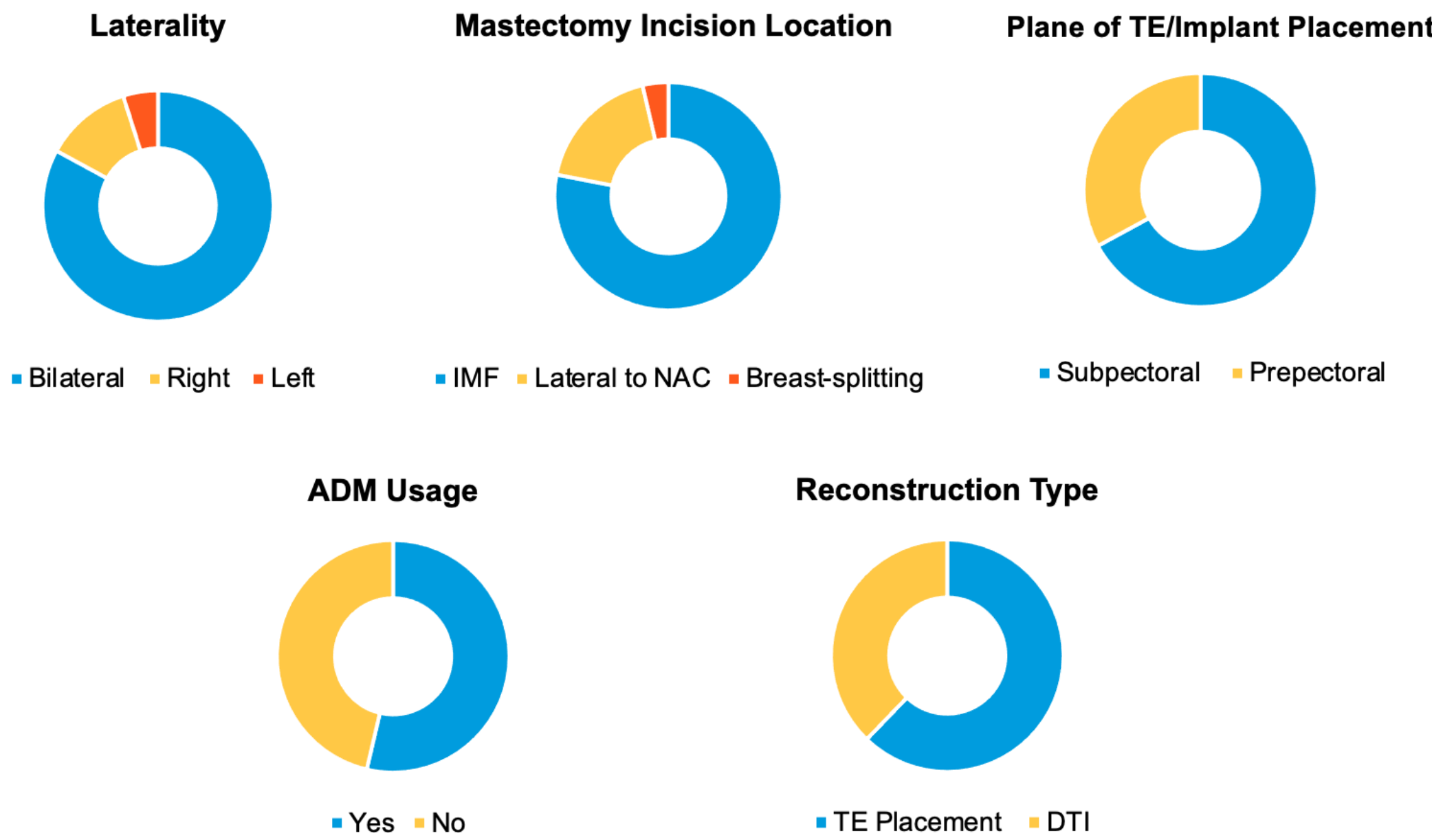


FIGURE 2: Measurements for Proportion Calculations⁵

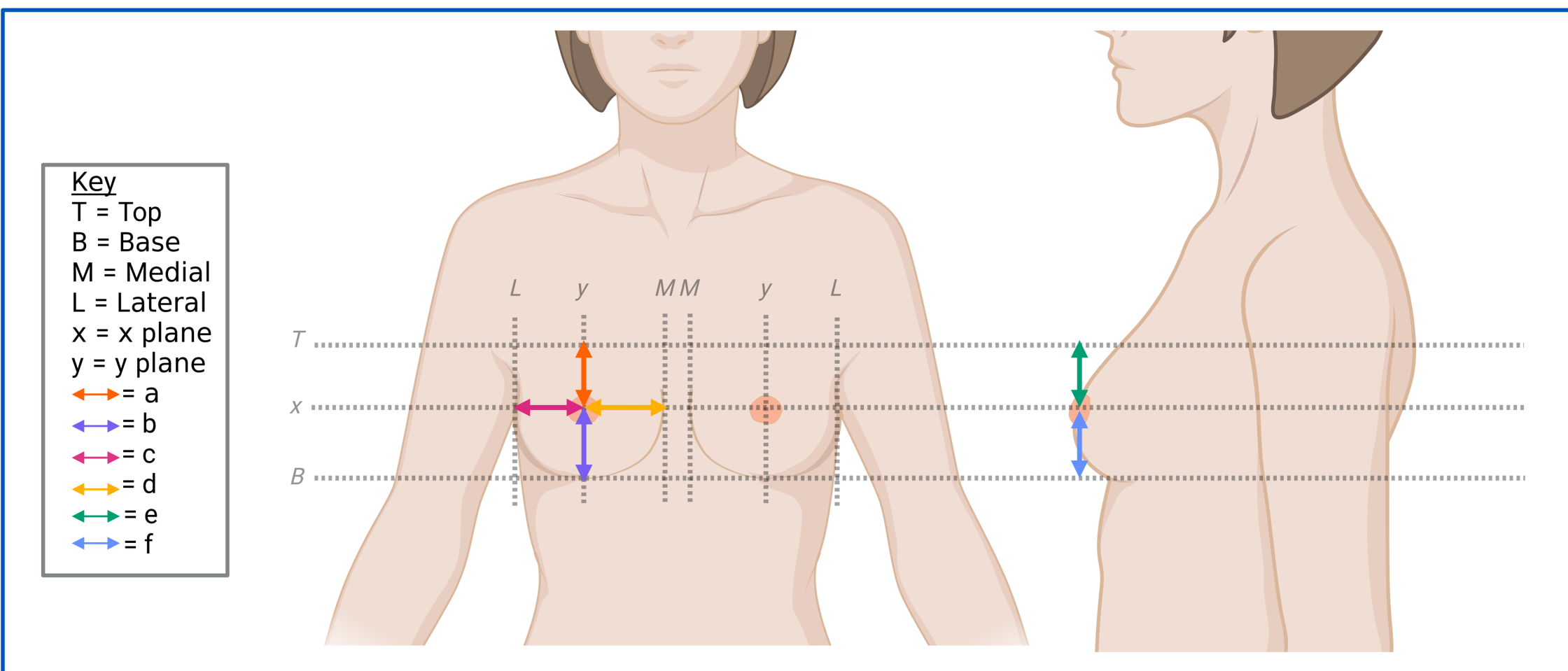


TABLE 1: Actual vs Ideal NAC Positioning

Actual Proportion Being Compared to Ideal Proportion	A) Pre-Operative vs Ideal NAC Position (%)	B) Post-Operative vs Ideal NAC Position (%)	Difference between B and A (%)
Lateral View, Vertical Axis NAC Location	13.306	15.792	2.486
Frontal View, Vertical Axis NAC Location	13.932	15.953	2.021
Frontal View, Horizontal Axis NAC Location	6.697	7.204	0.507

TABLE 2: Effect of Variables on Vertical Axis NAC Position (Lateral View)

Variable	Univariate Model		Multivariate Model	
	Estimate (95% CI)	P-value	Estimate (95% CI)	P-value
Time				
Pre-Op	Baseline	N/A	Baseline	N/A
Post-Op	2.02 (0.43, 3.61)	0.013	2.02 (0.43, 3.61)	0.013
Incision				
IMF	Baseline	N/A	Baseline	N/A
Breast-Splitting	8.85 (3.03, 14.67)	0.003	7.88 (2.16, 13.56)	0.007
Lateral to NAC	-0.42 (-3.34, 2.50)	0.78	-1.03 (-3.94, 1.89)	0.49
Plane of Implant/TE Placement				
Prepectoral	Baseline	N/A	Baseline	N/A
Subpectoral	3.10 (0.70, 5.50)	0.012	0.60 (-2.48, 3.69)	0.70
ADM Use				
No	Baseline	N/A	Baseline	N/A
Yes	-4.17 (-6.41, -1.94)	<0.001	-3.52 (-6.75, -0.30)	0.033
Reconstruction Type				
TE	Baseline	N/A	Baseline	N/A
DTI	-2.28 (-4.63, 0.081)	0.058	-0.21 (-2.82, 2.40)	0.87

TABLE 3: Effect of Variables on Vertical Axis NAC Position (Frontal View)

Variable	Univariate Model		Multivariate Model	
	Estimate (95% CI)	P-value	Estimate (95% CI)	P-value
Time				
Pre-Op	Baseline	N/A	Baseline	N/A
Post-Op	2.49 (0.73, 4.24)	0.006	2.49 (0.73, 4.24)	0.006
Incision				
IMF	Baseline	N/A	Baseline	N/A
Breast-Splitting	5.0 (-1.30, 11.29)	0.12	3.63 (-2.50, 9.77)	0.24
Lateral to NAC	0.011 (-3.15, 3.17)	0.99	-0.85 (-3.99, 2.29)	0.59
Plane of Implant/TE Placement				
Prepectoral	Baseline	N/A	Baseline	N/A
Subpectoral	3.32 (0.78, 5.85)	0.011	0.41 (-2.92, 3.72)	0.81
ADM Use				
No	Baseline	N/A	Baseline	N/A
Yes	-4.62 (-6.98, -2.27)	<0.001	-3.98 (-7.45, -0.50)	0.025
Reconstruction Type				
TE	Baseline	N/A	Baseline	N/A
DTI	-2.27 (-5.25, -0.29)	0.029	-0.77 (-3.58, 2.03)	0.59

DISCUSSION

- The greater NAC malposition seen post-operatively in nipple-sparing mastectomy reconstruction patients may also be associated with the use of a smooth, round implant or anatomic shaped tissue expander to reconstruct a natural tear-dropped anatomic shaped breast that has a footprint that is a larger surface area than the implant or tissue expander.
- Due to the retrospective design of this study, there was some inconsistency in the timing of post-operative photographs and measurements. Thus, another potential contributing factor to NAC malposition may be affected from the time that has elapsed from surgery to clinical photographs. For example, the NAC position may be in a more optimal position and closer to ideal in patients who have had more time since surgery for their tissue to heal and undergo relaxation.

CONCLUSIONS

- There is slightly more NAC malposition, in reference to established ideal positioning, post-operatively compared to pre-operatively.
- There are multiple potential contributing factors to post-operative increased malposition, such as plane of placement, incision type, use of ADM, and type of reconstruction.

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5. Figure 1 created with BioRender.com