

# SmoothSilk®/SilkSurface® Recent Publications & Clinical Data

December 2018





# References

1. ISO 14607:2018. Non-active surgical implants – Mammary implants particular requirements. Geneva, Switzerland: International Organization for Standardization.
2. Kyle DJ, Oikonomou A, Bayat A. Development and functional evaluation of biomimetic silicone surfaces with hierarchical micro/nano-topographical features demonstrates favourable in vitro foreign body response of breast-derived fibroblasts. *Biomaterials*. June 2015;52:88-102. doi: [10.1016/j.biomaterials.2015.02.003](https://doi.org/10.1016/j.biomaterials.2015.02.003)
3. Establishment Labs Post-Market Surveillance Report Q3-2018
4. Atlan, et al. Breast implant surface texture impacts host tissue response. *Journal of the Mechanical Behavior of Biomedical Materials*. Dec 2018;88:377-385. doi: [10.1016/j.jmbbm.2018.08.035](https://doi.org/10.1016/j.jmbbm.2018.08.035)
5. Jones et al. The functional influence of breast implant outer shell morphology on bacterial attachment and growth. *Plast Reconstr Surg*. 2018;142(4):837-849. doi: 10.1097/PRS.00000000000004801
6. James, G. et al. Bacterial adhesion and Biofilm formation on textured breast implant shell materials. *Aesth Plast Surg*. Oct 2018. doi: [10.1007/s00266-018-1234-7](https://doi.org/10.1007/s00266-018-1234-7)
7. Cappellano G, Ploner C, Lobenwein S, Sopper S, Hoertnagl P, Mayerl C, et al. Immunophenotypic characterization of human T cells after in vitro exposure to different silicone breast implant surfaces. *PLoS ONE*. 2018;13(2): e0192108. doi: [10.1371/journal.pone.0192108](https://doi.org/10.1371/journal.pone.0192108)
8. Sforza M, Zaccheddu R, Alleruzzo A, et al. Preliminary 3-year evaluation of experience with SilkSurface and VelvetSurface Motiva silicone breast implants: a single-center experience with 5813 consecutive breast augmentation cases. *Aesthet Surg J*. 2018;38(Suppl 2):S62-S73. doi: [10.1093/asj/sjx150](https://doi.org/10.1093/asj/sjx150)
9. Chacón M, Chacón M & Fassero J. Six-Year Prospective Outcomes of Primary Breast Augmentation with Nano-Surface Implants. *Aesthet Surg J*. Nov 2018; doi: [10.1093/asj/sjy196](https://doi.org/10.1093/asj/sjy196)



# ISO 14607:2018

## INTERNATIONAL STANDARD

## ISO 14607

Third edition  
2018-04

### Non-active surgical implants — Mammary implants — Particular requirements

*Implants chirurgicaux non actifs — Implants mammaires —  
Exigences particulières*

#### H.6 Expression of results

The obtained data is meant to generate information to improve knowledge on the correlation of texture characteristics, performance and safety.

Based on the average roughness measurement on the finished device, the surface can be described by the following:

- smooth: less than 10 µm;
- microtextured: from 10 µm to 50 µm; and
- macrotextured: over 50 µm.

**NOTE** The data resulting from the test at this point in time cannot be related to the performance or safety of the device, but enough data points should be collected to have the ability to study such relation.

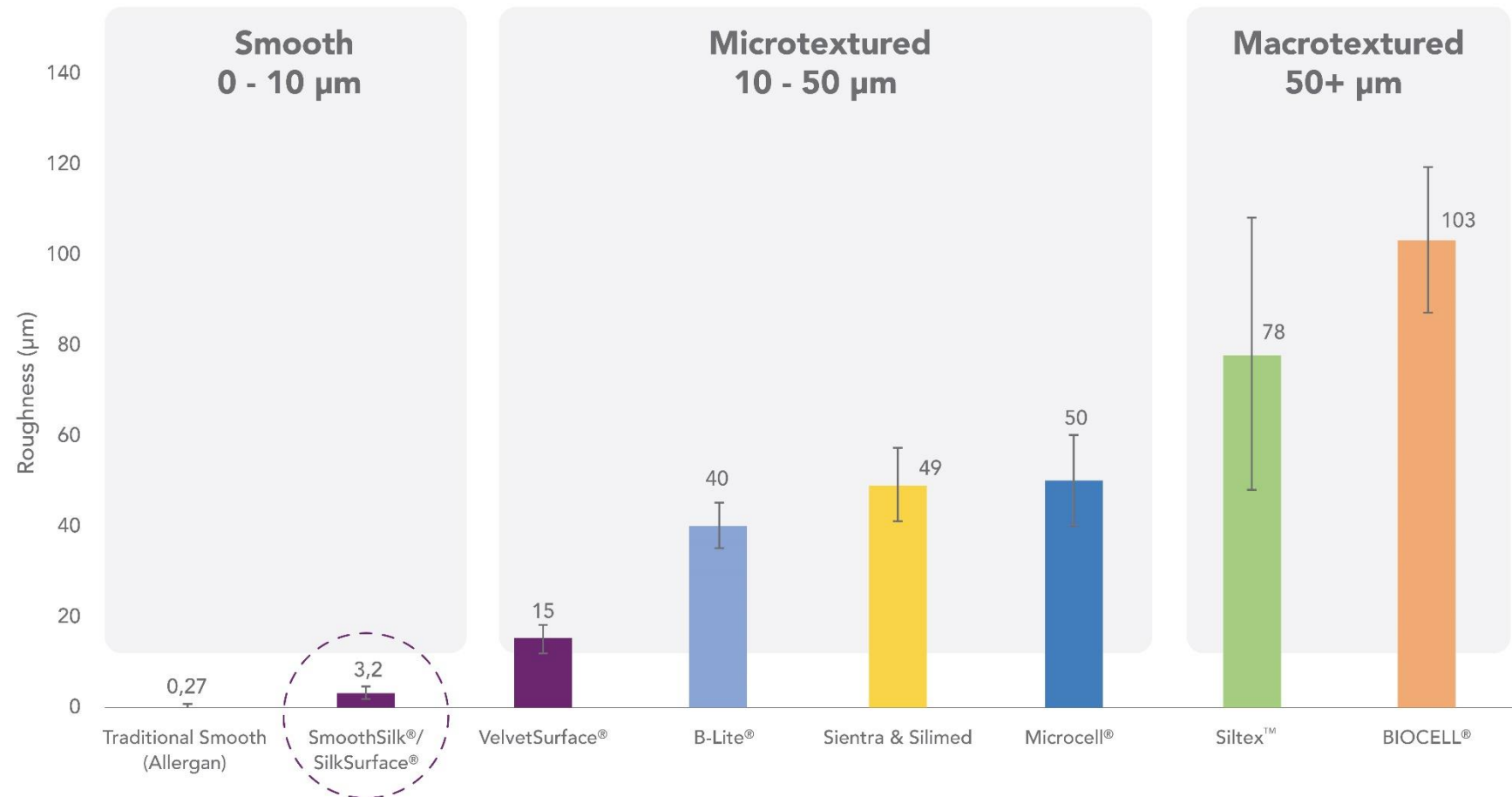
Licensed to Establishment Labs (purchasing@establishmentlabs.com)

ISO Store Order: OP-283853 / Downloaded: 2018-04-19

Single user licence only, copying and networking prohibited.

© ISO 2018 – All rights reserved

# International Standards Organization Surface Categorization ISO 14607:2018



**ISO14607:2018 Non-active surgical implants — Mammary implants**

**Note:** TS-17-026.R; TS-17-029.R; Jones et al.(2018) Plast Reconstr Surg. 142:837-849; Atlan et al.(2018) Journal of the Mechanical Behavior of Biomedical Materials. 88:377-385; James et al. (2018) Aesth Plast Surg. Doi:10.1007/s00266-018-1234-7



# Kyle et al (Mentor publication) – optimal cell response



## Design:

- A 3D silicone matrix replicating the micro and nanoscale features of ADM was created.
- Human dermal fibroblasts were cultured on the surface and cellular responses were compared to smooth and textured implant surfaces

## Results:

- The microenvironment of the silicone ADM replica promoted cell adhesion, proliferation and survival.
- A reduced inflammatory cytokine response was also observed.

## Conclusion:

- The topography of a micro/nano surface (such as SmoothSilk®/SilkSurface®) possesses features "that a cell is able to sense, interact and respond to" which facilitates cell adaptation and may significantly reduce the acute foreign body reaction to silicone.

# Smooth Surface but high density of peaks

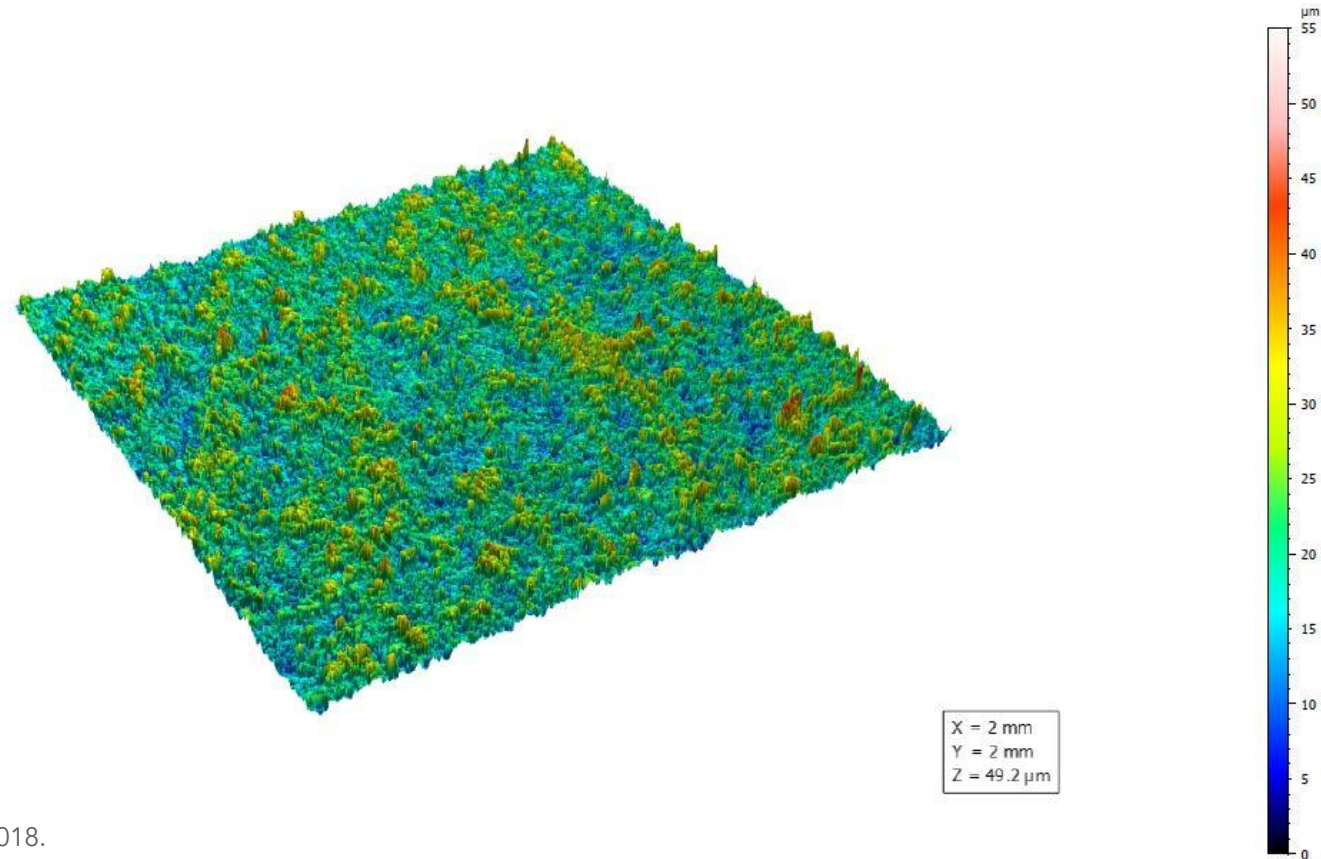
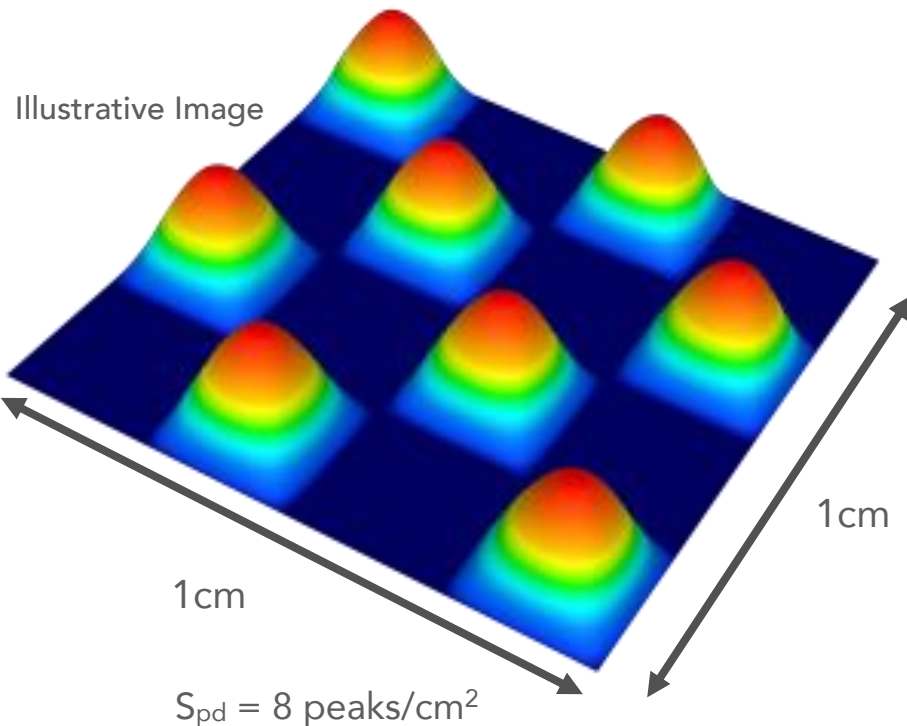


Peaks that function as contact points for cells attachment during the immune response

SmoothSilk® /SilkSurface®

Average Roughness:  $3.2 \mu\text{m} \pm 600 \text{ Nanometers}$

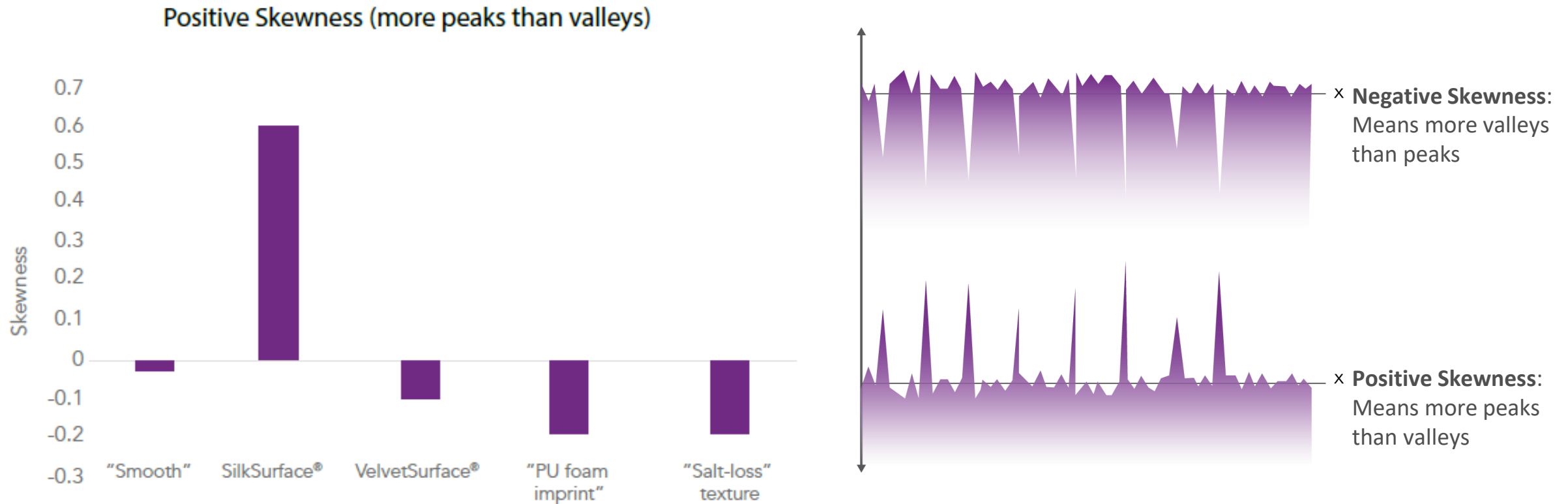
Density of Peaks:  $25.820(S_{pd}) \text{ (Peaks/cm}^2\text{)}$





# SmoothSilk®/SilkSurface® has more peaks than valleys

Peaks that function as contact points for cells attachment during the immune response



Skewness parameter comparison of different breast implants available in the market, measured with uSurf Mobile non-contact profilometer. Results Property of Establishment Labs (2017).

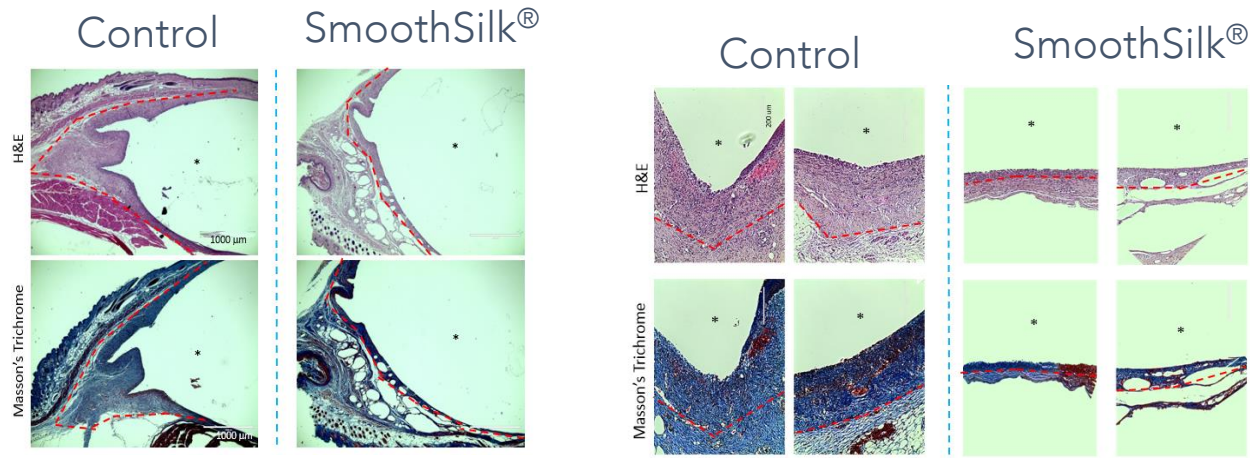


# BL6 Mice Pilot at Langer Lab at MIT

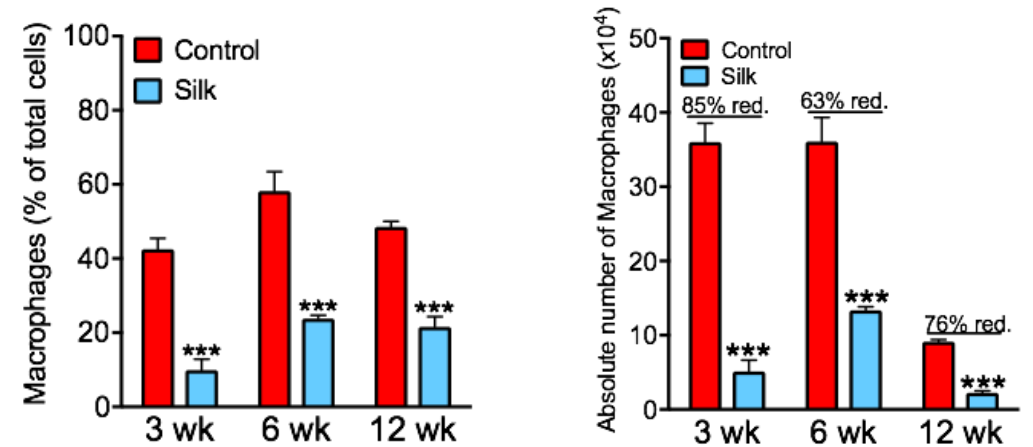
Low Inflammatory Response

Less Macrophages with SmoothSilk® /SilkSurface®

SmoothSilk® /SilkSurface® ameliorates fibrosis in B6 mice



Histological analysis of the tissue capsule surrounding the SmoothSilk® /SilkSurface® and Smooth tiny implants with two different staining techniques.



SmoothSilk® /SilkSurface® decreases fibrosis-dependent innate immune macrophages.

# Atlan et al (Allergan publication) – 12 implant surfaces evaluated



**Table 2**  
Texture surface area from anterior and posterior of the shell of each breast implant surface texture determined by X-ray computed tomography.

Implant texture	Mean (SD) texture surface area (mm <sup>2</sup> )		Mean % greater texture surface area than flat surface <sup>a</sup> Anterior
	Anterior	Posterior	
Allergan Smooth <sup>b</sup>	85 (4)	85 (4)	9
Motiva SilkSurface	85 (1)	85 (2)	8
Motiva VelvetSurface	90 (2)	89 (2)	14
Polytech	115 (7)	119 (5)	47
MESMOsensitive			
Mentor Siltex	125 (4)	143 (8)	60
Allergan Microcell	145 (4)	132 (12)	85
Allergan Biocell	213 (10)	248 (7)	171
Sientra True	218 (6)	244 (16)	178
Eurosilicone Crystalline	293 (8)	307 (17)	273
Nagor Nagotex	337 (9)	278 (12)	329
Polytech POLYtxt	347 (16)	431 (37)	341
Polytech Microthane	551 (21)	585 (46)	602

SD, standard deviation.  
<sup>a</sup> Surface area of a flat surface texture is 79 mm<sup>2</sup> for a 10-mm diameter disk.  
<sup>b</sup> The inside of the shell is not flat and contributes to the overall surface area.

# SilkSurface®/SmoothSilk® - same surface area as traditional smooth



M. Atlan et al.

Journal of the Mechanical Behavior of Biomedical Materials 88 (2018) 377–385

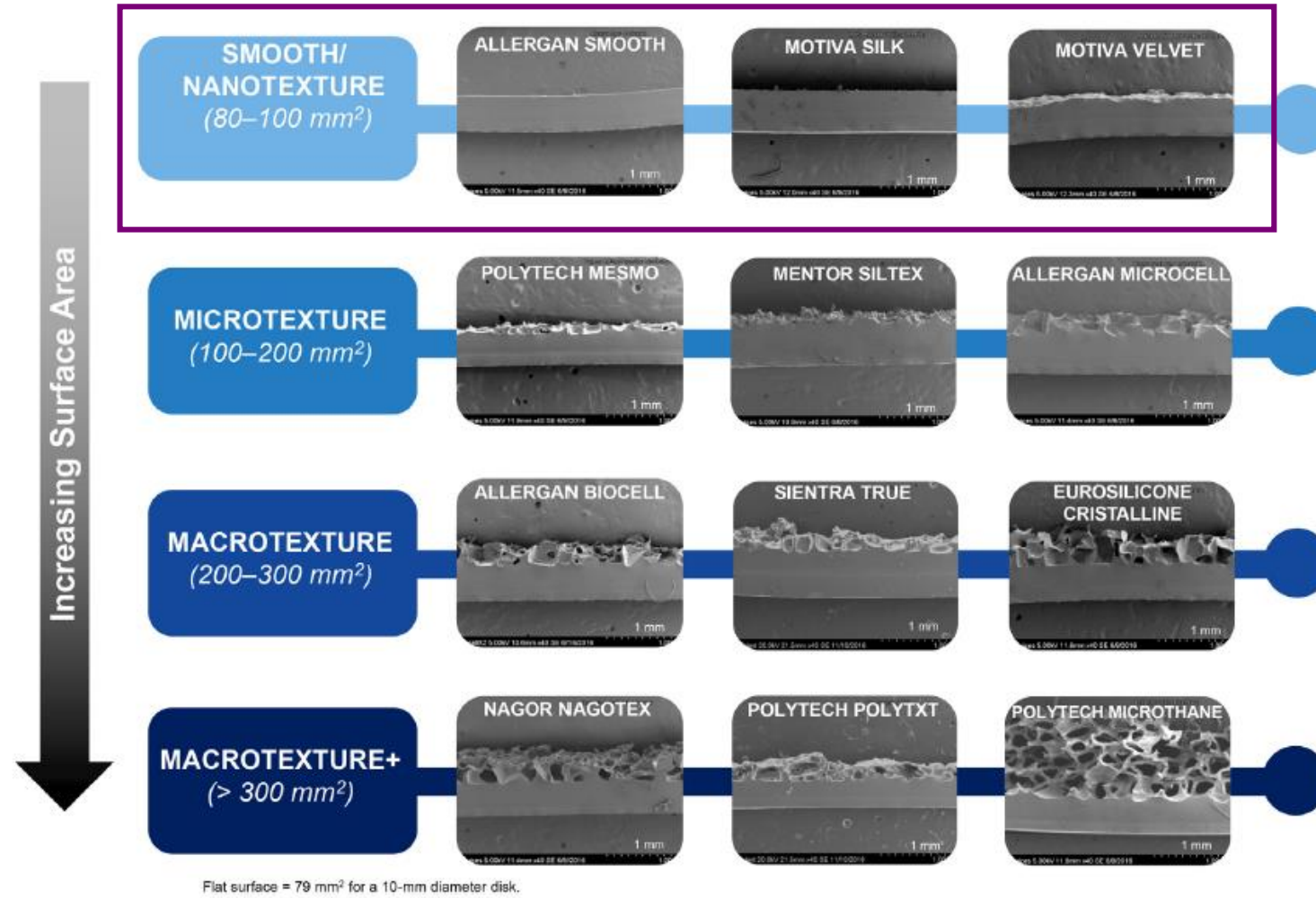
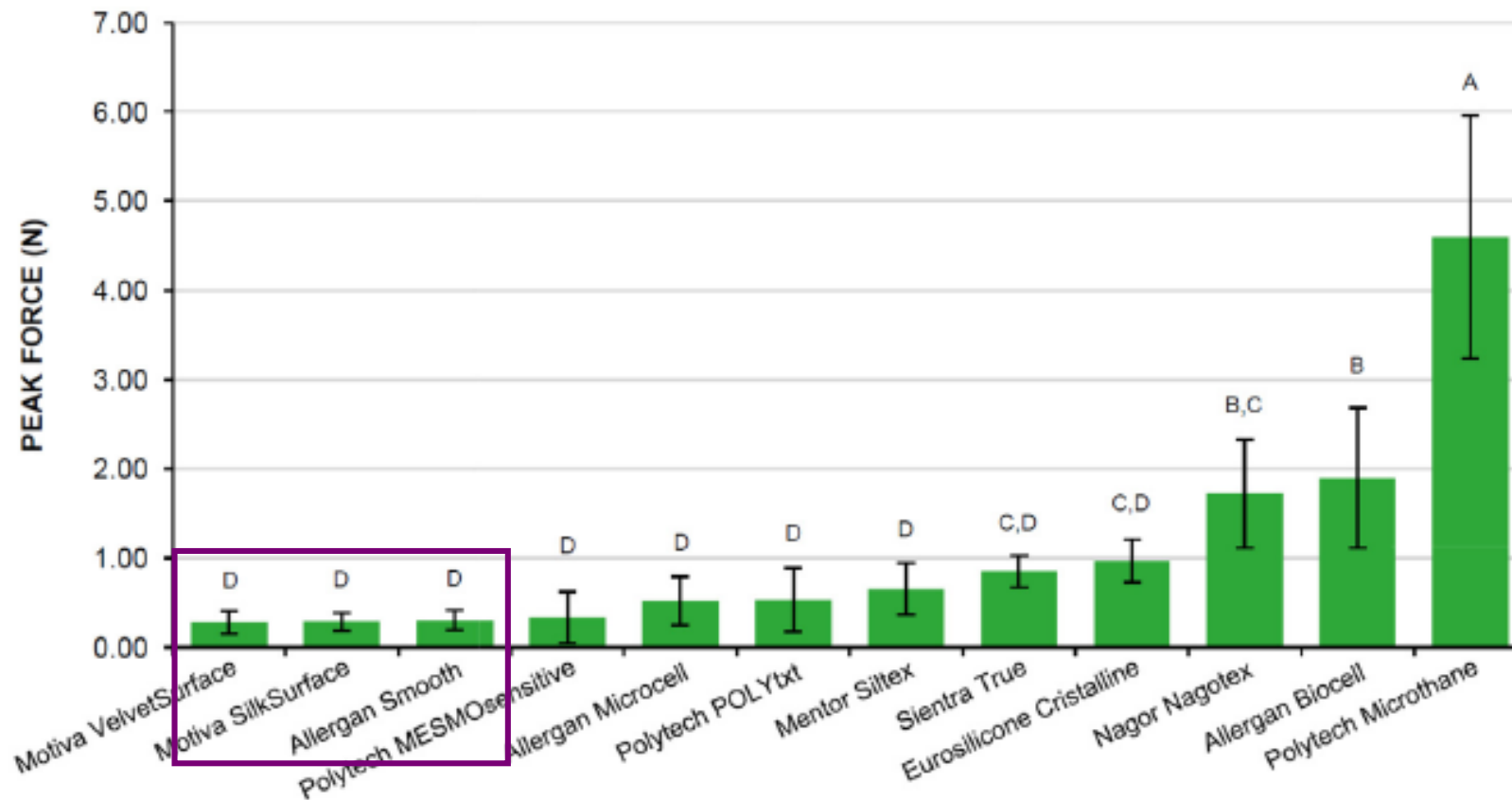


Fig. 7. Classification of implant textures based on texture surface area. SEM images of the cross section of each implant texture are organized into categories according to the magnitude of the texture surface area measured from the anterior of the shell by X-ray computed tomography.



# Atlan et al. – Tissue Adherence (peak force removal)



**Fig. 6.** Mean  $\pm$  SD adherence force required to separate the tissue capsule from the implant surface assessed 6 weeks after implantation of the different surface textures in Sprague-Dawley rats. N = 8 for each texture. Means that do not share a letter are significantly different ( $P \leq 0.05$ ).

# Jones et al – PRS Publication (Anand Deva)



BREAST

### The Functional Influence of Breast Implant Outer Shell Morphology on Bacterial Attachment and Growth

Phoebe Jones, M.B.B.S.,  
Maria Mempin, B.Med.Sc.,  
M.Res.(Med.)  
Honghua Hu, Ph.D.  
Durdana Chowdhury,  
M.B.B.S., M.Phil., Ph.D.  
Matthew Foley, Ph.D.  
Rodney Coote, M.D.  
William P. Adams, Jr., M.D.  
Karen Vickery, B.V.Sc.,  
Ph.D.  
Anand K. Deva,  
B.Sc.(Med.), M.B.B.S., M.S.  
*Sydney, New South Wales, Australia;  
and Dallas, Texas*

The texturization of the outer shell of breast implants was first introduced in 1968 with the “natural Y” implant, which incorporated a 1.2- to 2-mm polyurethane foam coating on its outer surface.<sup>1</sup> It was proposed that this surface prevented organized alignment of myofibroblasts, reducing the risk of capsular contracture.<sup>1</sup> In 1991, a specific association between polyurethane and the carcinogen 2,4-toluenediamine was reported.<sup>2,3</sup> This led to a voluntary withdrawal of polyurethane-coated silicone implants in the United States, which is still in place. Alternative surface technologies to modify the outer silicone

**Background:** The introduction of texture to the outer shell of breast implants was aimed at increasing tissue incorporation and reducing capsular contracture. It has also been shown that textured surfaces promote a higher growth of bacteria and are linked to the development of breast implant-associated anaplastic large cell lymphoma.

**Methods:** The authors aimed to measure the surface area and surface roughness of 11 available implants. In addition, the authors aimed to subject these implant shells to an in vitro bacterial attachment assay with four bacterial pathogens (*Staphylococcus epidermidis*, *S. aureus*, *Pseudomonas aeruginosa*, and *Ralstonia solanum*) and study the relationship among surface area, surface roughness, and bacterial growth.

**Results:** Surface area measurement showed grouping of implants into high, intermediate, low, and minimal. Surface roughness showed a correlation with surface area. The in vitro assay showed a significant linear relationship between surface area and bacterial attachment/growth. The high surface area/roughness implant texture grew significantly more bacteria at 24 hours, whereas the minimal surface area/roughness implant textures grew significantly fewer bacteria of all types at 24 hours. For implants with intermediate and low surface areas, some species differences were observed, indicating possible affinity of specific bacterial species to surface morphology.

**Conclusions:** Implant shells should be reclassified using surface area/roughness into four categories (high, intermediate, low, and minimal). This classification is superior to the use of descriptive terms such as macrotexture, microtexture, and nanotexture, which are not well correlated with objective measurement and/or functional outcomes. (*Plast. Reconstr. Surg.* 142: 837, 2018.)

From the Surgical Infection Research Group, Faculty of Medical and Health Sciences, Macquarie University; Integrated Specialist Healthcare Education and Research Foundation; Monash University; Australian Center for Microscopy and Microanalysis, University of Sydney; and the University of Texas Southwestern.

Received for publication December 28, 2017; accepted March 30, 2018.  
Copyright © 2018 by the American Society of Plastic Surgeons  
DOI: 10.1097/PRS.0000000000004801

www.PRSJournal.com

837

Copyright © 2018 American Society of Plastic Surgeons. Unauthorized reproduction of this article is prohibited.

**Table 2. Raw Surface Area Calculation and Three-Dimensional-to-Two-Dimensional Surface Area Ratio for Each Implant Type**

Implant Type	3D Surface Area (from 1.4 × 1.4-mm square) (mm <sup>2</sup> )	3D-to-2D Surface Area Ratio*
Silimed polyurethane	79	20.8
Eurosilicone textured	15	3.9
Allergan Biocell	12	3.2
Polytech POLYtxt†	12	3.2
Nagor Nagotex	10	2.8
Mentor Siltex	8.1	9.9
Motiva VelvetSurface	4.3	1.2
Sientra Smooth	4.1	1.1
Motiva SilkSurface	3.9	1.1
Allergan Smooth	3.9	1.0
Mentor Smooth	3.8	1.0

3D, three-dimensional; 2D, two-dimensional.  
\*Normalized to Mentor Smooth.  
†Represents available surface area after exclusion of internal cavities.



# SmoothSilk® & VelvetSurface® = Surface Type 1 (Minimal)

Volume 142, Number 4 • Implant Functional Surface Classification

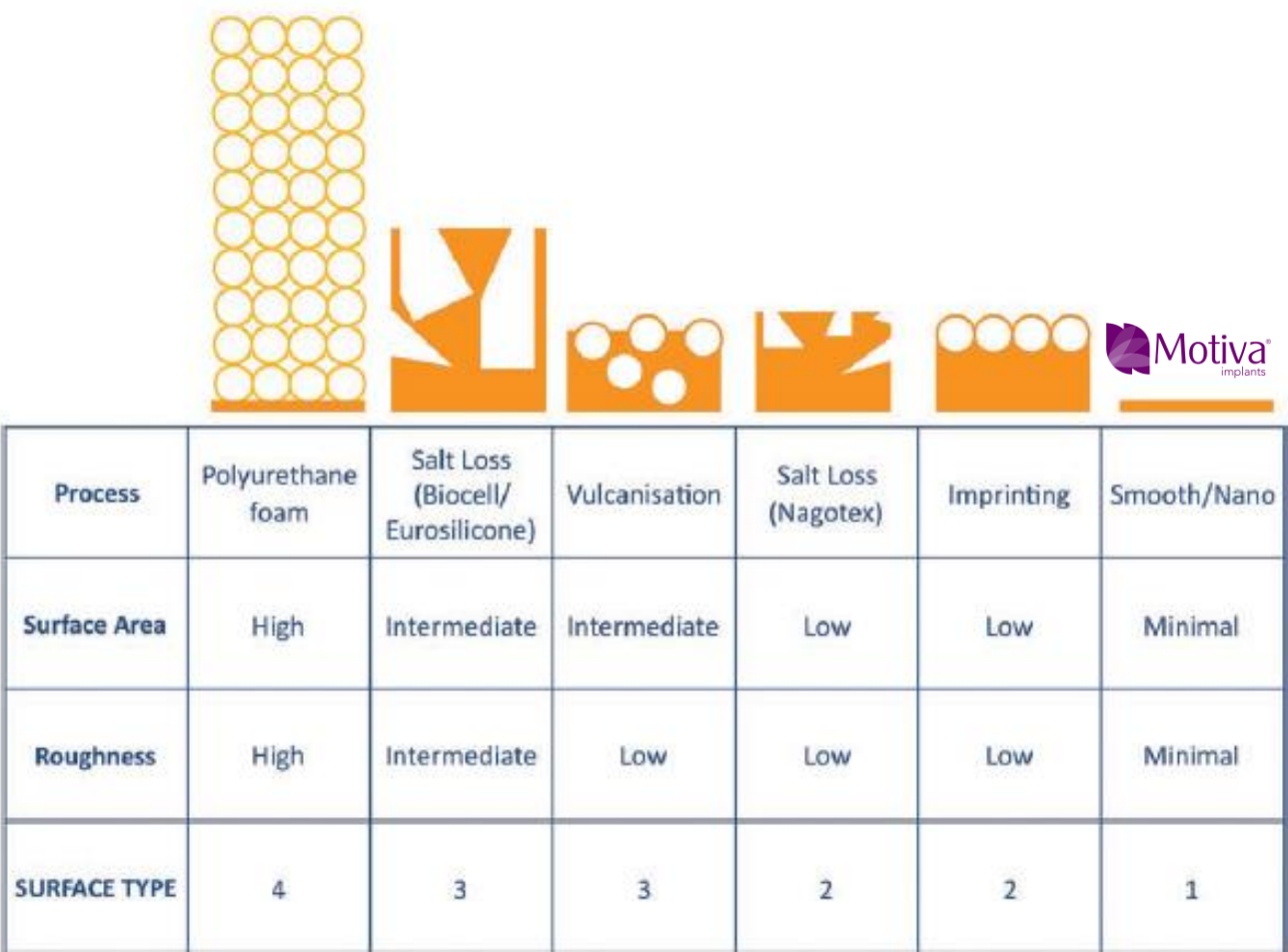
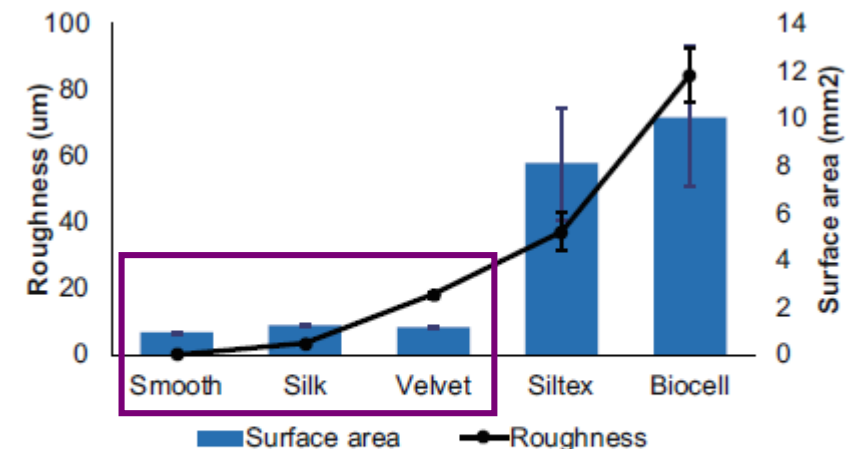
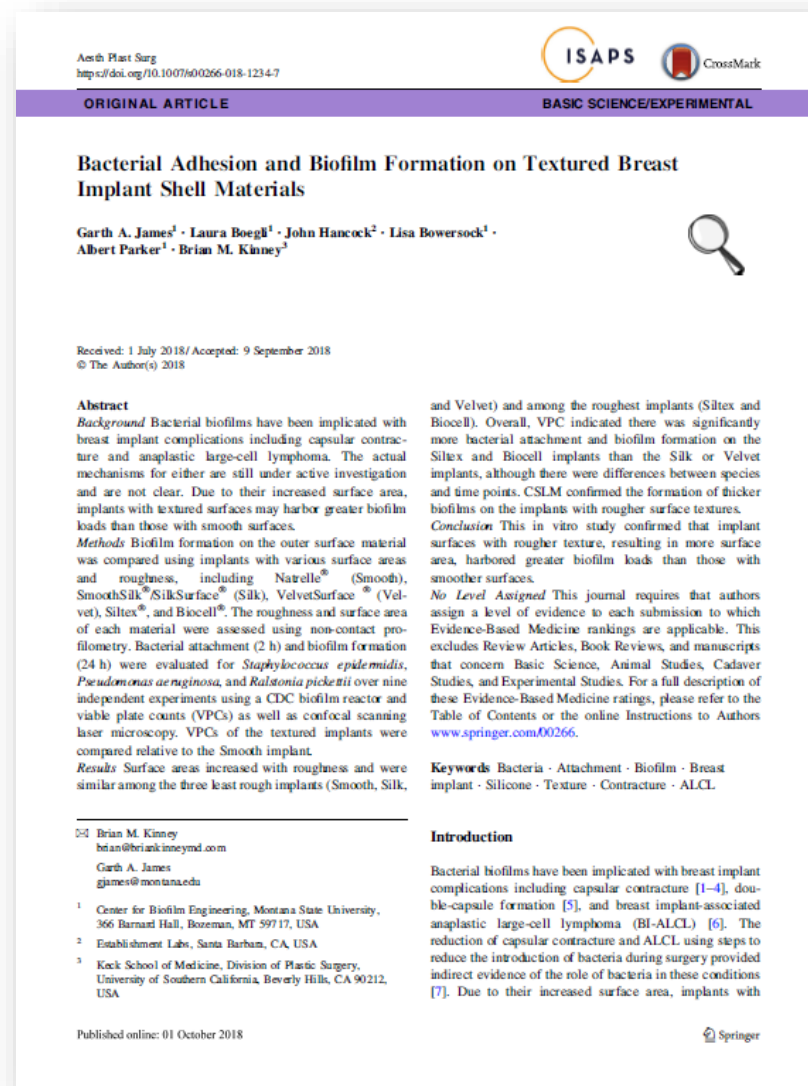


Fig. 8. Implant surface classification relating manufacturing method, surface area, and surface roughness.

Implant surfaces in the Type 1 (minimal) group classification (including SmoothSilk®/SilkSurface®) showed lower bacterial attachment and biofilm formation than implant surfaces in all other groups, due to the lower surface area / roughness.

# James et al. (ESTA Publication): Bacterial Adhesion & Biofilm Formation



**Fig. 1** Surface metrology results for the breast implant surfaces evaluated in this study. The two least rough surfaces (Silk and Velvet) had similar surface areas as did the two most rough surfaces (Siltex and Biocell)



Negative values for SmoothSilk<sup>®</sup>/SilkSurface<sup>®</sup> indicate less attachment/biofilm formation than smooth

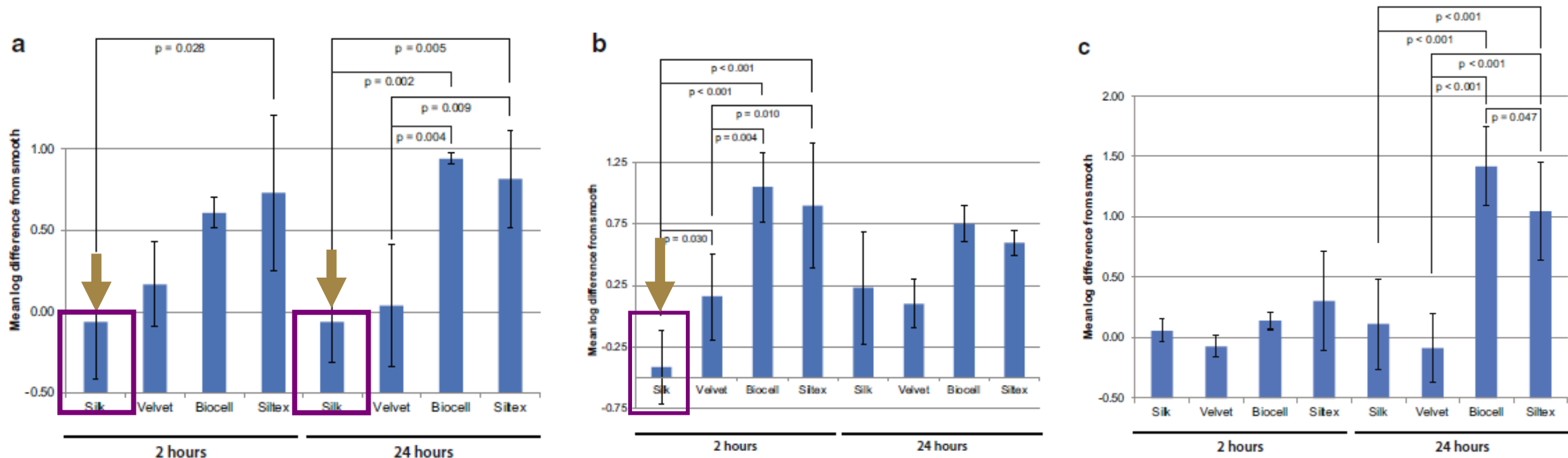
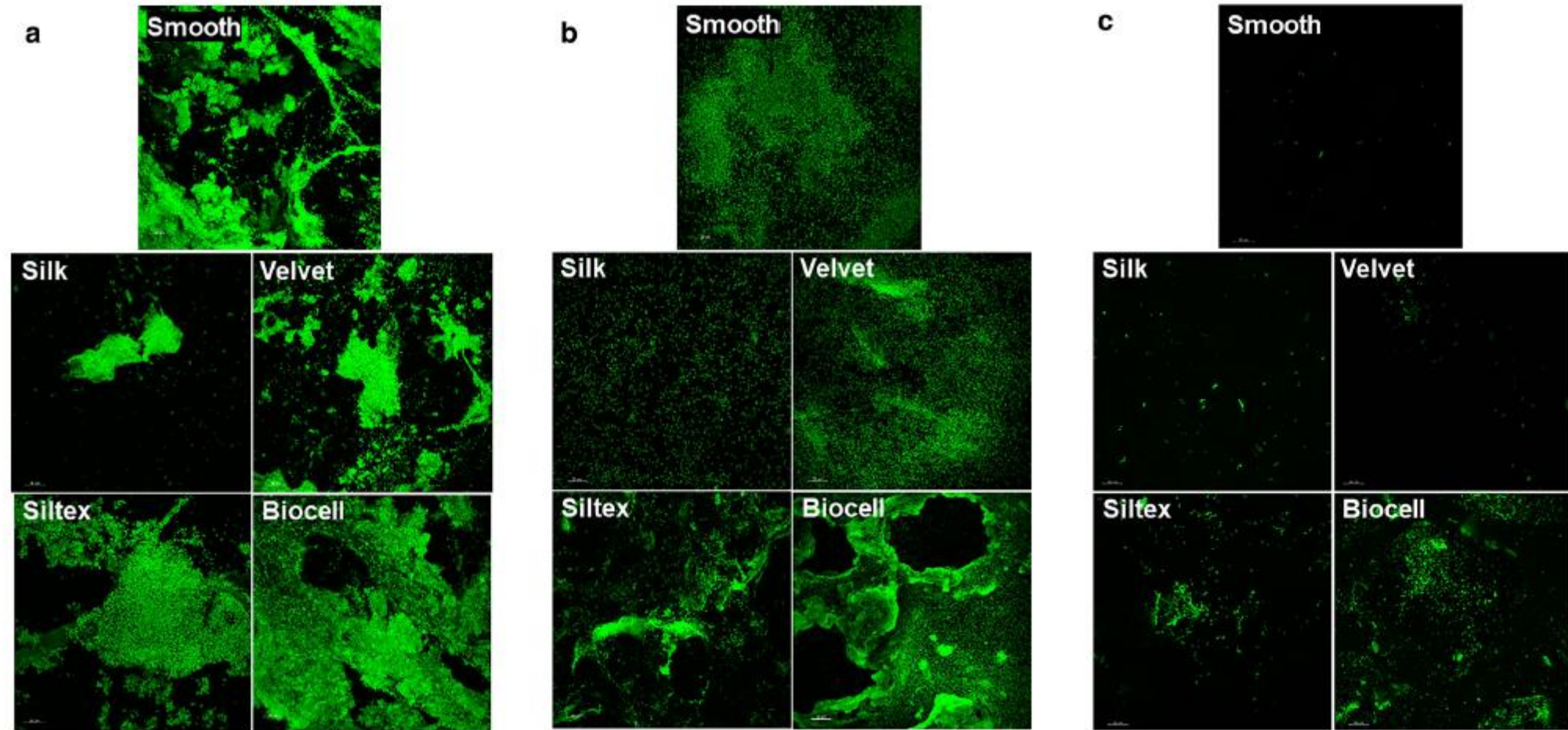


Fig. 2 Summary log difference from smooth data for *S. epidermidis* (a), *P. aeruginosa* (b), and *R. pickettii* (c). Error bars indicate  $\pm$  standard deviation from the mean. Positive values indicate more attachment/biofilm formation than Smooth, while negative values

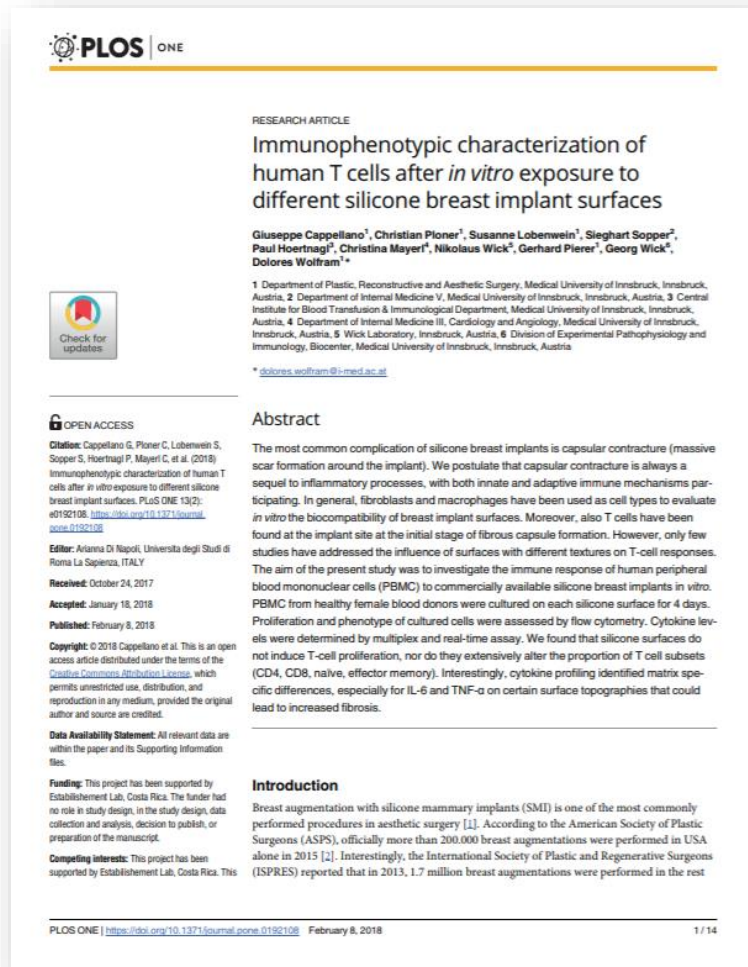
indicate less attachment/biofilm formation than Smooth. Overall, the Biocell and Siltex textures had greater differences from Smooth [i.e., more attached bacteria (2 h) and biofilm formation (24 h)] than the Silk and Velvet textures



**Fig. 3** CSLM images of *S. epidermidis* (a), *P. aeruginosa* (b), and *R. pickettii* (c) biofilms after 24 h of growth on breast implant surfaces. For all three species, more biofilm was observed on the Biocell and Siltex textures than the Silk and Velvet textures



# Cappellano et al (ESTA publication) – *in vitro* T cell response on 7 implant surfaces



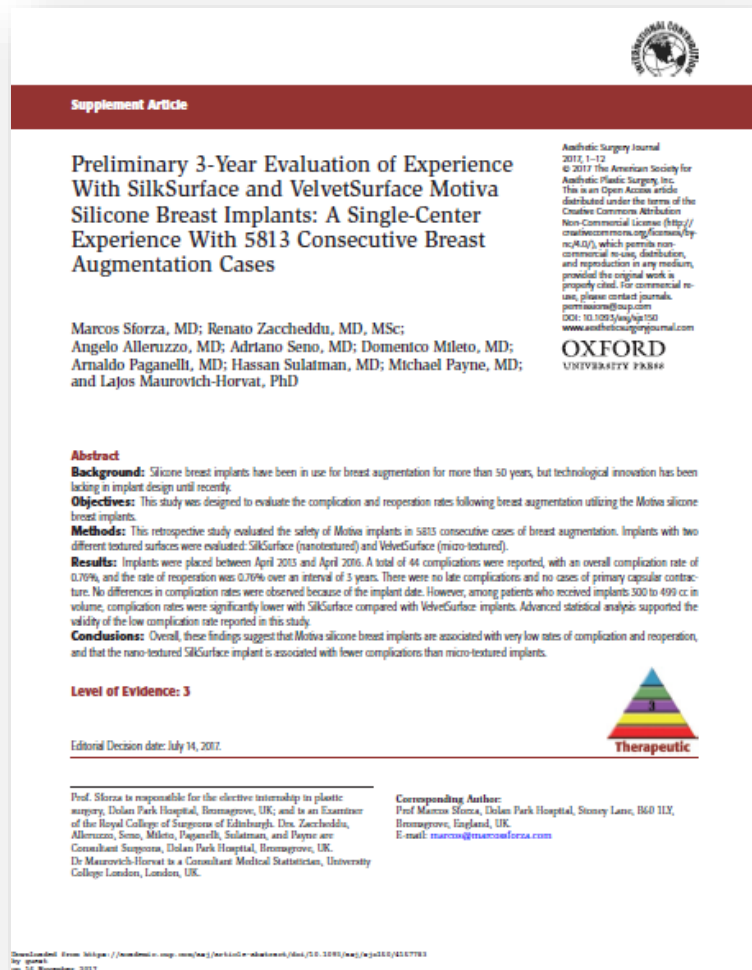
## Design:

- Human PBMCs (lymphocytes, monocytes and dendritic cells) were cultured on different implant surfaces
- Certain surface textures are more prone to causing an inflammatory immune response.
- Looking at whether the different surfaces could stimulate lymphocytes and cause activation of the T-cells (because BIA-ALCL is a T-cell disorder)

## Results:

- Found minimal changes in cytokine expression
- Compared to other surfaces, SmoothSilk<sup>®</sup>/SilkSurface<sup>®</sup>, VelvetSurface<sup>®</sup> and micropolyurethane foam surfaces showed lower degree of inflammation (downregulation of TNF $\alpha$  and IL-1 $\beta$ )
- Only SmoothSilk<sup>®</sup>/SilkSurface<sup>®</sup>, reduced TGF- $\beta$ 1 levels (TGF-1 $\beta$  has anti inflammatory and profibrotic properties)
- Further work required to understand the clinical significance of these findings.

# Sforza et al ASJ Publication: 5813 Cases 3 Years Retrospective



5813  
PATIENTS

2506 with Motiva Implants® SilkSurface®  
(Representing more than 5000 implants)

100%  
OF ASSESSED  
PATIENTS

Mean of post-surgical follow-up  
interval: 23 months

KAPLAN-MEYER  
ANALYSIS

16 PLASTIC  
SURGEONS

One Study Site: Dolan Park Hospital in UK

## SURGICAL TECHNIQUE

97%  
INFRAMAMMARY INCISION

79%  
DUAL PLANE

## RESULTS

0.36%

**OVERALL COMPLICATION RATE  
WITH MOTIVA IMPLANTS® SMOOTHSILK®**  
 Complications were: Early Seroma, Infection,  
Wound Dehiscence

1.06%

**WITH MOTIVA IMPLANTS® VELVETSURFACE®**  
 Complications were: Early Seroma, Infection,  
Hematoma, Wound Dehiscence and Malposition

## NO CASES OF:

0%  
CAPSULAR  
CONTRACTURE

0%  
RUPTURE  
DUE TO DEVICE FAILURE

0%  
RIPPLING

0%  
LATE  
SEROMA

# Chacon et al. ASJ Publication: 6 Year Prospective Safety Outcomes

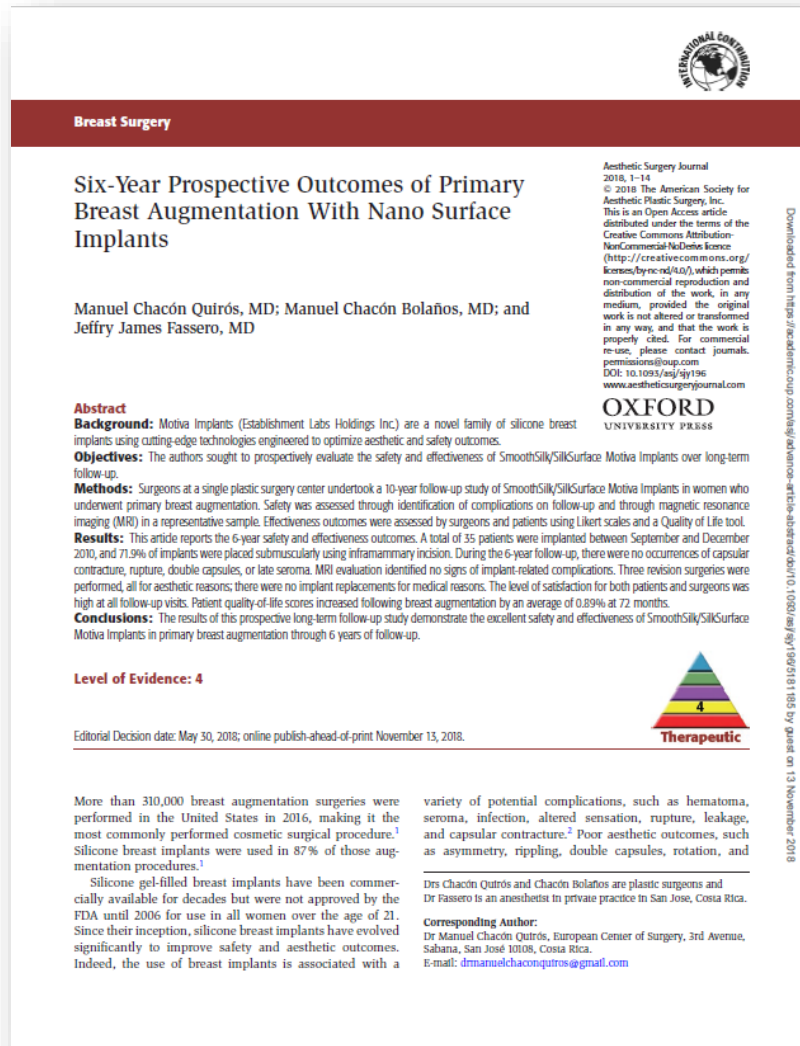


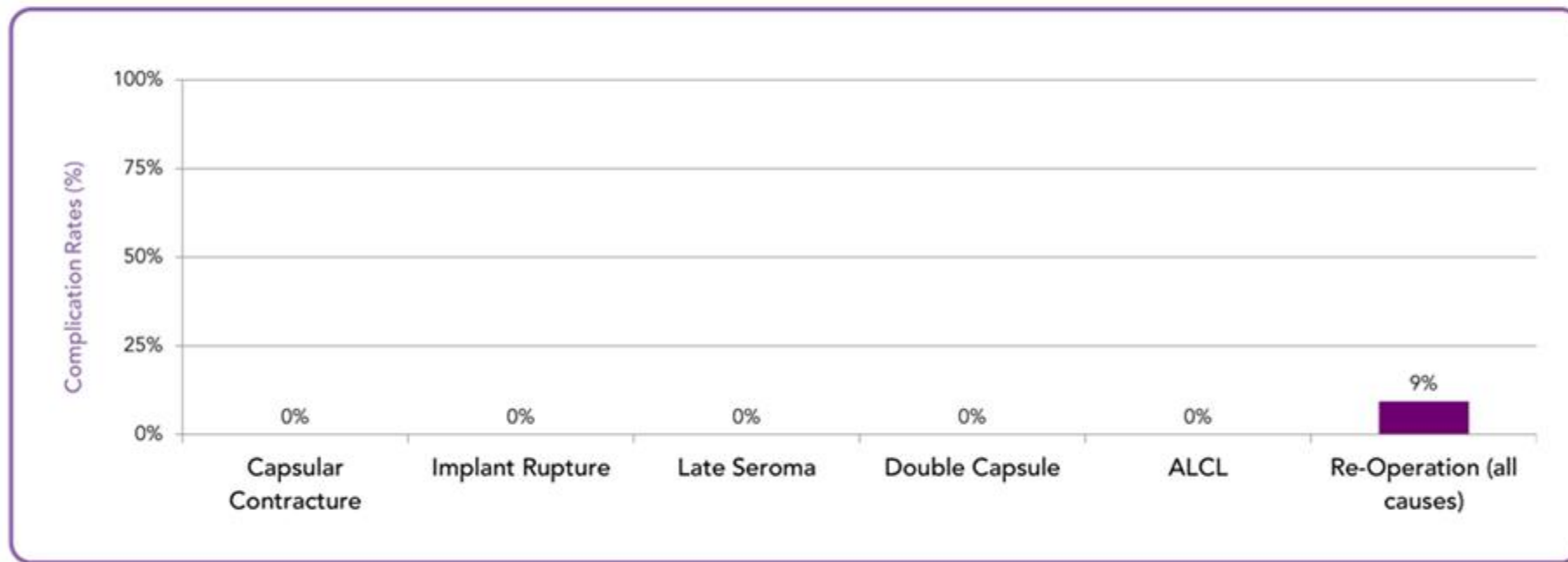
Table 3. Safety Outcomes

Duration of follow-up, years	6
Outcome (N = 32) <sup>a</sup>	Value N (%)
Changes in nipple sensitivity	3 (9.4%)
Implant rupture, capsular contracture, double capsules, late seroma, or ALCL	0 (0%)
Inadequate scarring	0 (0%)
Pain	2 (6.3%)
Pruritus	0 (0%)
Ptosis	17 (53.1%)
Reported loss of volume	0 (0%)
Symmastia	0 (0%)
Twinges	2 (6.3%)

ALCL, anaplastic large cell lymphoma. <sup>a</sup>.



## Prospective Study: 10-year follow-up study of SmoothSilk<sup>®</sup>/SilkSurface<sup>®</sup> Motiva Implants<sup>®</sup> on 35 patients with MRI assessment (6-year report).



0% Safety Issues at 6-years



# Establishment Labs 8 Year Post-Market Surveillance

Data collection to monitor the safety and effectiveness of Motiva Implants®.

Since the commercial launch of Sterile Silicone Breast Implants Motiva Implant Matrix® in October 2010, Establishment Labs® has placed a total of 578,613 breast implants in the market, including Latin America, Europe, Middle East, Africa, and Asia-Pacific regions.

477 (0.082%) complaints have been reported to Establishment Labs® up to the end of September 2018 and 179 events have been classified as clinically related.<sup>1</sup>

Motiva Implants® Clinical Complaints from October 2010 to September 2018

Complication	Number of reported cases	Risk rates %
Capsular contracture	122*	<1%
Rupture after implantation (surgical damage)**	27	<1%
Infection	12	<1%
Early seroma (< 1 year)	6	<1%
Undetermined	6	<1%
Others	5	<1%
Hematoma	1	<1%
Late seroma (> 1 year)	0	0%
Double capsule	0	0%
Breast implant associated anaplastic large cell lymphoma (BIA-ALCL)	0	0%

<1%

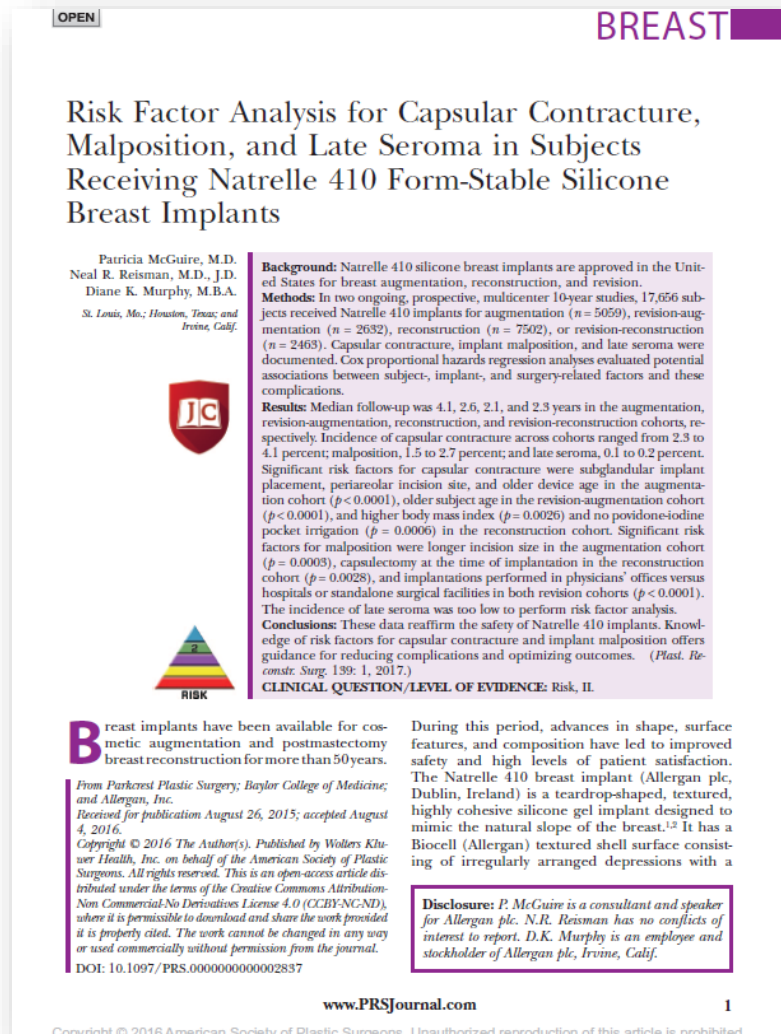
\* 75 confirmed cases (Baker Grade III/IV) and 47 unconfirmed cases | \*\* No reported cases of rupture due to device failure

Ongoing post-market surveillance is important to us and we encourage reporting of all Motiva® product complaints:

<https://motiva.health/support/>



# Time to onset for breast implant associated anaplastic large cell lymphoma (BIA-ALCL)



Two ongoing, prospective, multicenter 10-year studies

The cases of late seroma were insufficient to perform a risk factor analysis. All cases occurred with submuscular device placement. No obvious trends toward the development of late seroma were observed in relation to subject age or body mass index, device size, style, or incision site. Four cases of breast implant-associated anaplastic large cell lymphoma were reported. One case each was reported in the augmentation, revision-augmentation, reconstruction, and revision-reconstruction cohorts. In these four subjects, breast implant-associated anaplastic large cell lymphoma was diagnosed from approximately 3.5 to 11.6 years after implantation.

Average of 7.6 years, as early as 3.5 years

n = 17,656 subjects  
augmentation (n = 5059), revision-augmentation (n = 2632)  
reconstruction (n = 7502), revision-reconstruction (n = 2463)



## In Summary

- Motiva SmoothSilk® / SilkSurface® surface is categorized as smooth with no reported cases of BIA-ALCL to date
  - Supported by ISO 14607:2018 standards and numerous recent publications
  - There are different methodologies to measure surface area & roughness, all of them position SmoothSilk® / SilkSurface® in the same category as traditional smooth
- This peculiar surface has demonstrated to be **less inflammatory** with low capsular contracture rates reported
- Establishment Labs' vision is to focus on patient safety by addressing both **high risk uncommon** entities like BIA-ALCL as well as **low risk common** clinical complications like capsular contracture