

## Review Article

# Study on the effect of combined application of foam dressing, hydrocolloid dressing and wound treatment on nursing prognosis and pressure score improvement of patients with stage I-II pressure ulcer

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**Abstract:** To explore the effects of the combined application of foam dressing, hydrocolloid dressing and wound treatment on nursing, prognosis and improvement of pressure scores in patients with stage I-II pressure ulcers. Altogether 97 patients with stage I-II pressure ulcers treated in our hospital from January 2016 to September 2018 were selected as the research participants; 50 patients treated with conventional debridement and disinfection were selected as the control group, and 47 patients treated with foam adjuvant, hydrocolloid adjuvant and wound combination in addition to treatment in the control group were selected as the research group. The pressure ulcer scale for healing (PUSH) score, clinical efficacy, quality of life score, skin comfort and nursing satisfaction were compared between the two groups. PUSH scores of the two groups were compared, showing that the research group had lower scores than the control group ( $P < 0.05$ ). The healing time, dressing change times and turnover times of patients in the research group were less than those in the control group ( $P < 0.05$ ). The total effective rate of the research group was 95.74% (45/47), which was significantly higher than that of the control group (4.00% (42/50)) ( $P < 0.05$ ). The quality of life scores of patients in the research group were significantly better than those in the control group ( $P < 0.05$ ). The comfort of the patients in the research group was better than that of the patients in the control group ( $P < 0.05$ ). The total satisfaction rate of nursing in the research group was 97.87% (46/47), which was significantly higher than that in the control group (88.00% (44/50)) ( $P < 0.05$ ). The combined application of foam dressing, hydrocolloid dressing and wound treatment can improve the satisfaction of nursing, prognosis and pressure score of patients with stage I-II pressure ulcers, improve the comfort and satisfaction of patients, and is suitable for improved clinical pressure ulcer treatment.

**Keywords:** Foam dressing, hydrocolloid dressing, wound treatment, stage I-II pressure ulcer, pressure ulcer

## Introduction

A pressure ulcer is a kind of skin complication often found in long-term bedridden patients, which mostly occurs in areas with prominent bones. It is mainly caused by abnormal blood supply caused by long-term local pressure, shear and friction, resulting in skin and subcutaneous tissue damage [1]. The clinical manifestations are mostly local inflammatory symptoms such as complete skin or open ulcers. In serious cases, pus or odor may occur at the wound [2]. With the rising trend of population aging, the number of bedridden patients with chronic diseases is increasing, and the preva-

lence rate of pressure ulcers is also increasing [3]. Among them, surgical pressure ulcers are also summarized as common pressure ulcers. They mostly refers to pressure sores in the area of bone tuberosity with compression and fat tissue deficiency within 6 days after the completion of the operation and are affected by the operation posture [4]. According to relevant literature reports, about 60,000 people worldwide die each year due to pressure ulcer symptoms [5]. Fatality and difficulty in nursing make pressure ulcers a difficult problem that has always challenged rehabilitation and nursing work. The occurrence of pressure ulcers increases the mental and physical pain of

## Application of improving pressure ulcer in patients with stage I-II pressure ulcer

patients, increases the workload of clinical nursing staff, wastes medical resources to a certain extent, prolongs the time required for hospitalization, increases the economic pressure, and increases the number of medical dispute cases [6, 7]. However, the recovery of pressure ulcer wounds need a long recovery period, and they cannot heal naturally without intervention measures, but they can be recovered from after external means are used [8]. However, there is a lack of rapid and specific treatment plans for stage I-II pressure ulcers in clinical practice, and auxiliary treatment methods such as nursing and dressing are often used to achieve the purpose of improving the curative effect [9]. Therefore, research on nursing methods, application and value of dressing is still of great clinical significance.

The foam dressing is fine and soft in texture and uniform in pore diameter, it can absorb wound secretions, provide a moist environment for the wound surface, has no adhesion reaction between the dressing and the wound surface, causes low wound pain when replacing the dressing, and can accelerate wound healing [10]. The main component of hydrocolloid dressing is sodium carboxymethyl cellulose, and the main structure of the surface layer is a polyurethane semi-permeable membrane, which can prevent micro-organisms and water from permeating, but can ensure the effective permeation of oxygen and water vapor, and act on skin cleaning and moisturizing [11]. Both dressings were used to promote wound healing by keeping the skin in a good recovery state. Therefore, foam dressing, hydrocolloid dressing and wound treatment were used in this experiment to treat patients with stage I-II pressure ulcers, and the prognosis level of combined nursing and pressure scores were observed. The specific report is as follows.

### Methods and materials

#### *General data*

Altogether, 97 patients with stage I-II pressure ulcers treated in the general hospital from January 2016 to September 2018 were selected as the research participants; 50 patients treated with conventional debridement and disinfection were selected as the control group, and 47 patients treated with foam adjuvant, hydrocolloid adjuvant and wound combination in addition to treatment of the control group

were selected as the research group. There were 29 males and 18 females in the research group, with an average age of  $(49.24 \pm 8.38)$  years, with 13 cases in stage I and 34 cases in stage II. The control group consisted of 32 males and 18 females with an average age of  $(50.52 \pm 8.25)$  years, with 15 cases in stage I and 35 cases in stage II. This study was approved by the Ethics Committee of the general hospital and reported to the relevant medical departments for records. Patients signed informed consent forms on the premise of voluntary participation. Inclusion criteria: (1) Patients who met the diagnostic criteria for stage I-II pressure ulcers; (2) Patients with good compliance and complete information; (3) Patients with lucidity and good communication skills. Exclusion criteria: (1) Patients complicated with diabetes, kidney diseases and immunodeficiency diseases; (2) Patients lost to follow. All studies were carried out after patients signed an informed consent.

#### *Methods*

*Treatment methods:* Patients in the control group were given routine debridement, cleaning and iodophor disinfection, and the wound was wrapped with sterile gauze. According to the patient's condition, the dressing was generally changed twice/d for 2 weeks. For example, 0.9% sodium chloride solution was used to clean the wound surface and skin around the wound, and the succus in the blain of blister patients was cleaned. Regular back rubs, turn-over, massage and assistance in bed activities were given. Washing and cleaning with warm water in the morning and evening were carried out to ensure that the patient's skin and bedding are clean. Patients were required to eat a balanced diet with good nutrition and healthy calories, so as to improve the nutrition supply in an all-round way. In addition to the control group, the patients in the research group were given hydrocolloid dressing (Zhejiang Innomed (China) Medical Technology Co., Ltd.) according to the pressure ulcer size to protect the wound. After the skin was dry, foam dressing (Coloplast, Denmark) was applied to the wound surface to fix the dressing, protect the wound, reduce the damage to the wound caused by pressure, and friction. The dressing was changed for 1-3 d/time for 2 weeks according to the amount of exudation fluid. At the same time, the medical staff closely observed the disease state of all

## Application of improving pressure ulcer in patients with stage I-II pressure ulcer

patients and assisted the patients to turn over from time to time to reduce pressure ulcers.

*Nursing measures:* Both groups received comprehensive care during treatment. (1) Pressure sore monitoring plan: For long-term bedridden patients, a pressure ulcer assessment and technical guidance nursing team was established. Pressure ulcer nursing skills and professional knowledge were explained to nursing team members. The pressure ulcer reporting, treatment and resolving system were standardized, so as to ensure the timeliness of prevention, discovery and treatment, reduce the occurrence of pressure ulcer cases, and improve the nursing effect. At the same time, an electronic case for pressure sore treatment and rehabilitation was established, the whole process of information for patients with pressure sores was integrated, an effective monitoring system was applied to fully inform the patient's condition, and any matters needing attention for the implementation of pressure ulcer care was improved [12]. (2) Pressure ulcer nursing quality: Patients who may have pressure ulcers were monitored and intervention measures were implemented in advance to ensure the quality of nursing intervention. For patients with existing pressure ulcer symptoms, the nursing staff clearly divided their responsibilities according to the nursing level, carried out a relatively even responsibility for each individual, paid attention to the clean and dry sheets and bedding of the patients, and applied auxiliary medical equipment such as air cushion beds and turn-over pillows to reduce the possibility of local skin compression of the patients. According to the individual situation of the patients, the turn-over times meet the standards to avoid the occurrence of pressure ulcers due to local long-term compression. After the completion of a single nursing process, the nursing staff was evaluated in a single day so as to correct irregular nursing measures, analyze the formation factors of pressure ulcers and reasonably reduce the occurrence rate of pressure ulcers. (3) Psychological nursing: The quality of life of patients with long-term bedridden pressure ulcers is seriously affected. Patients often suffered from emotional instability, so nurses were required to communicate with patients in a timely and patient manner, strengthen the health awareness of patients and their families on the prevention and care of pressure injuries, guide patients

under the environment of maintaining positive and optimistic emotions, patiently meet the requirements of patients for disease improvement, and gradually urge patients to change their behaviors and cooperate with pressure ulcer care [13]. (4) Nutritional support: Insulin subcutaneous intramuscular injection was used to control blood sugar of diabetic patients. Antibiotics were given to treat patients with wound infection. Patients with hypoproteinemia were given reasonable nutritional support. Active targeted therapy for primary diseases of stroke patients was carried out to prevent aggravation of the disease and strengthen safety monitoring.

### *Outcome measures*

(1) Pressure ulcer scale for healing (PUSH) score [14]: the scale included wound area, 24 h exudate volume and wound tissue type. The PUSH score was 0-17. A low score was closely related to a better pressure ulcer healing state. (2) The healing time, dressing change times and turn-over times of pressure ulcers in the two groups of patients were observed. (3) Clinical curative effect [15]: cured (no obvious wound, complete tissue repair), markedly effective (scab formation and reduction of wound  $\geq 70\%$ ), effective (superficial wound, 30-70% of original wound), ineffective (no obvious change in wound, wound reduction  $< 30\%$ ). The total effective rate of treatment = (cured + markedly effective + effective)/total number of cases  $\times 100\%$ . (4) Quality of life score [16]: The quality of life comprehensive assessment questionnaire (GQOLI-74) was applied for evaluating. A high score was closely related to a better quality of life. (5) The skin comfort of the two groups of patients was observed. (6) Nursing satisfaction: The self-made nursing satisfaction questionnaire was used to investigate the research participants. The evaluation criteria were: very satisfactory  $\geq 80$  points, satisfactory at 60-80 points and unsatisfactory  $< 60$  points. Nursing satisfaction rate = complete satisfaction rate + satisfaction rate.

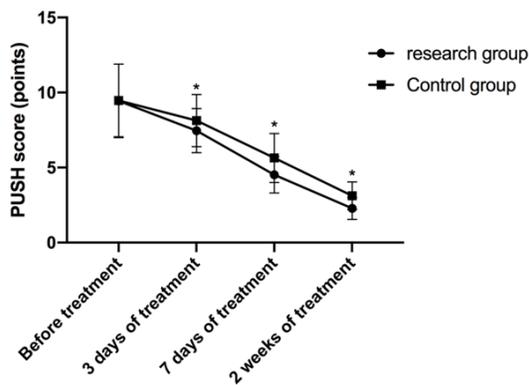
### *Statistical methods*

SPSS 20.0 statistical software was used to process the data. The measurement data were expressed as mean  $\pm$  standard deviation and t test was used. The counting data were expressed by the rate (%) and was tested by  $\chi^2$ .  $P < 0.05$  indicates that the difference is statistically significant.

# Application of improving pressure ulcer in patients with stage I-II pressure ulcer

**Table 1.** General data of wound patients

Group	Research group n=47	Control group n=50	t/X <sup>2</sup>	P
Gender (Case)			0.086	0.770
Male	29 (61.70)	32 (64.00)		
Female	18 (38.30)	18 (36.00)		
Age (years)	49.24±8.38	50.52±8.25	0.758	0.450
Weight (kg)	68.85±10.34	69.27±10.22	0.201	0.841
Pressure ulcer site (Case)			1.331	0.722
Sacrococcygeal region	23 (48.94)	26 (52.00)		
External malleolus	8 (17.02)	9 (18.00)		
Elbow joint	10 (21.28)	11 (22.00)		
Heel part	6 (12.77)	4 (8.00)		
Number of wounds (Wounds)	45.73±5.35	46.46±5.28	0.676	0.501
Type of pressure ulcers (Cases)			0.097	0.755
Phase I	13 (27.66)	15 (30.00)		
Phase II	34 (72.34)	35 (70.00)		



**Figure 1.** PUSH score comparison between two groups of pressure sore patients. The PUSH scores of the two groups were compared at 3 days, 7 days and 2 weeks of treatment, showing that the research group was better than the control group. Note: \* indicates  $P < 0.05$ .

## Results

### Details of general data of patients with stage I-II pressure ulcers included in the experiment

There was no significant difference in the general data of sex, age and body weight of patients with stage I-II pressure ulcers in both groups ( $P > 0.05$ ). See **Table 1** for details.

### Comparison of PUSH score between the two groups of pressure sore patients

Before treatment, the PUSH scores of the two groups of patients were approximately the

same ( $P > 0.05$ ). Comparing the PUSH scores of the two groups at 3 days, 7 days and 2 weeks of treatment, it was shown that the research group was lower than the control group ( $P < 0.05$ ). See **Figure 1** for details.

### Comparison of healing time, dressing change times and turnover times of pressure ulcers between the two groups

The healing time, dressing change times and turnover times of patients in the research group were less

than those in the control group ( $P < 0.05$ ). See **Table 2** for details.

### Comparison of clinical efficacy between the two groups

The total effective rate of the research group was 95.74% (45/47), which was significantly higher than that of the control group (84.00% (42/50)) ( $P < 0.05$ ). See **Table 3** for details.

### Comparison of quality of life scores between the two groups

The quality of life scores of patients in the research group were significantly better than those in the control group in physiological state, psychological function, physical state and social function ( $P < 0.05$ ). See **Figure 2** for details.

### Comparison of skin comfort between the two groups

The patients in the research group were better than the patients in the control group in terms of skin-pressed red, tenderness, burning sensation and moisture sensation ( $P < 0.05$ ). See **Table 4** for details.

### Observation of nursing satisfaction

The total satisfaction rate of nursing in the research group was 97.87% (46/47), which was significantly higher than that in the control

## Application of improving pressure ulcer in patients with stage I-II pressure ulcer

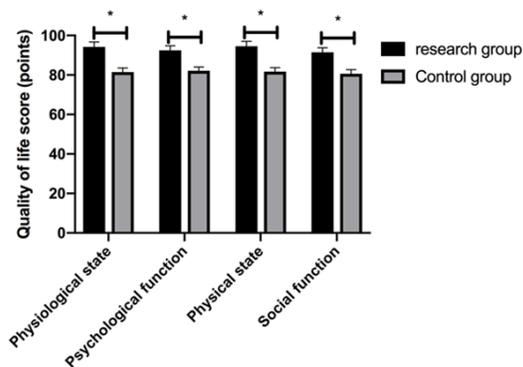
**Table 2.** Comparison of pressure sore healing time, dressing times and turnover times between two groups of patients

Group	Research group n=47	Control group n=50	t	P
Healing time of pressure ulcer (d)	8.63±4.65	15.43±6.44	5.930	<0.001
Number of dressing changes within 2 weeks (times)	5.74±1.46	15.53±1.64	30.980	<0.001
Turnover times (24 h)	7.85±1.02	11.42±1.08	16.710	<0.001

**Table 3.** Comparison of clinical efficacy between two groups of stage I-II patients [n (%)]

Group	Research group n=47	Control group n=50	$\chi^2$	P
Cured	26 (55.32)	13 (26.00)	-	-
Markedly effective	14 (29.79)	16 (32.00)	-	-
Effective	5 (10.64)	13 (26.00)	-	-
Ineffective	2 (4.26)	8 (16.00)	-	-
Total effective rate of treatment	45 (95.74)	42 (84.00)	8.000	0.005

such as pressure ulcers, skin condition and changes of patients which are not paid attention to. Individual differences and inappropriate nursing will lead to an increase in the incidence rate of pressure ulcers as the patient's condition changes [18]. Therefore, it is necessary to adopt more



**Figure 2.** Comparison of quality of life scores between the two groups. The quality of life scores of patients in the research group were significantly better than those in the control group in physiological state, psychological function, physical state and social function. Note: \* indicates  $P < 0.05$ .

group (88.00% (44/50)) ( $P < 0.05$ ). See **Table 5** for details.

### Discussion

Most hospitalized patients have long-term bed rest and long-term application of various detection methods, which may cause serious skin surface damage. The incidence rate of pressure ulcers is higher than that of non-hospitalized patients [17]. The causes of pressure ulcers are divided into patient's own factors and nursing staff factors, mainly including patient factors such as age, nutrition level and motor function, and the nursing staff factors

scientific treatment and nursing methods to prevent and detect early pressure ulcers. Traditional treatment methods are mostly regular local disinfection, keeping the wound environment dry and preventing infection. However, patients with severe pressure ulcers can have a large area of pressure ulcers. The overall recovery by this method is slow, which is not conducive to the rapid relief of patients' pain. However, the current daily care does not pay close attention to the prevention of pressure ulcers and does not form a complete rehabilitation nursing system for patients' physical recovery. Therefore, it is necessary to improve the treatment and nursing methods, adopt more scientific programs to promote the recovery of pressure ulcer wounds, cooperate with standardized nursing measures, further reduce the possibility of late recurrence, and provide more scientific treatment measures for patients. The wet healing theory is currently a new type of method for wound care, which is different from the traditional concept of maintaining dry wounds, and it has achieved good therapeutic effects in many clinical applications [19]. A large number of studies [20, 21] have shown that maintaining a moist environment of the wound surface is conducive to preventing tissue dehydration and cell death, promoting vascular regeneration and generating wound growth factors, accelerating the speed of superficial cell migration, accelerating wound healing and relieving pain of patients. Therefore,

## Application of improving pressure ulcer in patients with stage I-II pressure ulcer

**Table 4.** Comparison of skin comfort between two groups of patients [n (%)]

Group	Research group n=47	Control group n=50	X <sup>2</sup>	P
Skin-pressed red	2 (4.26)	7 (14.00)	6.105	0.014
Skin tenderness	1 (2.13)	6 (12.00)	7.680	0.006
Skin burning sensation	0	4 (8.00)	8.333	0.004
Skin moisture sensation	2 (4.26)	8 (16.00)	8.000	0.005

**Table 5.** Comparison of nursing satisfaction between two groups [n (%)]

Group	Research group n=47	Control group n=50	X <sup>2</sup>	P
Very satisfied	29 (61.70)	19 (38.00)	-	-
Satisfied	17 (36.17)	25 (50.00)	-	-
Unsatisfied	1 (2.13)	6 (12.00)	-	-
Total satisfaction rate of nursing	46 (97.87)	44 (88.00)	7.680	0.006

this study applied foam and hydrocolloid auxiliary materials to moisten the wound surface, combined with wound treatment and nursing to treat early pressure ulcers in patients, and observed the clinical treatment effects of patients under different treatment conditions.

The PUSH scores of the two groups were compared at different time points after treatment, and the results showed that the research group was better than the control group. The score of PUSH scale could reflect the dynamic changes of pressure injury and quantify it. A lower score was closely related to the better healing state of pressure injury. It can be used as an objective evaluation tool to adjust the nursing and intervention measures of pressure injuries in real time [22]. The foam dressing included foam absorbent padding and semi-permeable waterproof coating, which had excellent control effects on exudate wound treatment [23]. The hydrocolloid dressing composition material was rich in sodium carboxymethyl cellulose particles with a strong hydrophilic force, and formed a main dressing structure with elastic polymer and medical application adhesive [24]. Our results showed that the application of foam dressing and hydrocolloid dressing combined with wound treatment and nursing operation was better for the improvement of early pressure sores. In order to further confirm the curative effects of pressure ulcer treatment and nursing, our experimental observations found

that the healing time, dressing change times and turnover times of patients in the research group were less than those in the control group. The total effective rate of the research group was significantly better than that of the control group. It was shown that the clinical nursing difficulty of the combined application patients was lower than that of the control group, and the recovery effects of pressure ulcers were more accurate. In order to understand the prognosis, the quality of life of patients after nursing was observed, and it was found that the research group patients were better than the

control group. Research [25] indicated that pressure ulcer nursing staff developed a consciousness for regularly checking the skin condition of patients, scientifically managed the pressure ulcer nursing process from evaluation to application, improved the effect and quality of pressure ulcer nursing, and avoided anybody injury caused by pressure ulcers. In this experiment, all patients applied the same nursing operation, which showed that applying dressing on the basis of scientific nursing can improve the quality of life of patients. Research results on patient comfort showed that patients in the research group did significantly better than those in the control group. Hydrocolloid dressing could form hypoxia tension, accelerate blood circulation, activate the secretion and distribution of macrophages and interleukins, and strengthen the anti-infection ability of the body [26]. Similar to the conclusion of this study, foam dressings could completely block the moisture of wound surface, avoid invasion and attack of surrounding dust and microorganisms, and avoid cross infection of the wound [27]. Both of the two dressings had the effect of inhibiting infection, which could improve the sensation of skin surface burning and pain. Finally, the satisfaction degree of patients was evaluated, and it was found that the total satisfaction rate of the research group was significantly higher than that of the control group. The analysis found that the satisfaction was related to the recovery of the patient's

## Application of improving pressure ulcer in patients with stage I-II pressure ulcer

wound, the reduction of pain and the obvious improvement of comfort.

### Conclusion

The combined application of foam dressing, hydrocolloid dressing and wound treatment can improve the satisfaction in nursing, patient prognosis and pressure sore situation of patients with stage I-II pressure ulcers, improve patient comfort and satisfaction, and is suitable for improvement in clinical pressure sore treatment. However, there are still many deficiencies in this article. For example, the PUSH score involved the wound area, but the patients selected in the experiment were all stage I-II pressure ulcers. The actual usefulness of wound area detection for patients with early pressure ulcers is relatively small, which may cause the reliability of PUSH score detection to decline. In addition, the patients in the research group that we selected and included applied foam dressing, hydrocolloid dressing and wound treatment, which were three different factors, so it is difficult to judge the therapeutic effect conveniently. We will improve this research in the follow-up study in order to achieve a more accurate monitoring of the curative effects of pressure ulcer patients.

### Disclosure of conflict of interest

None.

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### References

- [1] Horvat VB and Kos M. [Pressure ulcer as the principal indicator of health care quality at neurology department]. *Acta Med Croatica* 2016; 70 Suppl 1: 17-24.
- [2] Ziraldo C, Solovyev A, Allegretti A, Krishnan S, Henzel MK, Sowa GA, Brienza D, An G, Mi Q and Vodovotz Y. A computational, tissue-realistic model of pressure ulcer formation in individuals with spinal cord injury. *PLoS Comput Biol* 2015; 11: e1004309.
- [3] Lee HJ, Ju YJ, Park EC, Kim J and Lee SG. Effects of home-visit nursing services on hospitalization in the elderly with pressure ulcers: a longitudinal study. *Eur J Public Health* 2017; 27: 822-826.
- [4] Frankel H, Sperry J and Kaplan L. Risk factors for pressure ulcer development in a best practice surgical intensive care unit. *Am Surg* 2007; 73: 1215-1217.
- [5] Jaul E, Rosenzweig JP and Meiron O. Survival rate and pressure ulcer prevalence in patients with and without dementia: a retrospective study. *J Wound Care* 2017; 26: 400-403.
- [6] Saghaleini SH, Dehghan K, Shadvar K, Sanaie S, Mahmoodpoor A and Ostadi Z. Pressure ulcer and nutrition. *Indian J Crit Care Med* 2018; 22: 283-289.
- [7] Kayser SA, Phipps L, VanGilder CA and Lachenbruch C. Examining prevalence and risk factors of incontinence-associated dermatitis using the international pressure ulcer prevalence survey. *J Wound Ostomy Continence Nurs* 2019; 46: 285-290.
- [8] Yamamoto T, Yoshimatsu H, Hayashi A and Koshima I. Parallel pocket incision: less invasive surgical intervention for the treatment of intractable pressure ulcer with wound edge undermining. *J Plast Reconstr Aesthet Surg* 2015; 68: 1432-1437.
- [9] Bergstrom N, Smout R, Horn S, Spector W, Hartz A and Limcangco MR. Stage 2 pressure ulcer healing in nursing homes. *J Am Geriatr Soc* 2008; 56: 1252-1258.
- [10] Zoellner P, Kapp H and Smola H. A prospective, open-label study to assess the clinical performance of a foam dressing in the management of chronic wounds. *Ostomy Wound Manage* 2006; 52: 34-36, 38, 40-2 passim.
- [11] Dutra RA, Salome GM, Leal LM, Alves MG, Moura JP, Silva AT, Pereira VO, de Brito MJ and Ferreira LM. Cost comparison of pressure ulcer preventive dressings: hydrocolloid dressing versus transparent polyurethane film. *J Wound Care* 2016; 25: 635-640.
- [12] Nicoll LH. A practical way to create a library in a bibliography database manager: using electronic sources to make it easy. *Comput Inform Nurs* 2003; 21: 48-54.
- [13] Zulkowski K, Ayello EA and Wexler S. Certification and education: do they affect pressure ulcer knowledge in nursing? *Adv Skin Wound Care* 2007; 20: 34-38.
- [14] Iizaka S, Sanada H, Matsui Y, Furue M, Tachibana T, Nakayama T, Sugama J, Furuta K, Tachi M, Tokunaga K, Miyachi Y; Scientific Education Committee of the Japanese Society of Pressure Ulcers. Predictive validity of weekly monitoring of wound status using DESIGN-R score change for pressure ulcer healing: a multicenter prospective cohort study. *Wound Repair Regen* 2012; 20: 473-481.
- [15] Lima-Serrano M, Gonzalez-Mendez MI, Martin-Castano C, Alonso-Araujo I and Lima-Rodriguez JS. Predictive validity and reliability of the

## Application of improving pressure ulcer in patients with stage I-II pressure ulcer

- Braden scale for risk assessment of pressure ulcers in an intensive care unit. *Med Intensiva* 2018; 42: 82-91.
- [16] Manhalter N, Bozsik G, Palasti A, Csepany E and Ertsey C. The validation of a new comprehensive headache-specific quality of life questionnaire. *Cephalalgia* 2012; 32: 668-682.
- [17] Curley MA, Quigley SM and Lin M. Pressure ulcers in pediatric intensive care: incidence and associated factors. *Pediatr Crit Care Med* 2003; 4: 284-290.
- [18] Serpa LF and Santos VL. Validity of the Braden Nutrition Subscale in predicting pressure ulcer development. *J Wound Ostomy Continence Nurs* 2014; 41: 436-443.
- [19] Eriksson E and Vranckx J. Wet wound healing: from laboratory to patients to gene therapy. *Am J Surg* 2004; 188: 36-41.
- [20] Li J, Zhang YP and Kirsner RS. Angiogenesis in wound repair: angiogenic growth factors and the extracellular matrix. *Microsc Res Tech* 2003; 60: 107-114.
- [21] Roubelakis MG, Trohatou O, Roubelakis A, Mili E, Kalaitzopoulos I, Papazoglou G, Pappa KI and Anagnou NP. Platelet-rich plasma (PRP) promotes fetal mesenchymal stem/stromal cell migration and wound healing process. *Stem Cell Rev Rep* 2014; 10: 417-428.
- [22] Saino Y, Wakabayashi H, Maeda K, Nishioka S, Hao T and Mimatsu K. Rehabilitation nutrition in pressure ulcer management with type 2 diabetes: a case report. *Asia Pac J Clin Nutr* 2018; 27: 728-734.
- [23] Barrett S. Mepilex Ag: an antimicrobial, absorbent foam dressing with Safetac technology. *Br J Nurs* 2009; 18: S28, S30-36.
- [24] Koo FP, Piletta-Zanin P, Poliitta-Sanchez S, Milingou M and Saurat JH. Allergic contact dermatitis to carboxymethylcellulose in Comfeel hydrocolloid dressing. *Contact Dermatitis* 2008; 58: 375-376.
- [25] Wilborn D, Halfens R, Dassen T and Tannen A. [Pressure ulcer prevalence in german nursing homes and hospitals: what role does the national nursing expert standard prevention of pressure ulcer play?]. *Gesundheitswesen* 2010; 72: 240-245.
- [26] Mawaki A, Nakatani T, Sugama J and Konya C. Relationship between the distribution of myofibroblasts, and stellar and circular scar formation due to the contraction of square and circular wound healing. *Anat Sci Int* 2007; 82: 147-155.
- [27] Lee SM, Park IK, Kim YS, Kim HJ, Moon H, Mueller S and Jeong YI. Physical, morphological, and wound healing properties of a polyurethane foam-film dressing. *Biomater Res* 2016; 20: 15.