



# Comparison between surgical sutures and Prineo® in terms of esthetic result and scar formation

## *Comparação de resultado estético em cicatrizes com uso de fios cirúrgicos e Prineo®*

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Article received: January 24, 2016.  
Article accepted: February 3, 2017.

Conflicts of interest: none.

DOI: 10.5935/2177-1235.2017RBCP0014

### ■ ABSTRACT

**Introduction:** Wound healing is a well-organized, directed process of tissue repair. The process can be expedited using topical glues and adhesives, which offer a non-invasive, easily removable alternative to suturing. Furthermore, such products have good tensile strength and involve lower application time. In particular, the Prineo® adhesive is applied to a polyester mesh that covers the wound. **Method:** We carried out a retrospective, cross-sectional study, with subsequent statistical analysis, involving 101 surgical procedures in which wound closure was performed using either nylon sutures or Prineo®. All the procedures were performed between 2012 and 2014. **Results:** Six patients had contact dermatitis after Prineo® was used, with statistical significance ( $p = 0.042$ ). Furthermore, Prineo® decreased the rate of scar enlargement ( $p < 0.05$ ). There was no statistical difference between the Prineo® and suture groups in terms of scar quality ( $p = 0.068$ ); in both groups, the scar result was mostly excellent (87%) to good (27%). **Conclusion:** Patients whose wounds were closed using Prineo® a system involving octyl-2-cyanoacrylate and an associated polyester mesh displayed lower rates of scar enlargement, which depended on whether the thickness of the dermis was satisfactory. However, the same patients had higher rates of contact dermatitis than those whose wounds were closed using surgical sutures. Both groups showed excellent to good scar quality, with no significant difference in terms of esthetic scar results.

**Keywords:** Healing; Wounds and injuries; Sutures; Nylons; Tissue adhesives.

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## ■ RESUMO

**Introdução:** Cicatrização de ferida é um processo bem organizado que tem como finalidade a reparação tecidual completa. Colas e adesivos tópicos oferecem uma alternativa não invasiva, de retirada fácil e espontânea; boa força tênsil; menor tempo de aplicação, sendo o Prineo® uma cola adesiva associada a uma malha de poliéster aplicados sobre a ferida. **Método:** Trata-se de um estudo transversal retrospectivo com análise de 101 procedimentos cirúrgicos no período de 2012 a 2014, nos quais a síntese da ferida operatória ocorreu com fios cirúrgicos de náilon ou Prineo®, sendo aplicada análise estatística. **Resultados:** Neste estudo, seis pacientes apresentaram dermatite de contato ao uso do Prineo® com significância estatística ( $p = 0,042$ ). O uso desse sistema diminuiu a taxa de alargamento cicatricial ( $p < 0,05$ ). O presente trabalho não apresentou diferença estatística ( $p = 0,068$ ) na qualidade da cicatriz entre os pacientes que utilizaram Prineo® em relação ao grupo controle, demonstrando que em ambos os grupos o resultado cicatricial foi de excelente (87%) a bom (27%) na sua maioria. **Conclusão:** Conclui-se no estudo que os pacientes que utilizaram o sistema de octil-2-cianoacrilato associado a malha, Prineo®, apresentaram menores índices de alargamento cicatricial, dependentes de uma espessura de derme satisfatória, e maiores taxas de dermatites por contato em relação àqueles em que a ferida foi encerrada com fios cirúrgicos. Os dois grupos demonstraram qualidades cicatriciais excelentes a bons, sem diferença estatística em tais resultados estéticos cicatriciais.

**Descritores:** Cicatrização; Ferimentos e lesões; Suturas; Nylons; Adesivos teciduais.

## INTRODUCTION

Wound healing is a well-organized tissue repair process in which platelets, keratinocytes, macrophages, microcirculation, and fibroblasts play key roles in restoring tissue integrity. The ultimate end of wound healing is to restore the structural and functional integrity of the skin. The success of this process depends partly on the personal characteristics of the patient, which clinicians cannot influence. However, good wound closure techniques also affect the outcome<sup>1</sup>.

Wound closure materials should primarily ensure good coaptation of the wound edges until the tissue heals. Premature failures of various types of wound closure can result in separation of the edges, which can lead to esthetically unpleasant scarring<sup>2</sup>. Furthermore, if the edges of the suture are incorrectly positioned, or if they are too tense, growth of epidermis inside the wound along the suture may cause fibrous tissue development. Loss of traction of the suture (degradation) before the scar has been properly consolidated can also cause changes in the wound<sup>3</sup>.

Topical adhesives offer an non-invasive alternative to sutures; they have the following advantages: (1) spontaneous removal from the system, bringing comfort to the patient; good tensile strength; antimicrobial barrier; non-invasive application and shorter implementation time; reduced post-operative pain, edema, and hyperemia due to less trauma in the dermis<sup>4,5</sup>.

Cyanoacrylate was first used for wound closure in 1959, having been approved by the Food and Drug Administration (FDA) of the United States (USA). In 2008, the FDA reclassified it from class III to class II; thus, it could be marketed in the USA<sup>5</sup>. Cyanoacrylate possesses strength equivalent to that of non-absorbable sutures and intra-dermal Monocryl® 4-0<sup>6</sup>; its tension and malleability depend on the length of the alkyl chains.

Prineo® is a dual system comprising a polyester mesh and a 2-octyl cyanoacrylate skin adhesive; the latter has long alkyl chains, imparting high flexibility and a resistance to rupture, with low toxicity<sup>6</sup>. When applied to the wound, the cyanoacrylate initiates an intense molecular reaction in which the monomers become organized and polymerize quickly; when they

come into contact with traces of water, they bind to the stratum corneum and thus to keratinocytes<sup>7</sup>.

Surgical complications, such as infection, dehiscence, and delayed healing continue to be a problem, with significant associated morbidity and high treatment costs<sup>8</sup>. Thus, this study aimed to compare conventional surgical sutures with the Prineo<sup>®</sup> system in terms of the healing of surgical wounds after plastic surgery; we analyzed intrinsic and extrinsic factors related to the healing process.

## OBJECTIVE

To compare, 1 year after surgery, surgical sutures with 2-octyl cyanoacrylate (Prineo<sup>®</sup>) in terms of wound healing results in patients who had undergone abdominoplasty or mammoplasty between 2012 and 2014. All procedures were performed by the same surgeon.

## METHODS

This was a cross-sectional study involving retrospective analysis of 101 cases of abdominoplasty and mammoplasty; all procedures were performed by the same surgeon at the Daher Lago Sul Hospital, Brasilia, DF, between 2012 and 2014. By analyzing clinical reports and pictures, we compared two groups of patients; in both groups, the subdermal plane was closed using simple 4-0 nylon sutures.

However, in the intradermal plane, the surgical wound was closed using either Prineo<sup>®</sup> (Group 1) or a Monocryl<sup>®</sup> 4-0 suture (control group). The Prineo<sup>®</sup> dressing was removed after 21 days in all cases. The quality of surgical wound infection was analyzed using medical records, as well as pre- and post-operative photos. The following complications were analyzed in the same way: infection, hyperchromia, enlargement and hypertrophy, dehiscence, necrosis, etc. Comorbidities such as diabetes mellitus and smoking were also assessed. Age, gender, skin color, and skin characteristics were studied and analyzed in both groups; in this way, the factors associated with a good and a poor wound healing were investigated.

The results were analyzed by the chi-square ( $\chi^2$ ) test, the t-test, or Fisher's exact test, where appropriate.

The two groups were homogeneous in that they were organized according to similarities in physical biotype, such as skin color (using the Fitzpatrick classification), Body Mass Index (BMI), skin texture, and comorbidities.

The authors had no conflicts of interest, and the study followed the principles of the Helsinki

Declaration, adopted by the 18<sup>th</sup> World Medical Association General Assembly, Helsinki, Finland, in June 1964 and corrected by the 29<sup>th</sup> World Medical Association General Assembly, Tokyo, Japan, in October 1975, the 35<sup>th</sup> World Medical Association General Assembly, Venice, Italy, in October 1983, and the 41<sup>st</sup> World Medical Association General Assembly, Hong Kong, in September 1989.

## RESULTS

The demographic data of the study detail 101 surgical procedures performed from 2012 to 2014: 48 abdominoplasties and 53 mammoplasties; surgical closure was performed using either the Prineo<sup>®</sup> or surgical Monocryl<sup>®</sup> sutures; the patient distribution was homogeneous across all procedures, as described in the Methods a (Table 1).

All procedures were carried out in women, with 31-40 years being the most prevalent age group. The frequency of the comorbidities diabetes mellitus and smoking were low 3% and 2%, respectively. These did not significantly influence the esthetic end result of the scars. This fact can be ascertained by considering only the cases of active disease.

Most of the patients (63%) had a BMI between 25 and 29.9 kg/m<sup>2</sup>, classifying them as pre-obese (Table 1). With regards to skin color (using the Fitzpatrick classification), there was no statistical difference between the groups, indicating that skin color had no involvement in the final result of the scar (Table 2).

The thickness of the dermis, another variable described in the study, was significantly associated with the final result of the scar ( $p = 0.01$ ; Table 3). Furthermore, there was a significant difference between the groups in terms of surgical complications: six cases of allergy occurred in the Prineo<sup>®</sup> group ( $p = 0.042$ ; Figure 1), while scar enlargement was more frequent in the suture group, occurring in eight cases ( $p = 0.042$ ; Table 4 and Figure 2).

Both the Prineo<sup>®</sup> and conventional suture groups displayed good to excellent (18% and 69%, respectively) results in terms of the esthetic end result of the scar 1 year after surgery; there was no significant difference between the groups in this regard (Table 5).

## DISCUSSION

The ideal suture material must display the following characteristics: ease of handling, minimal tissue reaction, adequate resistance to traction, hypoallergenicity, and low cost<sup>9</sup>. Prineo<sup>®</sup> technology consists of two components: a polyester mesh to connect

**Table 1.** Demographic profile of patients undergoing surgical wound synthesis using either conventional surgical sutures or an adhesive system.

Demographic Characteristics	With Prineo®		Without Prineo®		TOTAL		p
	n	%	n	%	N	%	
Men	0	0	0	0	0	0	
Women	56	55	45	45	101	100	
Surgeries							
Abdominoplasty	28	28	20	20	48	48	
Mammoplasty	28	28	25	25	53	52	
Age							
Less than or equal to 20 years	1	1	0	0	1	1	
21-30 years	11	11	6	6	17	17	
31-40 years	24	24	14	14	38	38	
41-50 years	11	11	15	15	26	26	
51-60 years	8	8	8	8	16	16	
≥ 61 years	1	1	2	2	3	3	
Comorbidities							
Diabetes mellitus	3	3	5	5	8	8	
Smoking	2	2	3	3	5	5	
Diabetes and smoking	1	1	0	0	1	1	
Without comorbidities	50	50	37	37	87	86	
Body Mass Index							
< 18.5	2	2	0	0	2	2	
18.5-24.9	22	22	13	13	35	35	
≥ 25	32	32	32	32	64	63	
25-29.9	20	20	26	26	46	46	
30-34.9	9	9	5	5	14	14	
35-39.9	3	3	1	1	4	4	
> 40	0	0	0	0	0	0	
TOTAL	56	55	45	45	101	100	

N: Number of cases; p: Significance in cases of  $p < 0.05$ .

**Table 2.** Use of different materials to close wounds according to the patients' skin color.

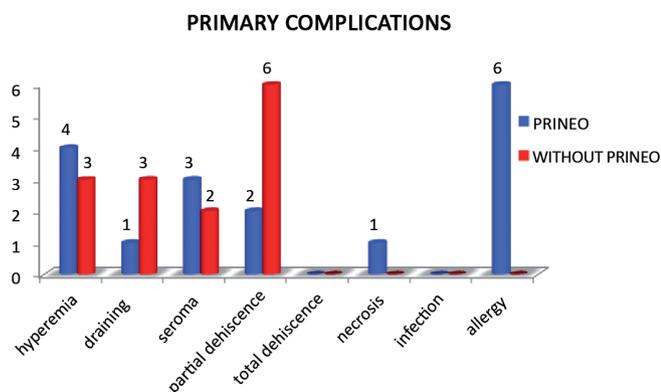
Fitzpatrick Classification	With Prineo®		Without Prineo®		TOTAL	p
	N	%	N	%		
Type 1	7	7	5	5	12	
Type 2	20	20	15	15	35	
Type 3	19	19	17	17	36	
Type 4	9	9	7	7	16	
Type 5	1	1	1	1	2	
Type 6	0	0	0	0	0	
TOTAL	56	55	45	45	101	

N: Number of cases; p: Significance in cases of  $p < 0.05$ .

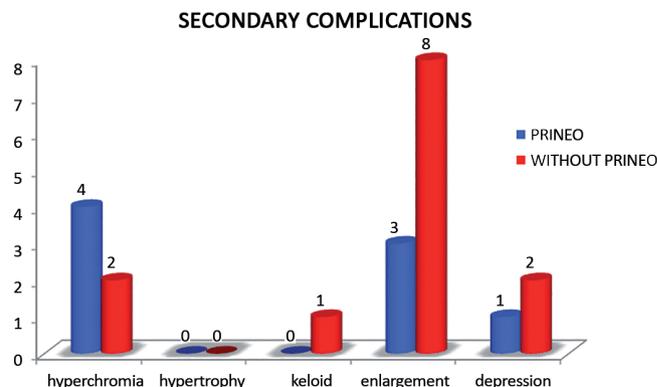
**Table 3.** Skin thickness according to the type of wound closure used.

Dermis thickness	With Prineo®		Without Prineo®		TOTAL	p
	N	%	N	%		
Thick dermis	7	7	4	4	11	
Average Dermis	15	15	30	30	45	$p = 0.001$
Thin Dermis	18	18	7	7	25	$p = 0.001$
Dermis with striation	16	16	4	4	20	
TOTAL	56	55	45	45	101	

N: Number of cases; p: Significance in cases of  $p < 0.05$ .



**Figure 1.** Graph showing that Prineo® caused an allergic reaction in 6% of all patients who underwent surgery, with statistical significance.



**Figure 2.** Graph demonstrating that scar enlargement mostly occurred in patients whose wound was closed using nylon 4-0 surgical sutures.

the edges of the wound, and a surgical liquid adhesive (octyl-2-cyanoacrylate) which closes the wound.

Topical adhesives offer some advantages; for example, easy and quick application, good tensile strength along the wound, an antimicrobial barrier, and less pain during removal<sup>10,11</sup>.

In the present study, all patients (n = 101) were women aged between 31 and 40 years; at this age, the women had already borne children and were concerned about aging (Table 1). There was no significant difference between the groups in terms of smoking and

diabetes, even though these factors negatively influence the healing process (Table 1).

The quality of a scar depends on racial characteristics, such as color and thickness of the dermis; usually, better scarring, from a cosmetic perspective, occurs in patients with lighter skin<sup>12</sup>. In this study, the skin color and thickness were homogeneous in both groups (Tables 2 and 3; Figure 3). Furthermore, considering hyperemia, hyperchromia, depressions, seroma, and dehiscence, there was no difference in the final quality of the scar between the groups ( $p > 0.05$ ; Table 5). However, the thickness of the dermis around

**Table 4.** The scar quality of the surgical wound 1 year after closure using sutures or Prineo®.

Scar Complications	With Prineo®		Without Prineo®		TOTAL	p
	N	%	N	%		
<b>Immediate complications</b>						
Hyperemia	4	4	3	3	7	
Drainage	1	1	3	3	4	
Seroma	3	3	2	2	5	
Partial dehiscence	2	2	6	6	8	
Total dehiscence	0	0	0	0	0	
Necrosis	1	1	0	0	1	
Infection	0	0	0	0	0	
Allergy	6	6	0	0	6	$p = 0.042$
<b>Late complications</b>						
Hyperchromia	4	4	2	2	6	
Hypertrophy	0	0	0	0	0	
Keloid	0	0	1	1	1	
Enlargement	3	3	8	8	11	$p = 0.042$
Depression	1	1	2	2	3	
Without complications	31	31	18	18	49	
<b>TOTAL</b>	<b>56</b>	<b>55</b>	<b>45</b>	<b>45</b>	<b>101</b>	

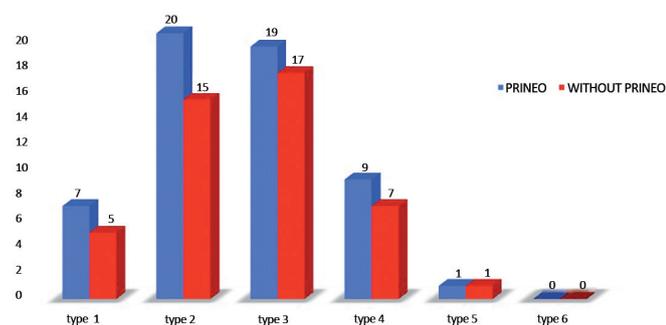
N: Number of cases; p: Significance in cases of  $p < 0.05$ .

**Table 5.** Scar quality 1 year after wound closure using surgical sutures or Prineo®.

Quality of Scar	With Prineo®		Without Prineo®		TOTAL		p
	N	%	N	%	N	%	
Excellent	42	42	27	27	69	69	
Good	7	7	11	11	18	18	
Reasonable	4	4	7	7	11	11	
Poor	3	3	0	0	3	3	
<b>TOTAL</b>	<b>56</b>	<b>55</b>	<b>45</b>	<b>45</b>	<b>101</b>		

N: Number of cases; p: Significance in cases of  $p < 0.05$ .

the wound did influence the final outcome of the scar ( $p = 0.001$ ; Table 3).

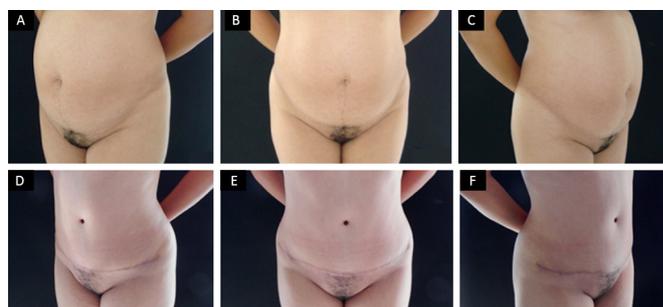


**Figure 3.** Patients of both groups were grouped homogeneously according to the color of their skin, defined using the Fitzpatrick classification.

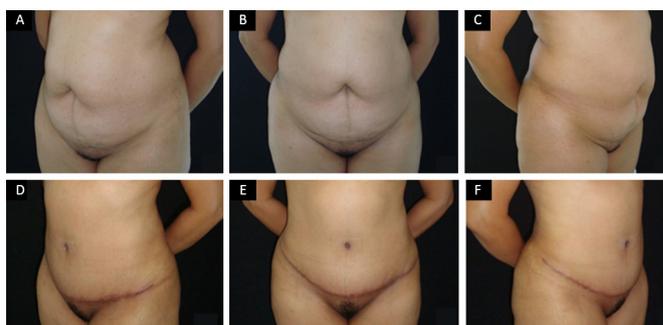
Surgical wound infection is a serious complication, and both *in vivo* and *in vitro* studies suggest that polyester mesh has an antibacterial protection of up to 75%<sup>9</sup>. In the present study, there was no significant difference between the two groups in terms of infection, because antiseptics and antibiotic prophylaxis were administered to all patients (Table 4).

The Prineo® system is indicated in cases of longer wounds that involve higher tension; it distributes the tension more easily while maintaining a traction equivalent to that of 4-0 Monocryl®<sup>9</sup>. Our statistical analysis showed in agreement with the literature that this system decreases the rate of scar enlargement ( $p < 0.05$ ; Table 4; Figures 4 and 5).

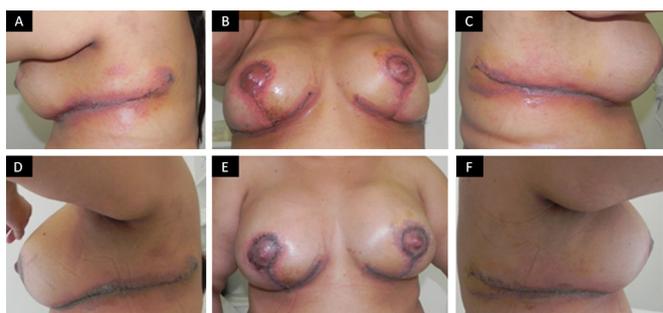
Contact between cyanoacrylate and the skin causes a polymerization reaction, releasing formaldehyde, which is probably what caused dermatitis in some patients in the present study<sup>4</sup>. Specifically, six patients developed contact dermatitis after Prineo® use. This was a significant number ( $p = 0.042$ ); however, all the affected patients improved after clinical treatment, and the final scar result was not affected (Table 4; Figures 1 and 6).



**Figure 4.** A, B, C: Patient in the preoperative period; D, E, F: Same patient 1 year after surgery for abdominoplasty using the Prineo® system; no scar enlargement can be seen.



**Figure 5.** A, B, C: Patient during the pre-operative period; D, E, F: Same patient 1 year after surgery for abdominoplasty, when the wound was closed using with nylon; scar enlargement occurred during the post-operative period.

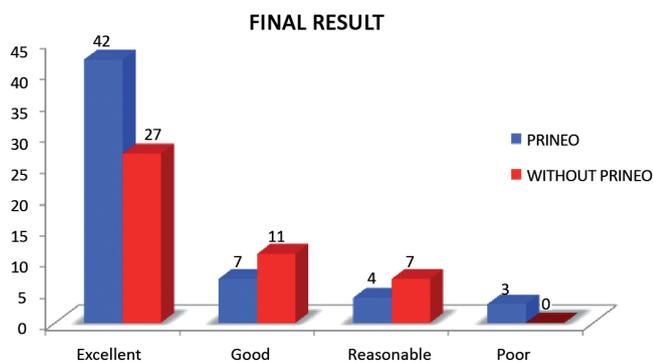


**Figure 6.** A, B, C: Patient during the pre-operative period; D, E, F: Same patient in the post-operative period after mammoplasty, with wound closure performed using the Prineo® system. Initial phase of hyperemia (above) and late phase of hyperchromia (below) after allergic reaction of the skin.

There was no significant difference between the groups ( $p = 0.068$ ) in terms of scar quality, indicating that, in both groups, the scarring result was mostly excellent (87%) to good (27%; Table 5 and Figure 7).

## CONCLUSION

Patients whose wounds were closed using Prineo® a system involving octyl-2-cyanoacrylate and an associated polyester mesh displayed lower rates of scar enlargement, which depended on whether the



**Figure 7.** Graph showing that, despite the complications in each group, the esthetic result of the scar after 1 year was similar, with no significant difference between the two groups.

thickness of the dermis was satisfactory. However, the same patients had higher rates of contact dermatitis than those whose wounds were closed using surgical sutures. Both groups showed excellent to good scar quality, with no significant difference in terms of esthetic scar results.

## COLLABORATIONS

- MC** Analysis and/or interpretation of data; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.
- LGM** Analysis and/or interpretation of data; statistical analysis; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.
- IRJ** Analysis and/or interpretation of data; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.
- RQL** Analysis and/or interpretation of data; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.
- CMA** Analysis and/or interpretation of data; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.

**LMCD** Analysis and/or interpretation of data; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.

**DASS** Analysis and/or interpretation of data; completion of operations and/or experiments.

**MCAG** Analysis and/or interpretation of data; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.

**FTM** Statistical analysis.

**JCD** Analysis and/or interpretation of data; statistical analysis; final approval of the manuscript; conception and design of the study; completion of operations and/or experiments; drafting the manuscript or critical review of its contents.

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