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Breast tissue expanders after mastectomy: A comparative study

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INTRODUCTION

Breast cancer has replaced lung cancer as the most common cancer worldwide with approximately 2.3 million new cases globally in 2020. (1) In tissue expander based breast reconstruction (TEBR), a tissue expander (TE) is placed into the mastectomy pocket for preservation of the mastectomy skin flap. With an increasing number of mastectomies and some changes in reconstructive approaches, such as hybrid reconstruction, the overall use of TEs is increasing and tends to stay in the mastectomy pocket for longer periods of time. Especially with the occurrence of anaplastic large cell lymphoma (BIA-ALCL), associated with the use of "textured" implants, the impact of surface roughness has become an immense topic of interest.

OBJECTIVE: ***Comparison of three different types of tissue expanders in patients undergoing TEBR and identification of predicting factors with regard to capsular contracture and overall complication profile***

METHODS

Retrospective review of a prospectively maintained database of 147 TEs in 122 patients undergoing TEBR from January 2016 until March 2022 at the Centro di Senologia della Svizzera Italiana (CSSI) from the Ente Ospedaliero Cantonale.

Patients were categorized into three main groups according to their surface texturization, resulting in a smooth group, a micro group, and a macro group. (Figure 1)

Endpoints included comparison of grade of capsular contracture (CC), as well as other complications, such as hematoma, seroma, mastectomy skin flap necrosis, infection, hematoma, delayed wound healing / wound dehiscence, pain until 3 months post surgery, as well as malpositioning, flipping rupture or rotation of the expander and breast animation.

Furthermore predicting factors for each endpoints were identified in a mixed multivariable regression model using LASSO (least absolute shrinkage and selection operator).

Group **MACRO**: (n=15, TE: NATRELLE® 133, Allergan Inc, Irvine, California)

Group **MICRO**: (n=38, TE: CPX®4 breast, MENTOR®, USA)

Group **SMOOTH «NANO»**: (n=82, TE: Motiva Flora®, Establishment Labs, Costa Rica)

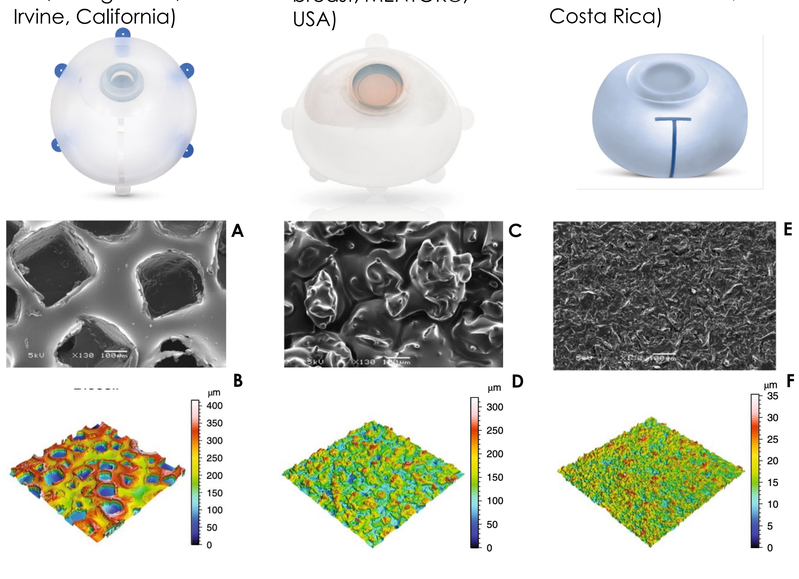


Figure 1: Comparison of the three different TEs used with electrone microscope (SEM) and profilometry images of implant surfaces.

A, biocell surface in SEM; B, profilometry biocell, **(MACRO)**

C, siltex surface in SEM; D, profilometry siltex, **(MICRO)**

E, smoothsilk surface in SEM, F, profilometry smoothsilk **(SMOOTH "NANO")**

Reference: Doloff et. al. NATURE https://doi.org/10.1038/s41551-021-00739-4

RESULTS

Baseline characteristics between the three groups were overall comparable. Breasts receiving nanotextured TEs showed statistically significant lower rates of capsular contracture (CC: p<0.001). 52.9% of breasts in the nano group scored asymptomatic Baker grades IA and IB CC, compared to none in the macro group and 5.6% in the micro group. (Table 1)

The presence of post-mastectomy radiotherapy (PMRT) and nanotexturization were both strongly significant predictive factors for CC (*p<0.0001*). PMRT increased the likelihood of higher CC, while a nanotexturization seemed to have a protective effect towards CC development. (Table 2) In an effect plot, separating the two identified predictors, nanotexturized TEs that were irradiated, showed comparable percentages of symptomatic CC, to other TE without PMRT. (Graph 1)

The most common post-operative complication that occurred after TEBR was seroma (34.0% of all TEs), followed by malpositioning of the expander (19.7% of all TEs). Group smooth "nano" had signficiantly higher levels of seroma, while presenting significantly lower levels of pain until three months after surgery, breast animation and less malpositioning. Mastectomy weight was identified as a significant predictor for the occurrence of overall complications (OR, 1.24; 95% CI, 1.04 to 1.49, p<0.05).

Figure 2: *Photgraphs of patients undergoing TEBR, before and six months after primary breast reconstruction, higher craniliazation and contracture can be observed in micro and macro.*

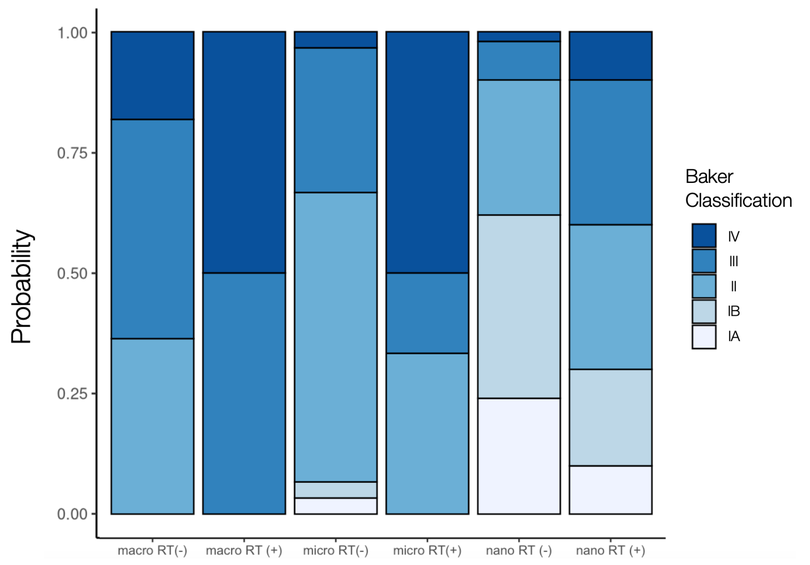
	Macro (%)	Micro (%)	SMOOTH "NANO" %)	*P*
Contracture grade				**<0.001**
IA	0 (0.0)	1 (2.8)	14 (20.0)	
IB	0 (0.0)	1 (2.8)	23 (32.9)	
II	4 (26.7)	20 (55.6)	20 (28.6)	
III	7 (46.7)	10 (27.8)	10 (14.3)	
IV	4 (26.7)	4 (11.1)	3 (4.3)	

Table 2. Overview of Capsular Contracture categorised by Baker-Spearson Classification *Statistically significant (p < 0.05)

Predictors selected by LASSO	Levels	Odds Ratio (95% CI)	*P*
TE group	**Smooth Nano**	0.12 (0.05 - 0.28)	<0.0001 *
	Macro	2.51 (0.75 - 8.40)	0.13
	Micro (Ref)	—	—
PMRT	**Yes**	4.67 (1.86 - 11.71)	0.0008*
	No (Ref)	—	—
ALND	**Yes**	2.02 (0.84 - 4.89)	0.1
	No (Ref)	—	—

Table 2. Results of proportional mixed effects model for capsular contracture. LASSO, least absolute shrinkage and selection operator; 95% CI, 95% confidence interval; PMRT, post-mastectomy radiation therapy; ALND, axillary lymph node dissection *Statistically significant (p < 0.05).

Marginal Distribution of Capsular Contracture with regard to significant predictors



Graph 1. Effect plot TE group and PMRT, marginal distribution of capsular contracture; PMRT, post-mastectomy radiation therapy;

CONCLUSION

Usage of nanotexturized tissue expanders are associated with significantly lower degrees of capsular contracture, compared to microtextured and macro textured tissue expanders. Presence of PMRT significantly increased the risk of developing capsular contracture. Together with its MR-compatibility, the nanotexturized TE is likely to have an advantage in reconstructive breast surgery.

References:

[1] Arnold M, Morgan E, Rumgay H, et al. Current and future burden of breast cancer: Global statistics for 2020 and 2040. Breast. 2022;
[2] Doloff, J.C., Veiseh, O., de Mezerville, R. et al. The surface topography of silicone breast implants mediates the foreign body response in mice, rabbits and humans. Nat Biomed Eng 5, 1115–1130 (2021).