ORIGINAL ARTICLE

Evaluation of Absorbent Versus Conventional Wound Dressing

A Randomized Controlled Study in Orthopedic Surgery

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Summary

Background: Lower-limb endoprosthetic operations and spinal operations are among the more common types of orthopedic procedures. Postoperative wound-healing disturbances and infections can lead to longer periods of hospital stay and recovery as well as to higher morbidity and mortality.

Methods: 209 patients who had been judged to have an indication for a primary knee or hip endoprosthesis or for a primary spinal operation were included in this randomized trial (ClinicalTrials.gov: NCT01988818) over the period June 2014–February 2015. After randomization, patients in the intervention group were given a trial dressing (Mepilex-Border Post-Op) and those in the control group were given a conventional adhesive dressing (Cosmopor). The primary endpoint was blister formation.

Results: In the overall study population, only a single case of blister formation was seen. The affected patient belonged to the intervention group but was mistakenly given a control dressing and developed blisters on the 6th day after surgery. Dressings were changed less frequently in the intervention group, and this difference was statistically significant ($p < 0.001$). The patients, nurses, and physicians all expressed greater satisfaction with the trial dressings than with the control dressings ($p < 0.001$).

Conclusion: The intervention group did not differ from the control group with respect to the primary endpoint, postoperative blister formation. The patients, nurses, and physicians all judged the dressing used in the intervention group more favorably than the conventional dressing.

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Total hip and knee replacement surgery (arthroplasty) as well as spinal surgery are among the most commonly performed orthopedic surgical procedures (1). Typically, a suitable wound dressing is used to protect the wound closure by providing external cover and creating a physical barrier against contamination. In addition, an ideal wound dressing should absorb wound exudate without causing excessive dryness of the wound, allowing a microclimate to form that promotes wound healing (2). A wide range of dressings designed for surgical wounds are available. However, at present the existing data do not allow to make evidence-based recommendations as to which wound care product applied after surgical procedures is superior in terms of infection rate, scarring, pain, dressing change, and, most importantly, patient acceptance (2).

Despite impeccable surgical technique and highest hygienic standards, complications of wound healing may occur after orthopedic procedures (3–6). Relevant wound complications do not only develop after major surgery, but also in day-to-day clinical practice after minor surgical procedures or injuries, both in an out- and in-patient setting (3–5). In patients with risk factors, such as diabetes mellitus, advanced age, ischemia, and bacterial infection, seemingly small and harmless wounds can lead to complications and chronic wounds (7). The incidence of complications of wound healing after primary orthopedic knee and hip procedures is reported to be 0 to 1.25% (5, 8–12) and even 0 to 16% after spinal surgery (1, 13–15). After elective orthopedic surgery, sepsis occurred in 0 to 0.34% of patients (16, 17). Here, harmless wounds can result in acute life-threatening complications (18).

Besides impaired wound healing, blistering is a potential post-operative complication with incidence rates of 6 to 24% reported in the literature (12, 13, 19, 20). Lack of elasticity and insufficient flexibility of adhesive dressings are among the factors promoting the formation of blisters (21, 22). Here, shear forces between skin and wound dressing/plaster play a key role (22). These occur when the epidermis separates from the dermis as the result of continuous abrasion (23). Other factors include age-related skin changes, postoperative soft-tissue edema, the type of wound

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FIGURE 1

Flowchart of the study according to CONSORT guidelines
CONSORT, Consolidated Statement of Reporting Trials

dressing and the way a wound dressing is applied (22, 24). Due to the irritation of dermal nerve endings resulting from injury to the epidermis, patients often experience discomfort and pain during dressing changes (24). Following the breakdown of the skin barrier, superficial wound infection may occur which, in the worst case, can progress to deep wound infection (24). Moist wounds are associated with faster healing, less infections, and less wound pain compared to dry wounds (25). However, dressings with low adsorption capacity may result in the exposure of the wound to excessive wound exudate. This wet environment favors moisture-associated skin damage (maceration) and bacterial contaminations of the wound, especially if the dressing has a mechanical

leak (26). Postoperative wound complications or infections may result in increased rehabilitation time (27, 28), hospital length of stay as well as morbidity and mortality rates (18, 29).

Here, primary prevention is the most effect way to avoid blistering, complications of wound healing and secondary infection. Selection of the best suited wound dressing is key (30). According to Ousey et al., criteria for the fitting wound dressing include adhesion level, thickness of wound dressing, shape of the direct wound contact area of the dressing, absorbability of the dressing, as well as friction (4, 20). Similar criteria have been compiled by the National Institute for Health and Clinical Excellence (NICE) (31).

In everyday clinical practice, conventional dressings are typically used. The regular wound dressing changes required with conventional dressings are associated with pain and a slight risk of infection (32). Currently published data from prospective randomized trials (9, 12) and reviews (10, 21) suggest that absorbent wound dressings already established for the treatment of chronic wounds may also offer benefits in standard postoperative wound management.

In view of these facts, we designed a randomized study comparing a conventional adhesive dressing (Cosmopor E, Hartmann) with an absorbent wound dressing in an orthopedic surgery setting. From the many absorbent wound dressings available in the market, we selected Mepilex Border Post-Op (Mölnlycke, Gothenburg, Sweden)—a flexible, self-adhering and absorbent dressing coated with a soft silicone layer. The integrated Mepilex wound dressing combined with the Safetac adhesive technology used had already shown good results in terms of adhesibility, usability and patient satisfaction in previous studies (12, 21).

The aim of this study was to evaluate the performance of this absorbent wound dressing and to compare it with that of a conventional dressing.

Material and methods

This randomized study conducted at the University Hospital Cologne between June 2014 and February 2015 included a total of 209 adult patients with an indication for primary total knee or hip replacement or primary spinal surgery and an expected duration of the post-operative hospital stay of at least 6 days. Patients were allocated to either of the two treatments at a ratio of 1:1. Allocation was performed in a stratified manner (hip, knee, spine), using permuted blocks of variable lengths. This study was blinded with the help of computer-generated, pseudo-random treatment allocations in sequentially numbered, opaque, sealed envelopes.

The primary endpoint of this study was the incidence of blistering in patients after total hip or knee replacement or after primary spinal surgery. The sample size was calculated on this basis (13). Secondary endpoints were dressing performance, wearing

TABLE 1

Comparison of baseline data of the two groups

	Control group	Intervention group	p value
Age (years)	66.2	66.8	0.696
Men (%)	55.2	47.6	0.269
Women (%)	44.8	52.4	
Hip surgery (%)	34.3	33.0	0.981
Knee surgery (%)	34.3	33.0	0.981
Spinal surgery (%)	33.3	34.0	0.981

comfort, conformability, and patient acceptance of the dressing. Fulfilling the Consolidated Statement of Reporting Trials (CONSORT) criteria, we highlight here within the framework of selective reporting of endpoints that contrary to the requirement set in the study protocol both wound care provision and wound outcome assessment were performed by the same persons.

The detailed study protocol of this study was published in advance (13). The randomization method used is depicted in the CONSORT flowchart (*Figure*). The approval of this study by the relevant ethics committee of the University Hospital Cologne is available (reference number 13–348). This study was registered in advance (ClinicalTrials.gov number: NCT01988818). A comprehensive description of the methods used is provided in the *eMethods* section.

Results

Of the 209 patients enrolled in this study, 208 could be included in the analysis. Of these, 105 were allocated to the control group and 103 to the intervention group. The mean age was 66.2 years (33–90 years) in the control group and 66.8 years (37–92 years) in the intervention group. In the control group, 55.2% of patients were male and 44.8% female. In the intervention group, 47.6% of patients were male and 52.4% female. There were no significant differences in demographic characteristics between the 3 surgery groups (total knee replacement, total hip replacement and spinal surgery) (*Table 1*).

In the entire study population, blistering was observed in one patient on postoperative day 6 (primary endpoint). This patient was in the intervention group, but had accidentally received a control wound dressing. *Table 2* shows overall patient satisfactions, broken down by type of surgery performed. In all 3 groups (knee, hip, spine), patients in the intervention group reported higher satisfaction levels ($p < 0.001$).

In the intervention group, patients rated the wearing comfort of the dressing significantly better compared to the control group (*Table 3*). The ratings in terms of usability, assessment of the wound situation through the dressing and removal of the adhesive dressing were significantly more favorable in the intervention group ($p < 0.001$) (*Tables 4–6*). In the overall evaluation, nursing staff/physicians rated the usability of the dressing in the intervention group as being better ($p < 0.001$) (*Table 4*).

Taking into consideration pain after dressing change—measured using a visual analog scale [VAS]—, the intervention group experienced significantly less discomfort compared to the control group (postoperative day 6; $p = 0.006$), regardless of the type of surgery (hip, knee or spine) performed (*eTable*).

The number of dressing changes during the study period was significantly lower when the silicone dressing (approved for 7 days) was applied ($p < 0.001$) (*Table 7*). In 70.9% of patients, no change of dressing

TABLE 2

Overall patient rating (postoperative day 6; $p < 0.001$)

	Standard group [%]	Intervention group [%]
excellent	1.9	50.5
very good	20	30.1
good	39	17.5
poor	39	1.9

TABLE 3

Patient-rated comfort (postoperative day 6; $p < 0.001$)

	Standard group [%]	Intervention group [%]
excellent	1.9	53.4
very good	19	27.2
good	40	17.5
poor	39	1.9

TABLE 4

Rating of usability by nursing staff/physicians (postoperative day 6; $p<0.001$)

	Standard group [%]	Intervention group [%]
excellent	1	30.9
very good	44	50
good	23	17
poor	32	2.1

TABLE 5

Rating of wound dressing removal by nursing staff/physicians (postoperative day 6; $p<0.001$)

	Standard group [%]	Intervention group [%]
excellent	1	64.9
very good	11	18.1
good	28	12.8
poor	60	4.5

was required during 6 postoperative days. In the control group, by contrast, all patients had a dressing change during this period, as this was required by the hospital's general hygiene rules. On average, patients in the intervention group needed 0.3 dressings after the intraoperatively applied dressing, compared to 1.2 dressings per patient in the control group (Table 2). No difference between the dressings was found with regard to the time required for dressing change. During the study period, no wound complications were observed. The *eTable* provides an overview of all results.

Discussion

The primary study hypothesis that the use of absorbent wound dressing will reduce blistering was not confirmed. For conventional adhesive dressings, blistering rates of 6 to 24% have been reported in the literature (13, 23). However, these findings were not confirmed in our patient population. This may be due to the fact that the incidence of blistering can generally be reduced if the dressing is applied without tension, daily dressing changes are avoided, and the dressing is gently separated from the skin and cautiously removed.

However, our study showed that patients in the intervention group reported less postoperative pain, required less dressing changes overall, and were more satisfied with the dressing. Likewise, user satisfaction findings were in favor of the intervention group. In the analyses of the data collected for all primary and

secondary parameters (*eTable*), no differences between the two studied groups were found for numerous parameters.

The wound dressing used in the intervention group of this study meets all requirements set in the 2008 National Health and Clinical Excellence (NICE) guideline.

This dressing's permeability had already been shown in previous studies (12) and been rated as satisfactory. This rating is supported by the absence of blistering and the low frequency of dressing changes in the intervention group of our study.

Our results show that the wound dressing in the intervention group can be removed without causing relevant pain—a key criterion of patients when rating a wound dressing. Consequently, the absorbent adhesive dressing is significantly superior to today's standard dressing.

Here, it is worth mentioning that nursing staff/physicians starting to use absorbent dressing are confronted with a significant change in wound care procedures. Usually, the surgeon who applied the dressing assesses the patient's surgical wound postoperatively every 2 days to make sure that no wound complications have occurred. However, the silicone dressing used in this study limited the visibility of the area surrounding the wound (Figures 2 and 3). While a highly exuding section of the wound can be localized through the dressing, proper assessment requires a dressing change, as in the group with conventional dressing (Figure 4). Dressing changes were performed at the surgeon's discretion. For both nursing staff/physicians and patients, it was unfamiliar to have to wait for 7 days after surgery to see the skin incision wound for the first time. With the wound dressing in place, only the peripheral skin areas were visible, but not the surgical incision. However, this did not result in any medical disadvantages for the patients, as no impairment of wound healing or wound infection was overlooked. Complete transparency of the dressing could resolve this issue.

To avoid unnecessary dressing changes appears to make sense, as each dressing change is associated with the risk of contamination of the wound (32). In addition, cellular wound healing is disrupted for 3 to 5

TABLE 6

Ability to assess wound/wound complications with dressing in situ (postoperative day 6; $p<0.001$)

	Standard group [%]	Intervention group [%]
excellent	1	68
very good	1.9	6.8
good	15.2	12.6
poor	81.9	12.6

hours due to a fall in skin temperature, resulting in delayed healing (33). It is likely that the selection of the right dressing helps to prevent infection of surgical wounds. Intraoperatively, it was made sure that the exit site of the surgical drain, if any, was located outside of the area to be covered by the wound dressing. Only by keeping drain exit site and drain dressing separate, it was possible to leave the dressing in place on the surgical incision and remove the drain in time (Figure 5). Staples were used for skin closure after primary knee and hip surgery. According to a recently published meta-analysis, using a stapler for skin closure results in the lowest rate of wound complications after total knee replacement (34). After spinal surgery, the skin was closed with a running subcuticular suture.

In our study, both patients and nursing staff/physicians reported greater satisfaction in the intervention group compared to the control group. These results have been supported by recent randomized trials with absorbent wound dressings after knee or hip surgery (6, 24, 35–37).

In addition, Sharma et al. conclude in their meta-analysis of currently published randomized trials that despite these hints no evidence is available to confirm that absorbent wound dressings can reduce joint infection (36).

TABLE 7

Number of dressing changes ($p < 0.001$)

Number of dressing changes	Control group	Intervention group
0	6 (5.7 %)	73 (70.9 %)
1	74 (70.5 %)	25 (24.3 %)
2	25 (23.8 %)	5 (4.9 %)

For the first time, our study also included and assessed patients with spinal disorders. Especially in this region of the body, wound dressings are exposed to stronger forces as these patients spend more time lying on the wound dressing. Consequently, the risk that dressings are displaced by shearing forces is potentially greater in the spinal region compared to the extremities. However, in spinal surgery patients the new dressing applied in the intervention group was significantly better than that in the control group and met all NICE criteria.

The initially applied wound dressing should ideally be left in place as long as possible to reduce the risk of infection and increase patient comfort. Requirements

Figure 2: Wound before dressing change with silicone dressing (intervention group)

Figure 3: Wound before dressing change with silicone dressing (intervention group)

Figure 4: Wound after removal of silicone dressing (intervention group)

Figure 5: Wound after application of the silicone dressing (intervention group) and external pedunculated exit of surgical drain

KEY MESSAGES

- No difference between control and intervention group was found for the primary endpoint, postoperative blistering.
- Patient ratings for wearing comfort, overall satisfaction, usability, and removal of the adhesive dressing were significantly in favor of the intervention group compared to the control group.
- In the overall evaluation, the users (nursing staff/physicians) rated the wound dressing in the intervention group as better.
- Limitations of the study include the short 6-day follow-up period which was not long enough to allow a final evaluation of the incidence of blistering and postoperative infection.
- In addition, assessment was biased because the endpoints were assessed by the same persons who had before changed the dressings.

for the use of the new dressings are that no signs of infection or exudate production beyond the capacity of the dressing are detected. These new wound dressings are already commercially available and offered by various manufacturers. In other countries, it is common practice that patients take a shower on the second postoperative day—without increased rates of wound infections (38–40). Thus, the advantage of leaving absorbent wound dressings in place longer should be critically evaluated and put into perspective.

One limitation of this study was its short study period of only 6 days. Nevertheless, this period was sufficiently long to evaluate the primary study hypothesis. However, this study was not designed to determine the infection rate during the subsequent wound healing period. In addition, it cannot entirely be ruled out that the assessments by the nursing staff/physicians and the patients were biased as the endpoints were determined by the same persons who had earlier changed the dressings. Furthermore, after surgery the wrong dressing was used in 14 patients (control group dressing instead of intervention group dressing). It is desirable to perform an independent follow-up study to confirm these results.

Further studies should take into account that no data on revision surgery or treatment of patients with preexisting conditions have yet been reported in the literature. In addition, the aspect of the study of Rasmussen et al. from 1993 (28) could be revisited and the indication for absorbent adhesive dressings (occlusive wound dressing) could be extended to pediatric patients. Especially in the pediatric patient population, treatment could be significantly facilitated or improved by greater patient satisfaction as the result of almost painless dressing changes. Based on these considerations, the evident dogma of performing dressing changes every 2 to 3 days should be reconsidered in favor of longer wearing periods, provided wound and dressing status allow for it. An important point would be to ensure that the conventional adhesive dressings used in the control group provide reliable adhesion over a comparably long period of time.

Conclusion

No difference between the control and the intervention group was found for the primary endpoint, postoperative blistering. The dressing used in the intervention group was better tolerated by patients and nursing staff/physicians reported greater satisfaction with its application. Based on the results of this study, the postoperative use of absorbent wound dressings in patients with primary total hip or knee replacements or spinal surgery can be recommended as it offers increased patient comfort.

Conflict of interest

Dr. Bredow received reimbursement of congress fees and travel expenses as well as study support from Mölnlycke (free supply of Mepilex Border Post-Op for the intervention group).

Dr. Oppermann received study support (third-party funding) from Mölnlycke (supply of adhesive dressing for the study).

Dr. Zarghooni received reimbursement of congress fees and travel expenses, lecture fees, and study support of Mölnlycke.

Professor Eysel received study support (third-party funding) from Mölnlycke (supply of adhesive dressing for the study).

The remaining authors declare no conflict of interest.

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► Supplementary material

For eReferences please refer to:
www.aerzteblatt-international.de/ref0918

eMethods, eTable:
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Supplementary material to:

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eMETHODS

Exclusion criteria comprised known allergies or hypersensitivities to components of the wound dressing as well as known bone fractures, patients after polytrauma, cancer surgery and preexisting wounds in the surgical field. Additional exclusion criteria were neurological deficits at the surgical site and skin diseases.

After inclusion of the patient, the allocated wound dressing was applied in the operating room. In line with the standards of the hospital, patients were followed up on postoperative days 2, 3 and 6. At each visit, the following parameters were assessed:

- skin status, including edema and temperature assessments
- status with regard to blistering
- sensation of the patient underneath the dressing
- wound exudate quantity and quality
- absorbency of the dressing.

In case of a dressing change, the time from getting the material until completion of the dressing change was measured and documented. Dressing changes were performed as specified in the study protocol and in the general hygiene rules of the hospital. In the control group, dressing changes were performed not later than on the second postoperative day and subsequently as required, but not later than every second day. In the intervention group, the dressing was only changed before the sixth postoperative day if medically indicated, as the manufacturer recommends to leave the dressing in situ for this period of time to achieve optimum outcomes. Indications for a dressing change included apparent bleeding into the dressing, exudate penetrating the dressing, patient discomfort, and signs of infection.

Patients rated their pain before, during and after removal of the dressing and on application of the new wound dressing, using a visual analog scale (VAS). In addition, patient satisfaction was measured based on wearing comfort and overall rating of the wound dressing. In addition, outcome assessors documented their ratings for wound dressing size, shape, transparency and overall impression. The visit on postoperative day 6 was the final visit; subsequently, the conventional dressing was used for further wound care.

Patients marked their answers on the VAS and rated their satisfaction using Likert scales (from 0–10 or from “poor” to “good” and “very good” to “excellent”). Furthermore, at the study visits patients were asked to rate their own skin adjacent to the surgical site and the wound dressing.

Patients had the opportunity to report whether sensitivity had changed or whether they had experienced unusual sensations potentially related to the wound dressing.

The choice of answers included “normal”, “itchy”, “burning”, “biting”, “pricking”, “formication”, “numb”, “other—with more precise description”.

Validated quality-of-life questionnaires were not used in this study.

Statistical analysis

The primary analysis was performed according to the “intention-to-treat” principal (full analysis set). A patient was eligible to be included in this analysis if he underwent surgery and received a study treatment. Incomplete participation in the study was categorized as a treatment failure. A secondary analysis included all patients essentially treated and followed up according to the study protocol (per-protocol set).

Primary outcome analysis

The proportion of patients with blistering in each of the two groups were compared using the Mantel-Haenszel test. A two-sided type 1 error of 5% was used and data were stratified by the type of surgical procedure. The null hypothesis H_0 (the odds ratio for blistering is 1) was tested against the alternative hypothesis H_A (the odds ratio for blistering is $\neq 1$).

Secondary outcome analysis

Pain, number of dressing changes/blistering and performance/assessor and patient ratings were analyzed using rang-based tests (Wilcoxon signed-rank test or Wilcoxon rank-sum test). Other wound complications were compared using the chi-square test or Fisher’s exact test.

eTABLE

Comprehensive overview of the results

Variables		Rating	Postoperative day 2		Postoperative day 3		Postoperative day 6	
			Percentage	p value	Percentage	p value	Percentage	p value
Blistering	Intervention group		0		0		0	
	Control group		0		0		0	
Dressing changes performed	Intervention group		15.7	<0.0001	18.4	<0.0001	94.2	0.497
	Control group		59		59		96.2	
Visual analog scale (VAS) before dressing change	Intervention group		0 = 100	0.632	0 = 100	0.513	0 = 99	0.085
							2 = 1	
	Control group		0 = 98.4		0 = 92.2		0 = 96	
			1 = 1.6		1 = 3.1		1 = 4	
					2 = 4.7			
VAS during dressing change	Intervention group		0 = 78.6	0.001	0 = 50	0.16	0 = 85.6	<0.0001
			1 = 14.3		1 = 6.3		1 = 10.3	
			2 = 7.1		2 = 31.3		2 = 2.1	
					4 = 12.4		3 = 1	
							5 = 1	
	Control group		0 = 21.6		0 = 23.3		0 = 29.7	
			1 = 26.3		1 = 31.4		1 = 23.8	
			2 = 21.1		2 = 20.3		2 = 27.7	
			3 = 9.2		3 = 12.5		3 = 5.9	
			4 = 9.2		4 = 6.3		4 = 8.9	
			5 = 2.6		5 = 1.6		5 = 3	
					6 = 3.1		6 = 1	
					7 = 1.6			
VAS after dressing change	Intervention group		0 = 92.9	0.073	0 = 75	0.245	0 = 96.9	0.006
			2 = 7.1		1 = 12.5		1 = 2.1	
					2 = 12.5		2 = 1	
	Control group		0 = 77.6		0 = 75		0 = 82.2	
			1 = 19.2		1 = 21.9		1 = 15.8	
			2 = 2.6		2 = 3.1		2 = 1	
							9 = 1	
Dressing change time (mean)	Intervention group		2.2 minutes		2.5 minutes		2.3 minutes	
	Control group		2.2 minutes		2.6 minutes		2.5 minutes	
Patient satisfaction, overall	Intervention group	poor	3.9	<0.0001	2.9	<0.0001	1.9	<0.0001
		good	21.6		15.7		17.5	
		very good	57.8		50		30.1	
		excellent	16.7		31.4		50.5	
	Control group	poor	15.2		26.7		39	
		good	59		53.3		39	
		very good	25.7		17.1		20	
		excellent	0		2.9		1.9	

Variables		Rating	Postoperative day 2		Postoperative day 3		Postoperative day 6	
			Percentage	p value	Percentage	p value	Percentage	p value
Patient satisfaction, comfort	Intervention group	poor	3.9	<0.0001	2.9	<0.0001	1.9	<0.0001
		good	21.6		14.7		17.5	
		very good	57.8		51		27.2	
		excellent	16.7		31.4		53.4	
	Control group	poor	14.3		28.6		39	
		good	60		50.5		40	
		very good	24.8		19		19	
		excellent	1		1.9		1.9	
Assessor rating, overall	Intervention group	poor	3	<0.0001	4	<0.0001	1	<0.0001
		good	26.7		14.9		17.5	
		very good	56.4		49.5		33	
		excellent	13.9		31.7		48.5	
	Control group	poor	14.4		19.9		35.2	
		good	61.5		56.7		37.1	
		very good	24		22.1		26.7	
		excellent	0		1.9		1	
Assessor rating, size of wound dressing	Intervention group	poor	2.9	<0.0001	2.9	<0.0001	1.9	<0.0001
		good	20.6		15.7		17.5	
		very good	63.7		56.9		42.7	
		excellent	12.7		24.5		37.9	
	Control group	poor	6.7		14.4		19	
		good	62.9		53.8		46.7	
		very good	29.5		31.7		34.3	
		excellent	1		0		0	
Assessor rating, shape of wound dressing	Intervention group	poor	2.9	<0.0001	2.9	<0.0001	1	<0.0001
		good	19.6		15.7		18.4	
		very good	65.7		57.8		42.7	
		excellent	11.8		23.5		37.9	
	Control group	poor	8.6		16.3		21.9	
		good	62.9		53.8		45.7	
		very good	28.6		29.8		32.4	
		excellent	0		0		0	
Assessor rating, transparency of wound dressing	Intervention group	poor	8.8	<0.0001	13.9	<0.0001	12.6	<0.0001
		good	17.6		13.9		12.6	
		very good	16.7		11.9		6.8	
		excellent	56.9		60.4		68	
	Control group	poor	76.2		72.4		81.9	
		good	22.9		24.8		15.2	
		very good	0		1		1.9	
		excellent	1		1.9		1	

Variables		Rating	Postoperative day 2		Postoperative day 3		Postoperative day 6	
			Percentage	p value	Percentage	p value	Percentage	p value
Assessor rating, removal of wound dressing	Intervention group	poor	13.3	<0.0001	25	<0.0001	4.3	<0.0001
		good	20		35		12.8	
		very good	46.7		25		18.1	
		excellent	20		15		64.9	
	Control group	poor	57.9		29.9		60	
		good	33.3		22.4		28	
		very good	8.8		44.8		11	
		excellent	0		3		1	
Assessor rating, application of wound dressing	Intervention group	poor	6.7	0.083	17.6	0.573	2.1	<0.0001
		good	33.3		35.3		17	
		very good	53.3		41.2		50	
		excellent	6.7		5.9		30.9	
	Control group	poor	21.4		29.9		32	
		good	44.6		22.4		23	
		very good	33.9		44.8		44	
		excellent	0		3		1	
Mobilization	Intervention group	confined to bed	53.4	0.459	18.4	0.7	11.7	0.459
		confined to chair	17.5		28.2		12.6	
		mobile	29.1		52.4		75.7	
	Control group	confined to bed	58.1		18.1		6.7	
		confined to chair	11.4		25.7		13.3	
		mobile	30.5		55.2		80	
Tissue consistency	Intervention group	normal	96.1	0.362	98.1	0.575	99	0.227
		firm	1.9		1		1	
		boggy	1.9		1		0	
		other	0		0		0	
	Control group	normal	96.2		95.2		98.1	
		firm	0		1		0	
		boggy	2.9		2.9		1.9	
		other	0		1		0	
Skin temperature	Intervention group	normal	86.4	0.524	95.1	0.139	99	0.166
		warm	0		4.9		1	
		cold	13.6		0		0	
	Control group	normal	82.9		86.7		94.2	
		warm	1		10.5		4.8	
		cold	16.2		1.9		1	

Variables		Rating	Postoperative day 2		Postoperative day 3		Postoperative day 6	
			Percentage	p value	Percentage	p value	Percentage	p value
Skin status	Intervention group	normal	99	0.225	97.1	0.261	98	0.056
		dry	0		1.9		1	
		scaly	0		0		0	
		oily	0		1		0	
		moist	0		0		1	
		other	1		0		0	
	Control group	normal	98.1		93.3		88.5	
		dry	1.9		5.7		7.7	
		scaly	0		1		1	
		moist	0		0		2.9	
		other	0		0		0	
Patient-reported skin status	Intervention group	normal	97.1	0.05	94.2	<0.0001	96.1	<0.0001
		itchy	2.9		3.9		1.9	
		burning	0		0		0	
		numb	0		0		0	
		combined	0		2		2	
	Control group	normal	86.7		66.7		61	
		itchy	11.4		28.6		21	
		burning	1		0		0	
		numb	1		0		0	
		combined	0		4.8		18.2	
Sweating	Intervention group	none	95.1	0.497	95.1	0.711	96	0.515
		mild	3.9		4.9		4	
		moderate	1		0		0	
		severe	0		0		0	
	Control group	none	93.3		96.2		93.3	
		mild	5.7		3.8		5.8	
		moderate	0		0		0	
		severe	1		0		1	
Edema	Intervention group	none	82.5	0.626	84.5	0.319	87	0.762
		mild	4.9		7.8		11	
		moderate	9.7		5.8		1	
		severe	2.9		1.9		1	
	Control group	none	82.9		80		91.3	
		mild	7.6		12.4		6.7	
		moderate	8.6		7.6		1	
		severe	1		0		1	
Amount of exudate	Intervention group	none	70.9	0.366	73.8	0.932	81	0.057
		little	22.3		17.5		12	
		moderate	1		3.9		1	
		copious	5.8		4.9		6	
	Control group	none	80		71.4		92.3	
		little	14.3		20		3.8	
		moderate	1.9		4.8		1.9	
		copious	3.8		3.8		1.9	

Variables		Rating	Postoperative day 2		Postoperative day 3		Postoperative day 6	
			Percentage	p value	Percentage	p value	Percentage	p value
Quality of exudate	Intervention group	serous	0	0.12		0.557	11.1	0.296
		serous/hemorrhagic	20		14.8		16.7	
		purulent			85.2			
		hemorrhagic	80				72.2	
	Control group	serous	0				33.3	
		serous/hemorrhagic	4.8		10		22.2	
		purulent			86.7			
		hemorrhagic	95.2		3.3		44.4	
Absorbency	Intervention group	not stated	70.9	0.016	73.8	0.004	83	0.015
		little	2.9		1			
		good	6.8		7.8		3	
		very good	12.6		10.7		4	
		excellent	6.8		6.8		10	
	Control group	not stated	80		72.4		92.3	
		little	7.6		7.6		1.9	
		good	7.9		15.2		3.8	
		very good	2.9		2.9			
		excellent	1.9		1.9		1.9	
Wound odor	Intervention group	none	99	0.311	100		100	0.368
		mild						
		moderate	1					
	Control group	none	100		100		99	
		mild					1	
Drainage	Intervention group	external	9.7	0,079	1	0,111		
		none	1,9		87,4		100	
		removed today	88.3		11.7			
	Control group	external	3.8					
		none			95.2		100	
		removed today	96.2		4.8			