REDUCING PAIN AT SPLIT THICKNESS DONOR SITES WITH SILICONE DRESSING COMPARED TO PETROLATUM GAUZE DRESSING

DIMINUTION DE LA DOULEUR DU SITE DONNEUR: COMPARAISON DE PANSEMENTS À LA SILICONE ET À LA PARAFFINE

Akhoondinasab M-R.,[1] Karimi H.,[*] ✉ Sheikhizadeh S.,[1] Saberi M.[2]

[1] Hazrat Fatemeh Hospital, Iran University of Medical Sciences, Tehran, Iran
[2] Baqiyatalah University of Medical Sciences, Tehran, Iran

SUMMARY. Many modalities have been introduced to reduce devastating pain at the donor area. This is a prospective, randomized study to assess the effect of silicone dressing in reducing pain at split-thickness skin donor sites, and compare it with traditional petrolatum gauze. The patients were allocated to receive standard dressing (petrolatum gauze) or silicone dressing over skin donor sites. Pattern and severity of pain at the sites were assessed in both groups using the Visual Analog Scale for pain. Pattern of pain at the donor site during the postoperative period was consistently lower with silicone dressing ($p<0.005$). Regarding severity of pain, there were differences between the two groups ($p<.005$), but there were no significant differences between the two sexes regarding pattern and severity of pain ($p>0.5$). This study showed silicone dressing to be superior to petrolatum gauze in reducing severity and pattern of pain. It may increase patient satisfaction.

Keywords: skin graft, silicone dressing, pain pattern, donor, recipient

RÉSUMÉ. *De nombreuses techniques ont été utilisées afin de réduire la douleur du site de prélèvement des greffes cutanées. Cette étude prospective randomisée a comparé la douleur à ce niveau après pansement à la paraffine (PP) ou à la silicone (PS). Le site de la douleur a été précisé, son intensité étant cotée par échelle visuelle analogique. La douleur du site donneur était significativement ($p< 0,05$) après PS, tous sexes confondus. En réduisant la douleur du site donneur, PS peut augmenter la satisfaction des patients.*

Mots-clés : *greffe cutanée, site donneur, douleur, pansement siliconé*

✉ Corresponding author: Hamid Karimi M.D., Full Professor of Plastic and Reconstructive Surgery, Hazrat Fatemeh Hospital, Iran University of Medical Sciences, 21st AsadAbadi St., Tehran, Iran. Tel.: +98 9123179089; fax: +98 2188770048; email: hamidkarimi1381@yahoo.com
Manuscript: submitted 09/05/2019, accepted 11/09/2019

Introduction

Split-thickness skin grafting is a helpful reconstructive technique for the treatment of damaged or missing skin due to trauma, burns, chronic wounds and cancer surgery. Split- thickness auto grafts are comprised of epidermis and part of the dermis, but donor-site wounds only have dermis with variable thickness and there are some epithelial cells in the skin adnexa, so these epithelial cells will help in the re-epithelialization of the wound.[1]

Generally 10-14 days are required for a donor-site wound to heal, after which it may be used again when more grafts are needed for a large defect such as an extensive burn. Thus, proper management of the donor site is important to accelerate re-epithelialization and to prevent significant complications resulting from infection, hypertrophic scar, delayed healing, or conversion to a full-thickness wound.[1,2,3]

The ideal dressing in the donor site reduces healing time and hospital stay, prevents infectious complications, is less painful, is easy to apply and is cost effective.[4-16]

Different topical agents and dressings exist for donor-site wound healing, but the ideal dressing for local wound care has not yet been found. There are some reports stating the superiority of certain dressings, such as MEBO, Sofre-Tulle and moist dressings.[5,6,7,8,9]

Ability to absorb wound secretion as well as easy dressing removal after epithelialization are essential characteristics of a wound dressing. Gauzes, traditionally used as skin dressing materials, have suitable permeability but due to tight adhesion on the wound bed they induce incapacitating pain on removal. General anesthesia is often necessary for repeated, painful dressing changes of burn wound areas and skin graft donor sites.[9,10] Therefore, applying appropriate dressing to the donor site is critical for relieving pain and an earlier return to work.[4,12-20]

National and worldwide surveys indicate that surgeons usually apply the dressing they are most familiar with, and not according to its performance.[1] Human studies are the best way to determine the clinical effectiveness of donor-site dressings, but it is often difficult to have a sufficient number of similar wounds for randomized trials, thus limiting the studies.[1,14-23]

Most studies evaluated the time needed for re-epithelialization of the donor site, but a few compared pain among various materials. Ramesh et al. explained that collagen sheet dressing on the skin graft donor area reduces pain in the post-operative period compared to petroleum gauze.[11] Gee Kee et al. demonstrated that Mepilex Ag, which contains silicone, is superior to Acticoat regarding dressing change pain.[12] In a study by Zidan et al., human amniotic membrane in 98% glycerol reduced pain at the STSG donor site.[13] Upon results of a systematic review, Thoma et al. concluded that moist dressings over STSG donor sites were associated with less pain.[4] Dornseifer et al. performed a prospective study to compare polyurethane and Aquacel for skin donor site dressing, and results indicated that polyurethane dressing was significantly associated with less pain during and between dressing changes. In contrast to the polyurethane dressing concept, other existing materials do not meet all the criteria for an ideal donor-site dressing. Paraffin gauze is associated with a high pain level and impaired re-epithelialization because of desiccation and resulting shearing forces. In the case of suspected wound infection, the secondary dressing can be removed atraumatically and accurate assessment of wound, through the transparent film, is possible.[23]

Based on a study by Healy et al., fibrin sealant has been demonstrated to reduce time to hemostasis at wound sites, and patients receiving this treatment were incidentally noted to report less pain.[16] However Hu et al. showed no effect of autologous skin cell suspension on skin donor sites regarding pain severity or reducing pain severity.[24]

The purpose of this study was to evaluate the efficacy of silicone dressing at STSG donor sites to reduce pain compared with standard dressing, after skin graft harvesting.

Materials and methods

We prospectively performed a randomized controlled trial between August 2015 and July 2016 at the Fatima Hospital, Iran University of Medical Sciences, Tehran, Iran. Informed consent was obtained from all participants.

All patients had undergone split skin grafting from a lateral or anterior thigh donor site. The indication for skin grafts were trauma and laceration to the skin, skin burns and reconstructive surgeries. The patients were able to understand the nature of the study and were capable of completing daily pain assessments by filling in a sheet with the visual analogue scale score.

Our study comprised fifty-two patients who required skin grafting as a single procedure. Thirty patients formed the study group and 22 the control group. The assignment of patients into the study or control group was not random, as randomized division might have lead to an accumulation of patients with larger donor sites in one group. Therefore, we assigned patients to each group based on matching, i.e. the average size of skin donor site in both groups was not significantly different (since the bigger the size of donor site, the greater the possibility they may feel more pain). The assessment of cases was performed by independent assessors and was single-blinded.

All skin grafts had a thickness of 0.012 inches and were taken from the anterolateral thigh area. The grafts were taken by an electrical dermatome. The donor sites were covered, immediately after harvesting, with moist gauze containing normal saline and epinephrine 1:100000 until the end of surgery. At the end of the operation, the corresponding dressing was applied using NA ultra silicone dressing manufactured by Johnson and Johnson and petrolatum gauze dressing. About 1 cm of surrounding normal skin was covered by the dressing. Finally, two layers of cotton gauze pads were applied over the dressings. In the post-operative period, pain control was performed by central suppression of pain, i.e. pethidine or morphine, to prevent interference with local wound mediators. After surgery, 0.05-0.1 mg/kg morphine was given IV every 3-4 hours in case of pain. No medications were given prior to dressing change at the donor site. For all patients, dressings were changed at the 5th day post operation, and intensity and pattern of pain were recorded by Visual Analog Scale for pain.

A single expert nurse recorded the pain score. Pain scoring was done only on the fifth day after surgery and compared with others. It is normal practice at our centre to change donor site dressings at the 5th day to check for proper healing, any complications, and determine if any treatment is required.

The VAS-P is not appropriate for children under eight years old therefore all patients under 8 years old were excluded from the study.

Results

For data analysis, an independent t-test and chi^2 were used in SPSS package version 24, based on intention to treat. For normal distribution the Kolmogorov-Smirnov test was applied and p-values less than 0.05 were considered significant.

Fifty-two patients required skin grafting for the management of various types of reconstruction (*Tables I and II*). Thirty patients (17 males and 13 females) were assigned to the silicone group and 22 patients (18 males and 4 females) to the control group (*Table III*).

Table I - Type of dressing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Traditional	22	42.3	42.3	42.3
	Modern	30	57.7	57.7	100.0
	Total	52	100.0	100.0	

Table II - Age distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<15 years	7	13.5	13.5	13.5
	15-19 years	27	51.9	51.9	65.4
	20-44	14	26.9	26.9	92.3
	>=45	4	7.7	7.7	100.0
	Total	52	100.0	100.0	

Table III - Sex distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	35	67.3	67.3	67.3
	Female	17	32.7	32.7	100.0
	Total	52	100.0	100.0	

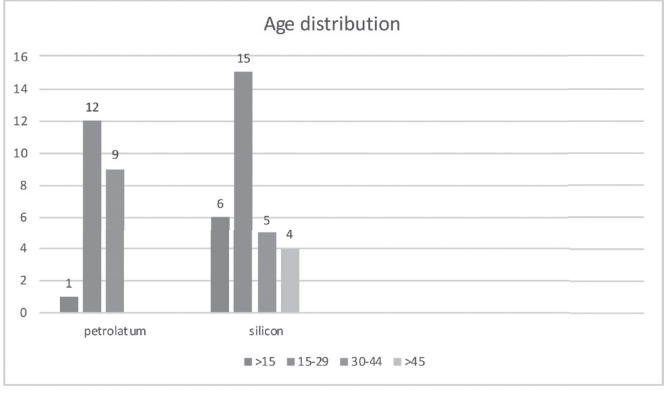

Fig. 1 - Age distribution for the two dressing groups

Age distribution of patients is presented in *Table II*. The youngest patient was 12 years old and the oldest was 52. There was no significant difference in demographic data between the two groups (*Fig. 1*).

Donor-site dimension ranged from 80 to 170 cm^2, with a mean of 125 cm^2: difference between mean surface area in the two groups was not significant.

A total of 86.5% of our patients resided in an urban area and 13.5% in a rural area (*Fig. 2*). As is shown in *Fig. 3*, 57.7% of patients are in the silicone group, and the remainder in the petrolatum group. There was no relation between place of residence and severity of pain, p> 0.9 (*Figs. 4 and 5*). Pattern of pain at the donor site during the postoperative

Fig. 2 - Place of residency

Fig. 3 - Silicone dressing in 58% and petrolatum in 42%

period was consistently lower after silicone dressing compared to petrolatum dressing (p<0.005, *Fig. 6*). Also regarding severity of pain, there was a difference between the two groups (p<.005, *Fig. 7*). However there were no significant differences in pattern and severity of pain between the two sexes (p>0.5). Although the focus of the study was not on rate of epithelialization, it seems that in the silicone group healing took a shorter time due to the moist environment beneath it, which prevents desiccation.

Discussion

Skin graft is a common procedure used by plastic and general surgeons. Pain at the donor site is significant after skin graft harvesting due to exposure of dermis, and is the major problem for the patients and surgical staff.[11]

An optimal environment that allows rapid re-epithelialization by accelerating keratinocyte proliferation and angiogenesis, while preventing infection, minimizing patient discomfort and promoting a good cosmetic result are the current goals for STSG donor site optimal dressing.[11]

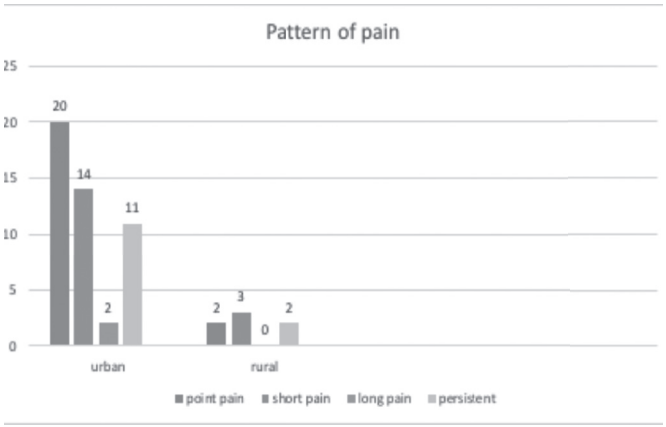

Fig. 4 - Difference in pattern of pain according to place of residence

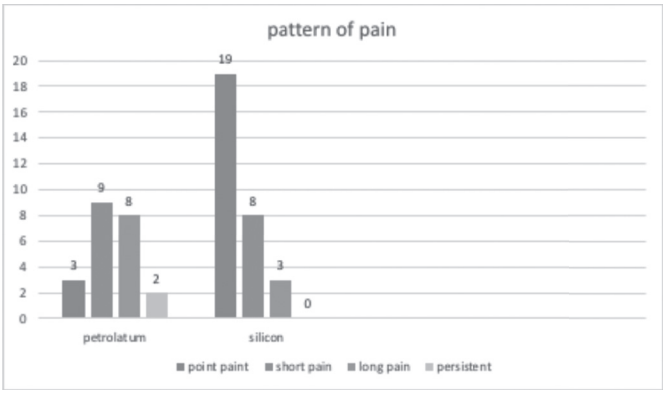

Fig. 6 - Difference in pattern of pain according to type of dressing

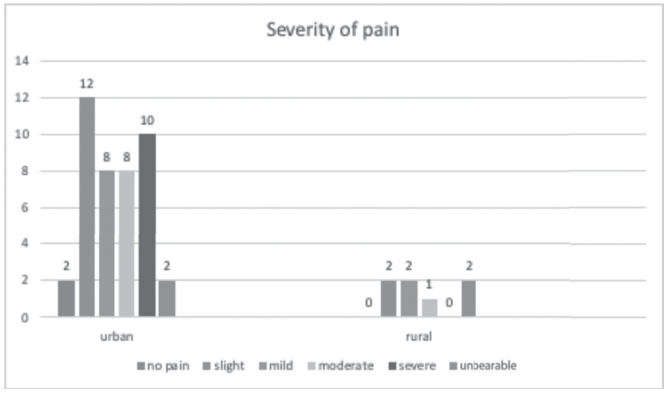

Fig. 5- Difference in severity of pain according to place of residence

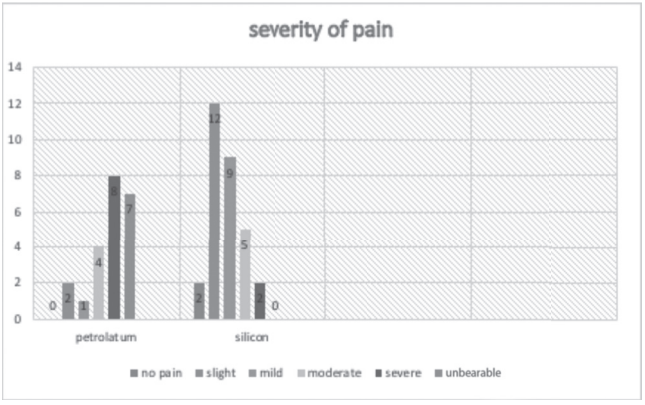

Fig. 7 - Difference in severity of pain according to type of dressing

Although the donor site depth is extremely thin, patients usually describe this new wound to be like bad gravel (herpes zoster) rash. Usually they complain of more pain in the donor wound site than in the original recipient site. The pain in the thigh donor site may delay early ambulation of the patients.[12] Therefore proper management of the donor site is an important issue. Other studies also have mentioned that patient discomfort at the donor site is worse than at the recipient site.[4,13]

Ability to absorb wound secretion as well as easy removal after healing of the donor wound are the essential characteristics of an optimal donor dressing. Petrolautum gauze clearly has proper permeability but its tight adhesion to bed induces intolerable pain on removal.[10]

The ideal dressing for STSG donor sites has not been found over the years.[14] Donor-site dressings are classified as open, semi-open, occlusive, semi-occlusive and biological.[14]

Many skin substitutes or occlusive dressings have been developed, which can reduce fluid loss, pain, infection and costs, and promote wound healing. These skin substitutes help re-epithelialization beneath the dressing and obviate the need for daily dressing. These will result in less stress for the patients, physicians, nurses or staff.[15] The occlusive dressings reduce arachidonic acid metabolites and alleviate pain by putting a barrier between nerve endings and air.[16] Also, it is a barrier to microorganisms and infection, and prevents dissemination of MRSA by hydrocolloid occlusive dressings.[17]

Occlusive dressings have greater benefit for the treatment of pediatric wounds, as less pain and decreased need for dressing changes would reduce the psychological trauma for them.[18]

These dressings can be grossly divided into moist (e.g. Tegaderm, Aquacel Ag, Kaltostat) and non-moist dressings (e.g., Scarlet Red, Xeroform, Jelonet). Moist dressings provide moisture, so can prevent exudate desiccation.[13] Most studies comparing moist and non-moist dressings showed that moist dressings had better outcomes.[13] It is also shown that continuous moist wound environment (MWE) is the treatment of choice as it promotes epithelialization and thus reduces pain.[18] For example, Adrian et al. reported that TISSEEL plus Mefix as a dressing over STSG donor site would result in significantly less pain than Mefix dressings alone.[19]

Healy and his colleagues in 2013 stated that fibrin sealant causes a shorter time of hemostasis at wound sites, and pain will be reduced.[16]

The use of amnion for burns dates back to 1910. Bujung et al. explained that amnion is an optimal dressing for donors in term of wound healing, controlling infection, decreasing pain and speeding up epithelialization.[15,20]

Kristan et al. stated that xeroform is superior to Jelonet dressing for STSG donor sites.[21] Usually, separation of dressing from the bed will begin 8 to 14 days after surgery, just after epithelialization.[22]

In a study by Dornseifer et al. they introduced polyurethane film as another choice for donor site dressing, but it is expensive and increases infection rate.[23] That trial showed the superiority of polyurethane film to Aquacel as regards pain.[23] Aquacel is a sodium carboxymethylcellulose hydrocolloid polymer with high hydrophilic characteristics.[23] In a clinical study, it was shown that Aquacel was better than petrolatum dressing regarding reducing pain, enhancing epithelialization, easy application and preventing hypertrophic scars.[22]

Paraffin gauze has two disadvantages: high pain level and diminished re-epithelialization due to wound bed desiccation.[23]

In a study by Hu et al. it was shown that hydrocolloid dressings enhance healing and minimize patient discomfort, but as a disadvantage, epithelialization of the donor site may occur between 1 to 3 weeks.[24]

In our study the main goal was to evaluate silicone dressing in reducing pain at the skin donor site, as the most frequent and most devastating complaint of patients was discomfort in the donor area.

Although the focus of our study was not on the healing properties of silicone, it seems that providing a moist environment can promote faster re-epithelialization. In our study we used silicone dressing, which can reduce pain and be easily removed from the donor site after 5 days.

The role of silicone in promoting epithelialization could be a subject for future research. The study showed that both severity and pattern of pain in the silicone group were significantly different to the petrolatum group. Silicone dressing is more expensive than petrolatum gauze, 0.8$ vs. 0.1$, but its cost is probably compensated by a reduced time of return to work. Moreover, silicone dressing is not covered by insurance companies in our country. This issue may reduce its usage. Silicone dressing reduces pain, therefore it increases the patient's satisfaction. Further studies are needed to address these issues and questions.

Conclusion

The new silicone dressing could alleviate pain at skin donor sites compared to traditional petrolatum gauze, thus it may reduce hospital length of stay and increase patient satisfaction. We recommend and encourage using silicon dressing, especially for the reduction of pain at donor sites.

BIBLIOGRAPHY

1 Masella PC, Balent EM, Carlson TL, Lee KW, Pierce LM: Evaluation of six split-thickness skin graft donor-site dressing materials in a swine model. PRS Global Open, 2014: 1-11, 2014.
2 Terrill PJ, Goh RC, Bailey MJ: Split-thickness skin graft donor sites: a comparative study of two absorbent dressings. J Wound Care, 16(10): 433-8, 2007.
3 NA Latifi, H Karimi: Correlation of occurrence of infection in burn patients. Ann Burns Fire Disaster, 30(3): 172-176, 2017.
4 Voineskos SH, Ayeni OA, McKnight L, Thoma A: Systematic review of skin graft donor-site dressings. Plast Reconstr Surg, 124(1): 298-306, 2009.
5 Kheiri A, Amini S, Javidan AN, Saghafi MM, Khorasani G: The effects of Alkanna tinctoria Tausch on split-thickness skin graft donor site management: a randomized, blinded placebo-controlled trial; BMC Complementary and Alternative Medicine, 17: 253, 2017.
6 Akhoondinasab MR, Akhoondinasab M, Saberi M: Comparison of healing effect of aloe vera extract and silver sulfadiazine in burn injuries in experimental rat model. World J Plast Surg, 3(1): 29-34, 2014.
7 Atiyeh BS, Al-Amm CA, Nasser AA: Improved healing of split thickness skin graft donor sites. J Appl Res, 2: 114-21, 2002.
8 Atiyeh BS, Ghanimeh G, Kaddoura IL, Al Amm C, Ioannovich J: Split thickness skin graft donor site dressing: preliminary results of controlled clinical comparative study of MEBO and Sofra-Tulle. Letter-to-the-editor. Ann Plast Surg, 46: 88-89, 2001.
9 Atiyeh BS, Al-Amm CA, El-Musa KA, Sawwaf A, Dham R: Scar quality and physiologic barrier function restoration following moist and moist exposed dressings of partial thickness wounds. Dermatol Surg, 29: 14-20, 2003.
10 Hakkarainen T, Koivuniemi R, Kosonen M, Escobedo-Lucea C et al.: Nanofibrillar cellulose wound dressing in skin graft donor site treatment. J Control Release, 244: 292-301, 2016.
11 Ramesh BA, Jayalakshmi BK, Mohan J: A comparative study of collagen dressing versus petrolatum gauze dressing in reducing pain at the donor area. J Cutan Aesthet Surg, 10(1): 18-21, 2017.
12 Donovan ML, Muller MJ, Simpson C, Rudd M, Paratz J: Interim pressure garment therapy (4–6 mmHg) and its effect on donor site healing in burn patients: study protocol for a randomised controlled trial. Trials, 17: 214, 2016.
13 Zidan SM, Eleowa SA, Nasef MA et al.: Maximizing the safety of glycerol preserved human amniotic membrane as a biological dressing. Burns, 41: 1498-1503, 2015.
14 Akan M, Yildirim S, Misirlioğlu A, Ulusoy G et al.: An alternative method to minimize pain in the split-thickness skin graft donor site. Plat Reconstr Surg, 111(7): 2243-9, 2003.
15 Bujang-Safawi E, Halim AS, Khoo TL, Dorai AA: Dried irradiated human amniotic membrane as a biological dressing for facial burns - a 7-year case series. Burns, 36: 876-882, 2010.
16 Healy C, Greig AVH, Murphy AD, Powell C et al.: Prospective randomized controlled trial: fibrin sealant reduces split skin graft donor-site pain. Plast Reconstr Surg, 132(1): 139e-46e, 2013.
17 Soltan Dallal MM, Safdari R, Emadi Koochak H, Hadayatpour A et al.: A comparison between occlusive and exposure dressing in the management of burn wound. Burns, 42(3): 578-82, 2016.
18 Konstantinow A, Fischer TV, Ring J: Effectiveness of collagen/oxidised regenerated cellulose/silver-containing composite wound dressing for the treatment of medium-depth split-thickness skin graft donor site wounds in multi-morbid patients: a prospective, non-comparative, single-centre study. Int Wound J, 14(5); 791-800, 2017.
19 Murphy AD, Greig AVH, Powell CA, Pinder RJ et al.: Prospective randomized controlled trial: fibrin sealant reduces split skin graft donor site pain. Plast Reconstr Surg, 132(1): 139e-146e, 2013.
20 Zidan SM, Eleowa SA, Nasef MA, Abd-Almoktader MA et al.: Maximizing the safety of glycerol preserved human amniotic membrane as a biological dressing. Burns, 41: 1498-1503, 2015.
21 Malpas KG, Snelling CFT, Torn V: Comparison of donor-site healing under Xeroform and Jelonet dressing: unexpected findings. PRS, 112(2): 430-9, 2003.
22 Grossman AJ: A simplified technique for split-thickness skin graft donor-site care. Plast Reconstr Surg, 113(2): 796-7, 2004.
23 Dornseifer U, Lonic D, Gerstung TI, Herter F et al.: The ideal split-thickness skin graft donor-site dressing: a clinical comparative trial of a modified polyurethane dressing and Aquacel: Plast Reconstr Surg, 128(4): 918-924, 2011.
24 Hu Z, Guo D, Liu P, Cao X, Li S, Zhu J et al.: Randomized clinical trial of autologous skin cell suspension for accelerating re-epithelialization of split-thickness donor sites. BJS, 104: 836-842, 2017.

Conflict of interest. The authors have derived no personal benefit from the materials and results of the present study. The authors declare no conflict of interest.
All of the study and preparation of the manuscript was performed by the authors