

NURSING INTERVENTION UNDER STRESS SYSTEM THEORY COMBINED WITH EXTERNAL APPLICATION OF SILVER ION DRESSING ON ANTI-STRESS LEVEL AND REHABILITATION EFFECT IN SEVERE BURN PATIENTS

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ABSTRACT

It was to investigate the anti-stress level and clinical rehabilitation effect of stress system theory-based nursing combined with external silver ion dressing in the treatment of severe burns. 60 severe burn patients were selected and randomly divided into the control group and the treatment group, with 30 cases in each group. The patients in the control group were treated with routine nursing and silver sulfadiazine cream, while those in the treatment group received nursing intervention of stress system theory and externally applied silver ion dressing. The post-traumatic growth, coping behavior, social support level, stress response, clinical curative effect, incidence of toxic and side effects, prognostic indicators, and serum inflammatory factors were evaluated in the two groups. The total scores of post-traumatic growth, coping behavior, and stress response in the treatment group were significantly higher than those in the control group ($P < 0.05$). The total effective rate in the treatment group (96.66%) was also higher than that in the control group (83.33%) ($P < 0.05$). The wound healing time (21.56 ± 3.28 h) was shorter than that of the control group (29.81 ± 3.67 h) ($P < 0.05$). The stress system theory-based intervention could improve the post-traumatic growth of severe burn patients, and promote patients to adopt more active coping behaviors. It could also improve the comprehension and anti-stress response of severe burn patients on the social support level. Silver ion dressing could improve clinical curative effect and promote wound healing without notable toxic and side effects.

Keywords: Stress system theory, silver ion dressing, severe burns, curative effect.

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Introduction

Burns are one of the common injuries, and there are dozens of thousands of people who are disabled or teratogenic because of burns⁽¹⁾. Severe burn patients are prone to bloodstream infections due to skin barrier damage, compromised immune system, use of invasive devices, and multiple wound management, leading to an increased risk of death, longer hospital stays, and increased healthcare costs. Pardesi and Fuzaylov (2017)⁽²⁾ found that the incidence of anxiety, bodily pain, sleep disorders, panic, stomachache, and dyspepsia was as high as

50-94% in burn patients. Li et al. (2017)⁽³⁾ showed that depression occurred in 13-23% of patients after discharge, and post-traumatic stress disorder occurred in 13-45% of patients. Severe burns in the pathological scars inevitably, which not only affect the appearance of patients, but also cause organ and tissue dysfunction, seriously affecting the patient's quality of life, physical and mental health⁽⁴⁻⁶⁾. Stress refers to the body's adaptive response to stressful events, whether positive or negative events, will cause the corresponding bodily behaviors and psychological changes^(7,8). The stress system theory points out that psychological stress factors include

stress stimuli, stress responses, cognitive evaluations, coping behaviors, social support, and personal characteristics. When stress occurs, the process of stress response is finally determined through the mediation of these factors. The stress system theory is utilized to explain how these factors act to affect physical and mental health, and is widely adopted to guide the formulation of scientific intervention strategies and the selection of comprehensive intervention techniques⁽⁹⁾. With the stress system theory, Taborsky et al. (2021)⁽¹⁰⁾ conducted nursing intervention for severe burn patients, and achieved good rehabilitation results.

With the deepening of people's pursuit of beauty, the wound treatment asks for higher and higher requirements in treating the size and color of scars. Thus, new issues have been posed for clinical drug selection. Therefore, it is urgent to find a safer and more effective treatment method. The silver ion dressing is applied in clinical nursing, which can not only effectively prevent the contamination of physical, chemical, and mechanical factors, but also prevent repeated contamination of burn wounds. It has the characteristics of keeping the wound clean and dry, reducing body fluid loss, and promoting wound healing⁽¹¹⁻¹³⁾. As a new dressing, silver ion dressing has been widely used clinically.

But most of the reports about the use of silver ion dressings on burn wounds worldwide are the case records or personal treatment experiences of researchers, so the repeatability is not high for clinical experiments. There are few randomized controlled trials with a sufficient number of cases, so the persuasiveness is low. With the stress system theory, the silver ion dressing was applied for intervention treatment of severe burn patients in this research. It was intended to study its effect on post-traumatic growth in severe burn patients, and to provide a theoretical basis for clinical work.

Materials and methods

Research objects

60 patients with severe burns in the hospital from May 2018 to May 2021 were included. They were divided into the control group and the treatment group by random number table method, 30 cases in each. There were 16 males and 14 females in the control group, aged 32-50 years old, with an average age of (42.4±4.5) years old; and the average visiting time was (5.4±1.2) h. In the treatment group, there were 17 males and 13 females, with an age of 34-

51 years old, an average age of (41.4±5.2) years old, and the average visiting time of (5.5±1.4) h. No significant difference was found in the basic information of patients between the two groups ($P>0.05$). Patients included met the following inclusion criteria. They met the diagnostic criteria for severe burns (the burn area reached 31%-50% or the degree III burn area reached 10%-20%). They could offer the complete clinical data, and had the basic skills of reading and comprehension.

Exclusion criteria were listed as below:

- The patients were allergic to the researched drugs;
- Those were in critical condition and unable to cooperate with the research;
- Those were complicated with chronic diseases of the heart, brain, liver, kidney, and so on;
- Those suffered from a systemic infection.

Treatment methods

The wounds of all the admitted patients were cleaned with 10% iodophor solution. Chlorhexidine solution at 1:2000 was used to repeatedly rinse the wound, and the blisters were drained. Routine symptomatic and supportive treatment such as anti-tetanus and anti-shock was given.

The cases in the control group were given routine nursing and treated with silver sulfadiazine cream (Shandong Health Pharmaceutical Co., Ltd., approval number of H37022775). An appropriate amount of the cream was evenly applied to the burns with a thickness of about 2 mm, and the drug was changed once a day. Before the drug change, the drug cream the previous day should be erased off. The wound should be exposed or semi-exposed when bandaging according to the depth and location of the wound. The treatment lasted for 2 months.

In the treatment group, the cases were given the intervention of stress system theory in addition to routine nursing. They were additionally treated with external silver ion dressing (Anson Bio-Technology Co., Ltd., with the national instrument approval number of 20163640191). The wound was bandaged with multiple layers of sterile gauze, the dressing was changed once a day, and the treatment lasted for 2 months.

Stress system theory

Stressor intensity perception consisted of continuous health education and relaxation therapy. Continuous health education was conducted including admission education, burn-related knowledge

education, psychological care, dietary guidance, and rehabilitation training guidance. The relaxation therapy was mainly to teach patients abdominal breathing, muscle relaxation, and other methods, supplemented by music therapy to divert their high attention to the disease itself. The intervention of coping behavior included individual psychological counseling and group treatment intervention. Individual psychological counseling asked to fully communicate with each patient, patiently listen to their feelings, and collect, evaluate, and analyze the reasons for their negative responses through detailed data. Group treatment intervention was to organize patients exchange meetings, so as to make patients discuss with each other, exchange experience, and relieve negative coping methods after they passed the shock period smoothly. Strengthening social support system required for emotional interventions, training of family members for the spiritual sustenance and emotional support.

Cognitive psychological intervention was a short-term psychotherapy to eliminate bad emotions and behaviors. It was implemented to change bad cognition by changing thinking and behaviors.

Observation indicators and evaluation criteria

Before and after intervention, a variety of indicators of patients in the two groups were evaluated. These indicators included the post-traumatic growth, coping behavior, social support, stress response, clinical curative effect, incidence of toxic and side effects, prognostic indicators, and serum inflammatory factors before and after treatment. The post-traumatic growth level was evaluated using the Post-traumatic Growth Inventory⁽¹⁴⁾, with a Cronbach's α coefficient of 0.874. There were 20 items in 5 dimensions, including relationships with others, new possibilities, mental changes, personal ability, and appreciation for life. The total score ranged from 0 to 105, with the higher score indicating the more growth.

Coping behaviors were evaluated with the Coping Behavior Inventory⁽¹⁵⁾, which included three coping strategies of facing, avoiding, and yielding. The Cronbach's α coefficient of this scale was 0.85. With 20 items in total, each item was scored on a degree of 1 to 4. The higher the score, the more likely the patient was to adopt this coping behavior. The Multidimensional Scale of Perceived Social Support⁽¹⁶⁾ was adopted to evaluate the social support level of patients. The Cronbach's α was 0.92, and 12 items were contained in this scale. The scale was

scored with the Likert 7-degree scoring method, ranging from strongly disagree to strongly agree with 17 points in order for each item. With a total score of 1,284 points, the higher the score, the higher the level of individual social support.

The level of stress response was compared using the symptom checklist⁽¹⁷⁾, as somatization, forcing, interpersonal sensitivity, depression, anxiety, hostility, terror, bigotry, and psychosis were included. The total Cronbach's α coefficient of the scale was 0.90, with 90 items. The severity of each symptom was scored on a five-degree scoring from 1 to 5 points. The higher the score, the lower the level of stress response. Evaluation criteria for clinical curative effect were described as follows. If the patient was cured, the wound healed completely. It was effective as the wound healing area $>1/3$. It was ineffective with no change in wound surface or wound healing area $\leq 1/3$. The total effective rate was calculated as equation (1).

$$\text{Total effective rate} = \text{cured rate} + \text{effective rate} \quad (1)$$

The toxic and side effects were counted including abnormal carcinoembryonic antigen (CEA), abnormal alpha-fetoprotein (AFP), abnormal renal function, and abnormal liver function. Prognostic indicators were composed of wound healing time and the positive rate of bacterial culture of the wound. For the detection of serum inflammatory factors before and after treatment, 3 mL of fasting venous blood was collected in the morning, and then centrifuged to collect serum. The interleukin- 1β (IL- 1β) and tumor necrosis factor- α (TNF- α) in serum were detected by enzyme-linked immunosorbent assay.

Statistical methods

An Excel database was built with all the data, which were then analyzed by SPSS 19.0 statistical software. Measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$). Enumeration data were analyzed using χ^2 test and were expressed as percentage (%). The difference was considered of statistical significance at $P < 0.05$.

Results

Effects on post-traumatic growth in severe burn patients

Before the intervention treatment, there was no statistical difference in the scores and total scores of

post-traumatic growth level between the two groups ($P>0.05$). The scores and total scores of interpersonal relationships, new possibilities, and appreciation of life in the treatment group were obviously higher than those in the control group with statistical differences ($P<0.05$).

The scores and total scores of various dimensions of post-traumatic growth after the intervention were greatly higher than those before the intervention in both groups, showing the statistical differences ($P<0.05$). The details were listed Table 1.

Post-traumatic growth	Control group (n=30)		t	P	Treatment group (n=30)		t	P
	Before intervention	After intervention			Before intervention	After intervention		
Total score	36.67±4.78	45.56±12.26*	5.83	<0.05	37.56±5.27	56.27±8.17**	1.29	<0.05
Interpersonal relationship	10.56±3.14	12.62±5.18*	2.91	<0.05	11.34±3.71	16.27±4.28**	1.31	<0.05
New probability	3.27±1.67	6.52±2.76*	3.81	<0.05	3.54±1.89	9.28±3.18**	0.89	<0.05
Personal ability	11.67±2.87	13.27±4.28*	2.18	<0.05	12.36±3.83	14.47±3.14*	0.56	<0.05
Mental changes	3.56±1.68	4.27±1.28*	6.27	<0.05	3.65±1.59	4.18±2.19*	0.61	<0.05
Appreciation of life	7.81±2.76	8.27±2.78*	5.48	<0.05	7.61±2.61	11.25±3.18**	1.28	<0.05

Table 1: Comparison of post-traumatic growth between the two groups before and after intervention ($\bar{x}\pm s$, points).

Note: * and # indicated that the statistical differences compared to corresponding data before intervention and in the control group, respectively, $P<0.05$.

Effect on coping behavior in severe burn patients

Before the nursing intervention treatment, no statistical difference was discovered between the treatment group and the control group in the three coping behaviors of facing, avoiding, and yielding ($P>0.05$). After the intervention, there were statistical differences in the treatment group compared with those before treatment ($P<0.05$).

For the patients in the control group, the statistical differences were shown in the scores of facing and avoiding ($P<0.05$), but no statistical difference in yielding ($P>0.05$). The score of facing in the treatment group were markedly lower than that in the control group, showing a statistical difference ($P<0.05$). The scores of avoiding and yielding in the treatment group were greatly higher than those in the control group, going with the statistical differences as well ($P<0.05$). More detailed analysis was displayed in Figure 1.

Effect on social support level in severe burn patients

Before the intervention, the social support level showed no statistical difference between the control group and the treatment group ($P>0.05$). The scores after intervention were significantly higher than those before the intervention in both groups,

and the differences were thought to be statistically significant ($P<0.05$). As shown in Figure 2, the score of the treatment group was much higher than that of the control group after the intervention, with a statistical difference ($P<0.05$).

Effect on stress response in severe burn patients

Before intervention, the scores of stress response showed no significant difference between the two groups ($P>0.05$). in the control group,

there were significant differences in the scores of depression, hostility, and psychosis before and after the intervention ($P<0.05$). The significant differences were also found in the total score and the scores of somatization, depression, hostility, and psychosis in the treatment group ($P<0.05$) before and after intervention, whose differences were also of statistical significance.

After the intervention treatment, the scores of somatization, interpersonal sensitivity, depression, and anxiety in the treatment group were higher than those in the control group, which went with the statistical differences ($P<0.05$). As the total score reflected the severity of diseases, that of the treatment group was notably lower than that of the control group ($P<0.05$); there was a statistical difference as presented in Figure 3.

Comparison of clinical curative effect

In the control group, 16 cases (53.33%) were cured, and 9 cases (30.00%) gained effective effect. In the treatment group, 27 cases (90.00%) were cured, while 2 cases (6.66%) were treated with effective effect. As could be observed in Table 2, the total effective rate in the treatment group (96.66%) was higher than that in the control group (83.33%), going with a statistical difference ($P<0.05$).

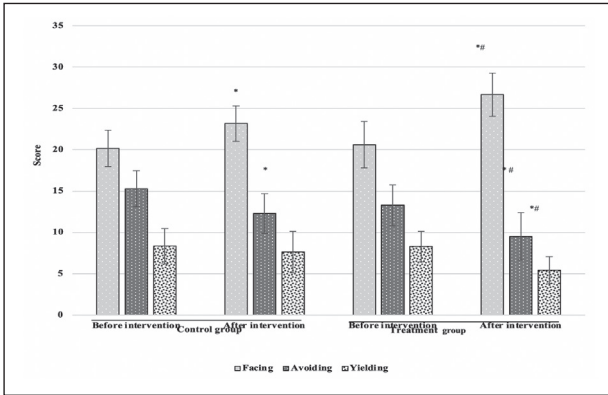


Figure 1: Comparison of coping behaviors between the two groups before and after the nursing intervention. Note: * and # indicated that there was a statistical difference between before intervention and the control group, $P < 0.05$.

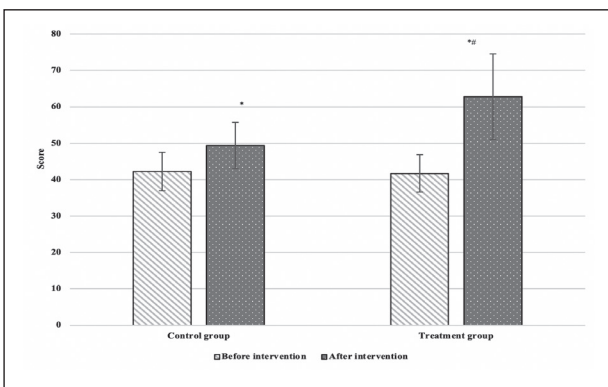


Figure 2: Comparison of social support levels between the two groups before and after intervention. Note: * indicated the statistical differences compared with the scores before intervention, while # indicated the difference statistically compared with the control group, $P < 0.05$.

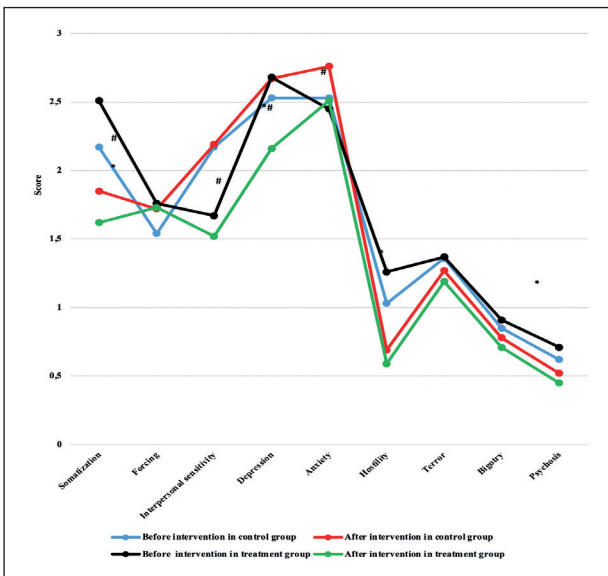


Figure 3: Comparison of stress response levels before and after intervention. Note: Both * and # indicated that the statistical differences, which were compared with those before intervention and the control group, respectively, $P < 0.05$.

Groups	Number of cases	Cured	Effective	Ineffective	Total effective rate
Control group	30	16 (53.33)	9 (30.00)	5 (16.66)	25 (83.33)
Treatment group	30	27 (90.00)	2 (6.66)	1 (3.33)	29 (96.66)*
χ^2					5.621
P					0.018

Table 2: Comparison of clinical curative effect (n, %). Note: * marked the statistical difference compared with the data of the control group, $P < 0.05$.

Before treatment, there was no statistical difference in the levels of IL-1 β and TNF- α between the two groups ($P > 0.05$).

The levels of IL-1 β and TNF- α after intervention were lower than those before intervention treatment ($P < 0.05$) in both groups. Moreover, those of the treatment group were lower than those of the control group ($P < 0.05$) after intervention, which was represented in Figure 4.

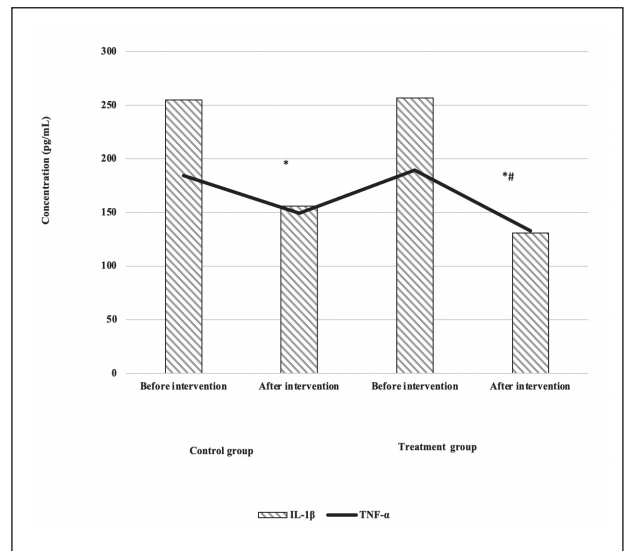


Figure 4: Comparison of serum inflammatory factors between the two groups. Note: * and # indicated that there was a statistical difference compared with that before intervention and that in the control group, $P < 0.05$.

Comparison of prognostic indicators between the two groups

The positive rate of bacterial culture of the wound in the treatment group (6.66%) was lower than that in the control group (20.00%), with a statistical difference ($P < 0.05$).

The wound healing time (21.56 ± 3.28 h) of the treatment group was also shorter than that in the control group (29.81 ± 3.67 h), having a statistical difference as well ($P < 0.05$). These results are presented in Figure 5.

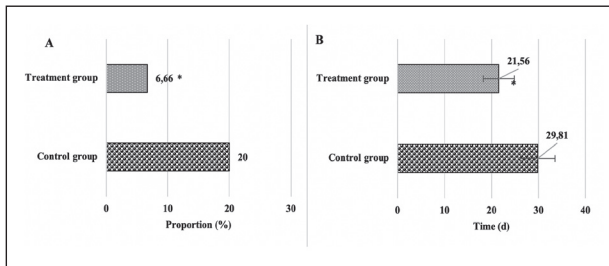


Figure 5: Comparison of prognostic indicators between the two groups. A: The positive rate of bacterial culture of the wound; B: The healing time of the wound.

Note: * marked the statistical differences compared with the corresponding indicators of the control group, $P < 0.05$.

Comparison of the incidence of toxic and side effects between the two groups

No significant difference was observed in the abnormal rates of CEA, AFP, renal function, and liver function between the two groups ($P > 0.05$) (Figure 6).

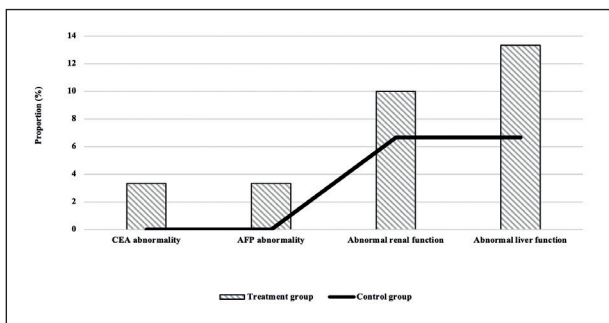


Figure 6: The incidence comparison of toxic and side effects between the two groups.

Discussion

Burns are common traumas in daily life. According to statistics, the incidence of burns is 2% in China. Burns not only make patients suffer physical and psychological blows, but also greatly increase the pressure on patients and their families from various aspects⁽¹⁸⁾. With the stress system theory, the targeted nursing intervention was given to those burn patients who needed help physically and psychologically. It could improve the post-traumatic growth level of severe burn patients effectively, and also improve their quality of life.

The stress system theory is made up of stressors, stress responses, cognitive evaluations, and coping behaviors. Many factors such as social support and personality characteristics play a mediating role, emphasizing the individual patient's initiative in stressful events⁽¹⁹⁾. The total score of post-traumatic growth in the treatment group in this research increased from (37.56 ± 5.27) before intervention

to (56.27 ± 8.17) after intervention. The scores of interpersonal relationships, new possibilities, and appreciation of life were greatly promoted with statistical differences ($P < 0.05$). This suggested that the stress system theory could improve the level of post-traumatic growth in severe burn patients, so that patients could experience a higher level of post-traumatic growth. Compared with the control group, the treatment group under the stress system theory intervention showed the significant advantages. After the intervention, the total score of post-traumatic growth in the control group (45.56 ± 12.26) was significantly lower than that in the treatment group (56.27 ± 8.17) . It was proved that the stress system theory could promote the post-traumatic growth of patients and prompt patients to produce positive psychological changes compared with traditional routine nursing, thereby improving the quality of life of patients. In terms of interpersonal relationships, patients suffered physical and psychological blows after major trauma. They needed care from relatives and friends urgently, and deeply recognized the importance of people around them. Therefore, patients in both groups experienced the growth of interpersonal relationship, which was consistent with the findings of Schneider et al. (2020)⁽²⁰⁾.

It was found that the coping behavior scores of patients in the two groups changed before and after the intervention. After intervention, the total score of coping behaviors in the treatment group was higher than that of the control group. The scores of avoiding and yielding highly decreased and lower than those of the control group, suggesting the statistical differences ($P < 0.05$). This showed that compared with the control group, the patients in the treatment group could take a positive way to debug their thoughts, psychology, and life, so that they could change to positive behaviors continuously and improve their comprehensive health level. Holt et al. (2021)⁽²¹⁾ believed that coping behaviors were relatively stable, and also had certain variability in different environmental backgrounds, which was similar to the results of this research.

In recent years, nano silver ion dressings have been gradually applied in clinical practice, but there are few reports on their safety clinically⁽²²⁻²⁴⁾. The silver ion dressing is to attach nanosilver to the medical degreased gauze, contact the wound through external application, and release nano silver ions continuously to kill invading bacteria. It can control pathogens, reduce infection rate, give full play to the effects of pain relief and anti-

inflammatory, and accelerate wound healing^(25, 26). The results proved that the total effective rate of the treatment group was 96.66%, higher than that of the control group (83.33%). The positive rate of bacterial culture on the wound surface (6.66%) was lower than that of the control group (20.00%). The wound healing time (21.56 ± 3.28 h) was also shorter than that of the control group (29.81 ± 3.67 h), all of which showed the statistical differences ($P < 0.05$). Thus, the external application of silver ion dressing, as an adjuvant therapy, could improve the curative effect, promote wound healing, reduce toxic and side effects, and ensure safety.

For the rich silver ions in the silver ion dressing are a type of heavy metal, it may cause toxic and side effects if it comes into contact with the human body. Therefore, the toxic and side effects were statistically analyzed in this research. As a result, there was no statistical difference in the abnormal rates of CEA, AFP, renal function, and liver function between the two groups ($P > 0.05$). This suggested that the external application of silver ion dressing did not produce obvious toxic and side effects, and the safety was guaranteed.

Conclusion

As 60 severe burn patients were randomly divided into the treatment group and the control group, this research was aimed to explore the rehabilitation effect and safety of nursing intervention under stress system theory combined with external application of silver ion dressing in severe burn patients. The intervention of stress system theory could improve the post-traumatic growth level of severe burn patients, and promote patients to adopt more active coping behaviors. It could also improve the comprehension ability and anti-stress response of severe burn patients on the social support. External silver ion dressing treatment could promote the clinical curative effect as well as wound healing without obvious toxic and side effects.

There were certain deficiencies in this research. Due to the limitation of research time, the long-term follow-up of patients was required in the later stage to further verify the long-term curative effect. It was believed that this work could provide some ideas and experimental support for the diagnosis and treatment of severe burn patients.

References

- 1) Moreira E, Burghi G, Manzanares W. Update on metabolism and nutrition therapy in critically ill burn patients. *Med Intensiva (Engl Ed)*. 2018 Jun-Jul; 42(5): 306-316. English, Spanish. DOI: 10.1016/j.medint.2017.07.007. Epub 2017 Sep 23. PMID: 28951113.
- 2) Pardesi O, Fuzaylov G. Pain Management in Pediatric Burn Patients: Review of Recent Literature and Future Directions. *J Burn Care Res*. 2017 Nov/Dec; 38(6): 335-347. DOI: 10.1097/BCR.0000000000000470. PMID: 27893572.
- 3) Li J, Zhou L, Wang Y. The effects of music intervention on burn patients during treatment procedures: a systematic review and meta-analysis of randomized controlled trials. *BMC Complement Altern Med*. 2017 Mar 17; 17(1): 158. DOI: 10.1186/s12906-017-1669-4. PMID: 28302117; PMCID: PMC5356403.
- 4) DeSpain K, Rosenfeld CR, Huebinger R, Wang X, Jay JW, Radhakrishnan RS, Wolf SE, Song J. Carotid smooth muscle contractility changes after severe burn. *Sci Rep*. 2021 Sep 10; 11(1): 18094. DOI: 10.1038/s41598-021-97732-3. PMID: 34508162; PMCID: PMC8433376.
- 5) Ogunbileje JO, Herndon DN, Murton AJ, Porter C. The Role of Mitochondrial Stress in Muscle Wasting Following Severe Burn Trauma. *J Burn Care Res*. 2018 Jan 1; 39(1): 100-108. DOI: 10.1097/BCR.0000000000000553. PMID: 28448295; PMCID: PMC5650955.
- 6) Folkestad T, Brurberg KG, Nordhaus KM, Tveiten CK, Guttormsen AB, Os I, Beitland S. Acute kidney injury in burn patients admitted to the intensive care unit: a systematic review and meta-analysis. *Crit Care*. 2020 Jan 2; 24(1): 2. DOI: 10.1186/s13054-019-2710-4. PMID: 31898523; PMCID: PMC6941386.
- 7) Etching AG, Fonda JR, McGlinchey RE, Howard EP. Toward a System Theory of Stress, Resilience, and Reintegration. *ANS Adv Nurs Sci*. 2020 Jan/Mar; 43(1): 75-85. doi: 10.1097/ANS.0000000000000277. PMID: 31299688.
- [8] Kolacz J, Kovacic KK, Porges SW. Traumatic stress and the autonomic brain-gut connection in development: Polyvagal Theory as an integrative framework for psychosocial and gastrointestinal pathology. *Dev Psychobiol*. 2019 Jul; 61(5): 796-809. DOI: 10.1002/dev.21852. Epub 2019 Apr 5. PMID: 30953358.
- 9) Grahm P, Ottosson J, Uvnäs-Moberg K. The Oxytocinergic System as a Mediator of Anti-stress and Restorative Effects Induced by Nature: The Calm and Connection Theory. *Front Psychol*. 2021 Jul 5; 12: 617814. DOI: 10.3389/fpsyg.2021.617814. PMID: 34290636; PMCID: PMC8286993.
- 10) Taborsky B, English S, Fawcett TW, Kuijper B, Leimar O, McNamara JM, Ruuskanen S, Sandi C. Towards an Evolutionary Theory of Stress Responses. *Trends Ecol Evol*. 2021 Jan; 36(1): 39-48. doi: 10.1016/j.tree.2020.09.003. Epub 2020 Oct 5. PMID: 33032863.
- 11) Aurora A, Beasy A, Rizzo JA, Chung KK. The Use of a Silver-Nylon Dressing During Evacuation of Military Burn Casualties. *J Burn Care Res*. 2018 Jun 13; 39(4): 593-597. doi: 10.1093/jbcr/irx026. PMID: 29901799.

- 12) Iljas JD, Röhl J, McGovern JA, Moromizato KH, Parker TJ, Cuttle L. A human skin equivalent burn model to study the effect of a nanocrystalline silver dressing on wound healing. *Burns*. 2021 Mar; 47(2): 417-429. DOI: 10.1016/j.burns.2020.07.007. Epub 2020 Jul 15. PMID: 32830005.
- 13) Nischwitz SP, Luze H, Popp D, Winter R, Draschl A, Schellnegger M, Kargl L, Rappl T, Giretzlehner M, Kamolz LP. Global burn care and the ideal burn dressing reloaded - A survey of global experts. *Burns*. 2021 Nov; 47(7): 1665-1674. DOI: 10.1016/j.burns.2021.02.008. Epub 2021 Feb 23. PMID: 33838957.
- 14) Hu R, Wang X, Liu Z, Hou J, Liu Y, Tu J, Jia M, Liu Y, Zhou H. Stigma, depression, and post-traumatic growth among Chinese stroke survivors: A longitudinal study examining patterns and correlations. *Top Stroke Rehabil*. 2022 Jan; 29(1): 16-29. DOI: 10.1080/10749357.2020.1864965. Epub 2020 Dec 28. PMID: 33371827.
- 15) Karaca A, Yildirim N, Cangur S, Acikgoz F, Akkus D. Relationship between mental health of nursing students and coping, self-esteem and social support. *Nurse Educ Today*. 2019 May; 76: 44-50. doi: 10.1016/j.nedt.2019.01.029. Epub 2019 Feb 6. PMID: 30769177.
- 16) Pérez-Villalobos C, Briede-Westermeyer JC, Schilling-Norman MJ, Contreras-Espinoza S. Multidimensional scale of perceived social support: evidence of validity and reliability in a Chilean adaptation for older adults. *BMC Geriatr*. 2021 Aug 11; 21(1): 461. DOI: 10.1186/s12877-021-02404-6. PMID: 34380422; PMCID: PMC8359117.
- 17) Timman R, Arrindell WA. A very short Symptom Checklist-90-R version for routine outcome monitoring in psychotherapy; The SCL-3/7. *Acta Psychiatr Scand*. 2022 Apr; 145(4): 397-411. DOI: 10.1111/acps.13396. Epub 2022 Feb 8. PMID: 35075633.
- 18) Ghasemifard H, Behnam H, Tavakkoli J. High-Intensity Focused Ultrasound Lesion Detection Using Adaptive Compressive Sensing Based on Empirical Mode Decomposition. *J Med Signals Sens*. 2019 Jan-Mar; 9(1): 24-32. DOI: 10.4103/jmss.JMSS_17_18. PMID: 30967987; PMCID: PMC6419567.
- 19) Ara SR, Bashar SK, Alam F, Hasan MK. EMD-DWT based transform domain feature reduction approach for quantitative multi-class classification of breast lesions. *Ultrasonics*. 2017 Sep; 80: 22-33. doi: 10.1016/j.ultras.2017.04.006. Epub 2017 Apr 24. PMID: 28499122.
- 20) Schneider JC, Shie VL, Espinoza LF, Shapiro GD, Lee A, Acton A, Marino M, Jette A, Kazis LE, Ryan CM; LIBRE Advisory Board. Impact of Work-Related Burn Injury on Social Reintegration Outcomes: A Life Impact Burn Recovery Evaluation (LIBRE) Study. *Arch Phys Med Rehabil*. 2020 Jan; 101(1S): S86-S91. doi: 10.1016/j.apmr.2017.10.022. Epub 2017 Nov 26. PMID: 29183751.
- 21) Holt R, Kornhaber R, Kwiet J, Rogers V, Shaw J, Law J, Proctor MT, Vandervord J, Streimer J, Visentin D, Cleary M, McLean L. Insecure adult attachment style is associated with elevated psychological symptoms in early adjustment to severe burn: A cross-sectional study. *Burns*. 2019 Sep; 45(6): 1359-1366. DOI: 10.1016/j.burns.2019.03.011. Epub 2019 Jun 1. PMID: 31160134.
- 22) Yang J, Huang Y, Dai J, Shi X, Zheng Y. A sandwich structure composite wound dressing with firmly anchored silver nanoparticles for severe burn wound healing in a porcine model. *Regen Biomater*. 2021 Aug 3; 8(4): rbab037. DOI: 10.1093/RB/rbab037. PMID: 34350029; PMCID: PMC8329475.
- 23) Gee Kee E, Stockton K, Kimble RM, Cuttle L, McPhail SM. Cost-effectiveness of silver dressings for paediatric partial thickness burns: An economic evaluation from a randomized controlled trial. *Burns*. 2017 Jun; 43(4): 724-732. DOI: 10.1016/j.burns.2016.09.018. Epub 2017 Apr 10. PMID: 28408145.
- 24) Do TB, Nguyen TN, Ho MH, Nguyen NT, Do TM, Vo DT, Hua HT, Phan TB, Tran PA, Nguyen HT, Vo TV, Nguyen TH. The Efficacy of Silver-Based Electrospun Antimicrobial Dressing in Accelerating the Regeneration of Partial Thickness Burn Wounds Using a Porcine Model. *Polymers (Basel)*. 2021 Sep 15; 13(18): 3116. DOI: 10.3390/polym13183116. PMID: 34578017; PMCID: PMC8469778.
- 25) El-Aassar MR, Ibrahim OM, Fouda MMG, Fakhry H, Ajarem J, Maodaa SN, Allam AA, Hafez EE. Wound dressing of chitosan-based-crosslinked gelatin/polyvinyl pyrrolidone embedded silver nanoparticles, for targeting multidrug resistance microbes. *Carbohydr Polym*. 2021 Mar 1; 255: 117484. doi: 10.1016/j.carbpol.2020.117484. Epub 2020 Dec 5. PMID: 33436244.
- 26) Bairagi A, Griffin B, Tyack Z, Vagenas D, McPhail SM, Kimble R. Comparative effectiveness of Biobrane®, RECELL® Autologous skin Cell suspension and Silver dressings in partial thickness paediatric burns: BRACS randomised trial protocol. *Burns Trauma*. 2019 Oct 31; 7: 33. DOI: 10.1186/s41038-019-0165-0. PMID: 31696127; PMCID: PMC6822367.

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