



# A Comparison of Smooth and Microtextured Breast Implants in Breast Augmentation: A Retrospective Study

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## Abstract

**Background** The number of cosmetic and reconstructive surgeries that use breast implants is increasing in Korea. Recently, it has been reported that breast implant-associated anaplastic large-cell lymphoma is related to textured breast implants, and interest in classification according to the texture of breast implants is increasing. However, there is currently no clear and unified classification. In particular, the definition of “microtextured” is highly varied. In this study, we retrospectively investigated and analyzed the clinical outcomes of smooth and microtextured breast implants.

**Methods** A retrospective chart review of all patients who underwent breast augmentation surgery with smooth and microtextured silicone gel implants between January 2016 and July 2020 was performed. We retrospectively analyzed implant manufacturer, age, body mass index (BMI), smoking status, incision location, implant size, follow-up period, complications, and reoperation rate.

**Results** A total of 266 patients underwent breast augmentation surgery, of which 181 used smooth silicone gel implants and 85 used microtextured silicone gel implants. Age, BMI, smoking status, implant size, and follow-up period were not significantly different between the two groups. Similarly, complications and reoperation rates were not significantly different between the two groups.

**Conclusion** It is important to provide information regarding the clinical risks and benefits of breast implants to surgeons and patients through a clear and unified classification according to the texture of the breast implant.

## Keywords

- ▶ breast implants
- ▶ mammoplasty
- ▶ complications

## Introduction

In Korea, cosmetic and reconstructive surgeries using breast implants are continuously increasing.<sup>1,2</sup> The clinical advantages and disadvantages of textured and smooth breast implants have been previously discussed.<sup>3–10</sup> Recently, it was reported that breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) was associated with textured

breast implants.<sup>1,2,11–13</sup> As interest in BIA-ALCL increases, various classifications for the textures of breast implants are being attempted and reported.<sup>13–15</sup> Textured breast implants are generally classified as macrot textured or microtextured. However, the real differences between them are complex and disordered. Many authors define the terms “macrot textured” and “microtextured” variably and arbitrarily. At present, no unified classification method has been

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ISO 2018 Average roughness by SEM		ANSM 2018 Average roughness by SEM		Atlan 2018 Surface area by x-ray CT		Jones/Deva 2018 SEM, Surface area/roughness by microCT		James/Kinney 2018 Bact adhes, Surface area/ area/roughness by profilometry	
Smooth <10 µm	All smooth, Motiva silk	Smooth	All smooth	Smooth/nanotexture 80-100 mm <sup>2</sup>	All smooth, Motiva Silk and Velvet	1 Minimal	All smooth, Motiva Silk/Velvet	Smooth	All smooth, Motiva Silk/Velvet
Microtextured 10-50 µm	Motiva Velvet, B-Lite, Allergan Microcell/ BRST, Mentor Siltex, Sientra True	Microtextured	Arion Micro, Sebbin Micro, Motiva Silk/Velvet	Microtextured 100-200 mm <sup>2</sup>	Mentor Siltex, Allergan Microcell/BRST	2 Low	Mentor Siltex, Nagor	Rough	Allergan Biocell, Mentor Siltex
Macrotextured >50 µm	Allergan Biocell, Silimed PU, Polytech PU	Macrotextured	Allergan Microcell/Biocell, Mentor Siltex, Eurosilicone Micro, Nagor, Polytech, Silimed	Macrotextured 200-300 mm <sup>2</sup>	Allergan Biocell, Sientra True, Eurosilicone	3 Inter- mediate	Allergan Biocell, Eurosilicone		
				Macrotexture-Plus >300 mm <sup>2</sup>	Nagor, Polytech	4 High	Polytech PU, Surgitek PU Silimed PU		
Based on ISO-14607:2018		By ANSM per ISO-14607:2007		Peer-Reviewed Scientific Publications					

**Fig. 1** Summary of smooth and textured implant classifications. Surface area is a measure of the total area that the outer surface topography of an implant occupies and that interfaces with the patient. Surface roughness is a measure of the average height of the peaks and valleys of an implant surface. SEM, scanning electron microscopy; ISO, International Organization for Standardization; Bact adhes, bacterial adhesion. (Reprinted from Jones P, Mempin M, Hu H, et al. The functional influence of breast implant outer shell morphology on bacterial attachment and growth. *Plast Reconstr Surg* 2018;142:837-49.)

developed. The industry-announced surface roughness values of Bellagel microtextured (HansBiomed Co., Ltd., Seoul, Korea) and Sebbin microtextured (Sebbin, Boissy-l'Aillier, France) implants are 5.96 and 6 µm, respectively, and that of the Eurosilicone microtextured implant (Eurosilicone, Apt Cedex, France) is 24 µm. Sebbin and Bellagel microtextured implants follow the ANSM (Agence nationale de sécurité du médicament) 2018 classification table, but they are both considered “smooth” if they follow the International Organization for Standardization (ISO) 2018 classification. In contrast, the Eurosilicone microtextured implant followed the ISO 2018 guidelines (► **Fig. 1**).<sup>16</sup> An absolute consensus has not yet been reached about the classification of “microtextured” implants. Therefore, we sorted the implants based on whether they had gross concavo-convex surfaces in this study. Mentor MemoryGel (Mentor Worldwide LLC, Irvine, CA) or Bellagel smooth implants were regarded as “smooth” because they do not have any gross concavo-convex surface, but Bellagel microtextured, Sebbin microtextured, and Eurosilicone microtextured implants were regarded as “microtextured” because they have observable concavo-convex surfaces.

Currently, the terms “microtextured” or “nanotextured” are used excessively without clear classification. In addition, these terms are used commercially without clinical basis, and inaccurate information is provided, which may cause confusion. Following identification of this problem, our study retrospectively investigated and analyzed the clinical results of smooth and microtextured breast implants. In addition, there have been many reports comparing smooth and textured breast implants, but few studies comparing smooth and microtextured breast implants.

## Methods

A retrospective chart review was performed for all patients who underwent breast augmentation surgery with smooth and microtextured silicone gel implants at a single plastic

surgery clinic by a single surgeon between January 2016 and July 2020. Retrospective analysis was conducted, including implant manufacturer, age, body mass index (BMI), smoking status, incision location, implant size, length of follow-up, complications, and reoperation rate.

## Statistical Analysis

R language version 3.3.3 (R Foundation for Statistical Computing, Vienna, Austria) and T&F program version 3.0 (YooJin BioSoft, Korea) were used for all statistical analyses. For continuous variables, median (interquartile range) or mean ± standard deviation was computed, and the Mann-Whitney *U* test was performed to analyze differences between groups. Categorical variables are presented as sample numbers (%), and *p*-values were computed using Fisher's exact test or a two-sample proportion test to analyze differences between groups.

## Results

A total of 266 patients underwent breast augmentation surgery, of which 181 used smooth silicone gel implants and 85 used microtextured silicone gel implants. In the smooth silicone gel implant group, Mentor MemoryGel was used at 88.4%, and Bellagel was used at 11.6%. In the microtextured silicone gel implant group, Bellagel was used at 61.2%, Eurosilicone was used at 24.7%, and Sebbin was used at 14.1%.

Age, BMI, smoking status, implant size, and follow-up length were not significantly different between the two groups. Regarding the location of the incision, there were significantly more transaxillary incisions in the smooth implant group and significantly more transaxillary and inframammary incisions in the microtextured implant group ( $p = 0.002$ ) (► **Table 1**). There was no significant difference between the two groups in terms of the complication and reoperation rates. In the smooth implant group, complications occurred in 14.4%, and capsular contracture occurred in 1.7%. In the microtextured implant group, complications

**Table 1** Distribution of variables between the smooth implant group and micro-textured implant group

		Smooth	Microtextured	p-Value
Patients (%)		181 (68)	85 (32)	
Manufacturer				< 0.001 <sup>b</sup>
	Mentor	160 (88.4)	0 (0)	
	Bellagel	21 (11.6)	52 (61.2)	
	Sebbin	0 (0)	12 (14.1)	
	Eurosilicone	0 (0)	21 (24.7)	
Age (y)		33.94 ± 6.72	35.59 ± 7.72	0.178
BMI (kg/m <sup>2</sup> )		19.03 ± 1.65	19.37 ± 1.74	0.287
Smoking		63 (34.8)	24 (28.2)	0.328
Incision location				0.002 <sup>b</sup>
	Transaxillary	126 (69.6)	41 (48.2)	
	Inframammary	45 (24.9)	39 (45.9)	
	Periareolar	10 (5.5)	5 (5.9)	
Implant size (mL)		282.24 ± 32.94	285.32 ± 29.2	0.333
Follow-up length (mo)		11.35 ± 8.83	13.45 ± 10.63	0.356

Abbreviations: BMI, body mass index; SD, standard deviation.

Note: Values are presented as number (%) or mean ± SD.

<sup>a</sup>p-Value < 0.05.

<sup>b</sup>p-Value < 0.01.

occurred in 8.2%, and capsular contracture occurred in 2.4%. Reoperation rate was 13.3% in the smooth implant group, and reoperation was performed in 8.2% in the microtextured implant group (→ **Table 2**).

In the microtextured implant group, according to the surface roughness value, Bellagel (5.96 μm) and Sebbin (6 μm) versus Eurosilicone (24 μm) were analyzed. Significant differences were found in terms of age, incision location,

and follow-up length between the two groups. No significant differences were found concerning complications and reoperation rates (→ **Table 3**).

## Discussion

Since Cronin and Gerow first introduced silicone gel-filled implants in 1962, silicone gel implants have been developed

**Table 2** Comparison of complication and reoperation rates between the smooth implant group and microtextured implant group

		Smooth (n = 181)	Microtextured (n = 85)	p-Value
Complication		26 (14.4)	7 (8.2)	0.231
Complication type				
	Capsular contracture	3 (1.7)	2 (2.4)	1.000 <sup>a</sup>
	Bottoming out	12 (6.6)	1 (1.2)	0.106 <sup>a</sup>
	Malposition	1 (0.6)	0 (0)	1.000 <sup>a</sup>
	Asymmetry	1 (0.6)	1 (1.2)	1.000 <sup>a</sup>
	Hematoma	5 (2.8)	0 (0)	0.288 <sup>a</sup>
	Pain	2 (1.1)	0 (0)	0.832 <sup>a</sup>
	Rippling	1 (0.6)	0 (0)	1.000 <sup>a</sup>
	Double bubble	1 (0.6)	1 (1.2)	1.000 <sup>a</sup>
	Hypermobility	0 (0)	1 (1.2)	0.698 <sup>a</sup>
	Inflammation	0 (0)	1 (1.2)	0.698 <sup>a</sup>
Reoperation		24 (13.3)	7 (8.2)	0.306

Note: Values are presented as number (%).

<sup>a</sup>p-Values are computed using a two-samples proportion test to analyze the differences of each complication between the two groups.

**Table 3** A comparison of variables between the Bellagel and Sebbin and the Eurosilicone groups in the microtextured implant group

		Bellagel and Sebbin	Eurosilicone	p-Value
Patients (%)		64 (75.3)	21 (24.7)	
Age (y)		34.20 ± 6.67	39.81 ± 9.23	0.012 <sup>a</sup>
BMI (kg/m <sup>2</sup> )		19.14 ± 1.43	20.07 ± 2.39	0.323
Smoking		21 (32.8)	3 (14.3)	0.161
Incision location				0.035 <sup>a</sup>
	Transaxillary	35 (54.7)	6 (28.6)	
	Inframammary	27 (42.2)	12 (57.1)	
	Periareolar	2 (3.1)	3 (14.3)	
Implant size (mL)		283.59 ± 29.45	290.60 ± 28.47	0.431
Follow-up length (mo)		15.41 ± 10.84	7.48 ± 7.37	0.003 <sup>b</sup>
Complication		5 (7.8)	2 (9.5)	1.000
Complication type				
	Capsular contracture	2 (3.1)	0 (0.0)	1.000 <sup>c</sup>
	Bottoming out	0 (0.0)	1 (4.8)	0.555 <sup>c</sup>
	Asymmetry	1 (1.6)	0 (0.0)	1.000 <sup>c</sup>
	Double bubble	1 (1.6)	0 (0.0)	1.000 <sup>c</sup>
	Hypermobility	0 (0.0)	1 (4.8)	0.555 <sup>c</sup>
	Inflammation	1 (1.6)	0 (0.0)	1.000 <sup>c</sup>
Reoperation		5 (7.8)	2 (9.5)	1.000

Abbreviations: BMI, body mass index; SD, standard deviation.

Note: Values are presented as number (%) or mean ± SD.

<sup>a</sup>p-Value < 0.05.

<sup>b</sup>p-Value < 0.01.

<sup>c</sup>p-Values are computed using a two-samples proportion test to analyze the differences of each complication between the two groups.

into the fourth generation. These advancements have been directed toward preventing gel bleeding, implant rupture, and capsular contracture.<sup>17,18</sup> There is ongoing research and discussion about the clinical benefits and risks of implant surface texture (smooth vs. textured). Many studies have reported that textured implants have lower rates of capsular contracture, rippling, and malpositioning than smooth implants.<sup>5-8</sup> Capsular contracture causes pain and poor aesthetic results, requiring reoperation. The following three theories have been proposed regarding the effect of textured implants on the prevention of capsular contractures. The first is the degradation of the contracted capsule by cells on the surface of the textured implant; the second is the ingrowth of breast tissue into the texture of the implant, increasing friction and reducing synovial-type metaplasia; and the third is the disruption of the planar arrangement of fibroblasts and the vectors of contraction seen on the surface of smooth implants.<sup>9,19,20</sup> However, it has been reported that textured implants are somewhat related to the occurrence of a double capsule and late seroma.<sup>9,10</sup> BIA-ALCL, a rare type of T-cell lymphoma, is a unique iatrogenic disease with evidence of association with breast implants, especially textured implants.<sup>1,2,11-13</sup> With the recent increase in BIA-ALCL

patients worldwide, the first BIA-ALCL patient was reported in Korea in 2019.<sup>2</sup> Therefore, interest in the texture of breast implants has increased, and studies have reported on a classification according to the textures of breast implants.<sup>13-15</sup> Currently, various classification methods are being used, as shown in **Fig. 1**.<sup>16</sup> However, these classifications remain unclear. The same terms were used within various classification systems, without a uniform definition. In addition, manufacturers use these nonuniform classification systems for marketing.<sup>3,16</sup> Some manufacturers are commercially promoting that microtextured implants have the advantages of smooth and textured implants and compensate for the disadvantages. In our study, the clinical differences between smooth and microtextured silicone gel implants were compared, but there were no significant differences in complications or reoperation rates.

Moreover, in the microtextured implant group, no statistically significant differences in terms of complications or reoperation rates were observed between the two groups according to surface roughness values.

There are existing studies on smooth and microtextured silicone gel implants (as shown in the following paragraph), but our study holds clinical significance as there are few

reports that completely compare the clinical results of smooth and microtextured silicone gel implants.

Buonomo et al conducted a study comparing the quality of life and aesthetic results of round smooth implants and shaped microtextured implants in breast reconstruction. They reported that round smooth implants had better softness and volume and less rippling. Additionally, shaped microtextured implants were found to be better in profile delineation.<sup>21</sup> Sforza et al evaluated the complication and reoperation rates of breast augmentation with two different Motiva silicone breast implants. A comparison of SilkSurface (nanotextured; mean surface roughness of 4,000 nm) and VelvetSurface (microtextured; mean surface roughness of  $17 \pm 3 \mu\text{m}$ ) showed that the nanotextured SilkSurface had fewer complications than the microtextured VelvetSurface.<sup>22</sup> Han et al retrospectively studied the short-term safety of silicone gel breast implants used for breast augmentation in Korea. The study mainly compared various silicone gel implant products, but there was no comparison or analysis of smooth and microtextured silicone gel implants and no statistical significance was found between groups.<sup>23</sup> Tanner reported that the incidence of capsular contracture was low as a result of analyzing the clinical results of 214 patients who used microtextured silicone gel implants in breast cosmetic surgery. However, that study also did not compare smooth and microtextured silicone gel implants.<sup>24</sup>

Based on our study findings, concern over whether to select a microtextured or smooth implant is not necessary. These two implants are marketed as being totally different; however, we found no clinical evidence to show that microtextured and smooth implants are manifestly different. ISO 2018 is cited frequently because many plastic surgeons are concerned about the association with the BIA-ALCL. While this classification has divided the microtextured and smooth implants separately, our findings did not support any such clinical difference.

Our study was limited, as it was conducted only in one clinic, the number of patients was not large, and only some implant products were compared. Based on the results of this study, we plan to conduct a comparative analysis by including more patients in the future. An international and uniform classification according to the textures of breast implants is required, and it is important to predict clinical benefits and risks according to the classification. Providing such reliable information to surgeons and patients may be helpful when discussing and determining surgery and breast implant options.

#### Note

This article was presented at PRS on November 12-14, 2021.

#### Author Contributions

J.H.L.: Conceptualization, data curation, supervision; J.H.J.: Data curation, methodology, writing—original draft; K.H.M.: conceptualization, data curation, writing—original draft, writing—review & editing.

#### Ethical Approval

The study was approved by the Institutional Review Board of Nowon Eulji Medical Center (IRB No. EMCIRB 2022-03-013) and performed in accordance with the principles of the Declaration of Helsinki. The requirement of informed consent was waived owing to the retrospective nature of the study.

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None.

#### Conflict of Interest

None declared.

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