ESTIMA
Brazilian Journal of Enterostomal Therapy

REVIEW ARTICLE
https://doi.org/10.30886/estima.v22.1415

The effectiveness of negative pressure wound therapy in burns: scoping review

Pâmela Costa Pinto dos Santos[1], Bruna Maiara Ferreira Barreto Pires[2], Ellen Marcia Peres[3], Ronilson Gonçalves Rocha[3], Vitor Gomes de Matos Gomes[1], Helena Ferraz Gomes[3], Lívia Fajin de Mello[3], Rafael Pires Silva[3], Norma Valéria Dantas de Oliveira Souza[3], Priscila Cristina da Silva Thiengo de Andrade[3], Carolina Cabral Pereira da Costa[3,*]

ABSTRACT

Objective: To map the scientific production regarding the use of negative pressure wound therapy in burn treatment of hospitalized adult and aged patients. **Method:** Scope review following the JBI method with a search for scientific production in PubMed, the Scientific Electronic Library Online, the Virtual Health Library, and the Thesis Database of the Coordination for the Improvement of Higher Education Personnel from March to May 2021. Studies with adult and aged burn patients undergoing negative pressure wound therapy in hospitals were included. There was no language or time frame restriction. **Results:** 106 publications were identified and 5 studies made up the final sample after the selection process. The results demonstrated that applying negative pressure wound therapy to burns was effective in healing thermal, chemical, and electrical burns, esoecially regarding healing time optimization, healthy granulation tissue formation, edema and infection reduction, and edema drainage and monitoring. **Conclusion:** Burn treatment using negative pressure has proven effective, given the benefits it promotes in the healing process. The theme should be more widely spread to deepen the knowledge about the use of this technology.

DESCRIPTORS: Burns. Negative-pressure wound therapy. Nursing care. Enterostomal therapy.

A efetividade da terapia por pressão negativa em queimaduras: revisão de escopo

RESUMO

Objetivo: Mapear a produção científica a respeito do uso da terapia de pressão negativa no tratamento de queimaduras, em pacientes adultos e idosos hospitalizados. **Método:** Revisão de escopo seguindo o método da JBI com busca da produção científica na PubMed, *Scientific Electronic Library Online*, Biblioteca Virtual de Saúde e Banco de Teses da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior nos meses de março a maio de 2021. Foram incluídos estudos com pacientes adultos e idosos com queimaduras, submetidos à terapia por pressão negativa no hospital. Não houve restrição de idioma, nem período de tempo. **Resultados:** Foram identificadas 106 publicações e, após o processo de seleção, cinco estudos compuseram a amostra final. Os resultados demonstraram que a aplicação da terapia por pressão negativa em queimaduras constituiu-se

[1]Bombeiro Militar do Estado do Rio de Janeiro – Rio de Janeiro (RJ), Brasil.
[2]Universidade Federal Fluminense – Rio de Janeiro (RJ), Brasil.
[3]Universidade do Estado do Rio de Janeiro – Rio de Janeiro (RJ), Brasil.
*Correspondence author: carolcuerj@hotmail.com

Section Editor: Manuela de Mendonça F. Coelho
Received: Mar. 15, 2023 / Accepted: Feb. 15, 2024.
How to cite: Santos PCP, Costa CCP, Pires BMFB, Peres EM, Rocha RG, Gomes VGM, et al. The effectiveness of negative pressure therapy in burns: scope review. ESTIMA, Braz J Enterostomal Ther. 2024;22:e1415. https://doi.org/10.30886/estima.v22.1415_IN

como uma ferramenta efetiva na cicatrização de queimaduras térmicas, químicas e elétricas, destacando-se a otimização do tempo de cicatrização, formação de um tecido de granulação saudável, diminuição do edema, redução da infecção, drenagem e monitorização do edema. **Conclusão:** O tratamento de queimaduras utilizando a pressão negativa tem se mostrado um método efetivo, visto os benefícios que promove no processo cicatricial. Sugere-se que a temática seja mais difundida, aprofundando-se o conhecimento sobre o uso desta tecnologia.

DESCRITORES: Queimaduras. Tratamento de ferimentos com pressão negativa. Cuidados de enfermagem. Estomaterapia.

La efectividad de la terapia de presión negativa en quemaduras: revisión del alcance

RESUMEN

Objetivo: Mapear la producción científica sobre el uso de la terapia de presión negativa en el tratamiento de quemaduras en pacientes adultos y ancianos hospitalizados. **Método:** Revisión de alcance siguiendo el método JBI con búsqueda de producción científica en PubMed, Biblioteca Científica Electrónica en Línea, Biblioteca Virtual en Salud y Banco de Tesis de la Coordinación para el Perfeccionamiento del Personal de Educación Superior en los meses de marzo a mayo de 2021. Se incluyeron estudios con adultos y pacientes ancianos quemados sometidos a terapia de presión negativa en el hospital. No hubo restricción de idioma ni período de tiempo. **Resultados:** Se identificaron 106 publicaciones y luego del proceso de selección, 5 estudios conformaron la muestra final. Los resultados demostraron que la aplicación de la terapia de presión negativa en quemaduras constituyó una herramienta eficaz en la curación de quemaduras térmicas, químicas y eléctricas, destacándose la optimización del tiempo de curación, formación de tejido de granulación sano, reducción de edema, reducción de infección, drenaje y seguimiento del edema. **Conclusión:** El tratamiento de quemaduras mediante presión negativa ha demostrado ser un método efectivo, dados los beneficios que promueve en el proceso de cicatrización. Se sugiere que el tema sea más difundido, profundizando el conocimiento sobre el uso de esta tecnología.

DESCRIPTORES: Quemaduras. Terapia de presión negativa para heridas. Cuidados de enfermeria. Estomaterapia.

INTRODUCTION

Burns are traumatic injuries that compromise the integrity and function of the skin and can reach deep layers. They are caused by thermal, chemical, electrical, or radioactive agents. They are characterized by acute and chronic debilitating conditions, accompanied by intense and prolonged pain, causing distress to the patient and their family[1].

Burns are a public health issue, accounting for an estimated 180,000 deaths per year, especially in low-income countries and in African and Asian regions[2]. In Brazil, about one million people are victims of burns per year, of which 10% seek hospital care and 2.5% die[3].

Burns are classified according to the degree of tissue impairment and thickness. First-degree burns are those that involve the epidermis, characterized by hyperemia and local pain. The second-degree ones, on the other hand, can be classified into superficial and deep. The superficial injuries reach the epidermis and dermis, with the presence of hyperemia, pain, and blisters; the deep ones reach the reticular dermis, are quite painful, and there is scarring. The third-degree ones, in addition to the aforementioned tissues, reach the subcutaneous tissue and are commonly associated with local infection. Fourt -degree burns involve bones, tendons, and muscles. As the nerve endings are destroyed, these injuries do not cause pain[4,5].

Burn injury extension is based on the body surface area affected. The fastest method to calculate the burn area in adults is the Rule of Nines, in which the head, upper limbs, chest, and abdomen represent 9% each, while lower limbs and genital region represent 18% and 1%, respectively[6].

Burn injuries are complex because of the difficulty in managing pain and the high risk of infection. An important strategy for its treatment is to use the negative pressure wound therapy (NPWT), which emerged in 1994 as an adjuvant therapy in healing wounds through a sub-atmospheric pressure applied directly to the wound bed. The purpose is to act in tissue repair to achieve total secondary intention healing or to prepare the wound bed to receive definitive coverage through tissue reconstruction, such as flaps and grafts[7].

Negative pressure is applied to the wound through a dressing of cotton gauze or polyurethane foam that fully covers the wound area. The interface is then covered with a transparent film, which is an airtight seal isolating it from the external environment. This system is coupled to a suction device and a fluid reservoir, which are connected to an electronically powered device to provide local and standardized pressure to the injury. Pressure can be applied continuously or intermittently, in the hospital or at home, and may be associated with fluid instillation to clean and treat infected wounds[7].

NPWT is recommended in lesions with low response to conventional treatment, as well as in complex wounds of various etiologies and thatshow a slow healing time[8]. NPWT is mainly indicated for pressure injuries, and traumatic and surgical injuries with dehiscence, grafts, and burns. In this sense, this study is justified by the applicability of this technology in complex and difficult-to-manage injuries, such as burns[7].

It is noteworthy that nurses evaluate and prescribe dressings and fluids indicated for each type of injury[9]. Wound Care nursing is a specialty within nursing, recognized by the Brazilian Federal Council of Nursing (COFEN), as per Resolution 581/2018[10]. According to Resolution 567 of January 29, 2018, the nurse is responsible for "participating in the evaluation, preparation of protocols, selection, and suggestion of new technologies in the prevention and treatment of people with wounds"[11].

Thus, as it is possible to use NPWT in burns, it is understandable that more studies addressing the topic are necessary. We hope that this research will broaden the discussions on the effectiveness of NPWT and that the findings will favor the nurses's clinical decision-making in burn treatment, by using scientific knowledge as a guide for practice.

From March to June 2021, preliminary research was conducted to map the existence of scope reviews on the topic in the public databases *Medical Literature Analysis and Retrieval System Online* (PubMed/MEDLINE), *Scientific Electronic Library Online* (SciELO) and Virtual Health Library (VHL), and no current or ongoing scope reviews on the topic discussed here were identified.

OBJECTIVES

This article is aimed at mapping the scientific production regarding the use of negative pressure wound therapy in burn treatment of hospitalized adult and aged patients

METHODS

This is a scope review, according to the method proposed by the Joanna Briggs Institute (JBI). This method examines broader areas to identify knowledge gaps and clarify key concepts and types of evidence that address the practice of a given topic[12]. The protocol was registered in the Open Science Framework (OSF), obtaining the registration code https://osf.io/ug3ev/.

To set up a search strategy and find studies, the descriptors indexed in the Health Science Descriptors (DeCS) and Medical Subject Headings (MeSH) were used with Boolean operators (AND, OR and NOT) (Chart 1).

From March to May 2021, a researcher with experience in searching databases searched for scientific production in journals indexed in the PubMed, SciELO, and VHL databases. These databases were selected because they are comprehensive, with wide coverage of publications in the health area.

The search for gray Literature was performed in the Thesis Database of the Coordination for the Improvement of Higher Education Personnel (CAPES). It is important to note that no time frame or language restriction was established in the search, as per recommendations of the JBI.

Chart 1. Scope review search strategy. Rio de Janeiro (RJ), 2021.

Database	Strategy
VHL	(terapia por pressão negativa OR negative-pressure wound therapy OR terapia de presíon negativa para heridas) AND (queimaduras OR burns OR quemaduras) AND (db:("IBECS" OR "LILACS")
PubMed	("Negative-Pressure Wound Therapy"[Mesh]) AND "Burns"[Mesh])
SciELO	(negative-pressure wound therapy) AND (burns)
Capes Thesis Database	"Terapia por pressão negativa" AND "queimaduras"

Source: Prepared by the authors, 2021.

Thus, the research question was: What is the effect of negative pressure wound therapy in treating burns in hospitalized adults and aged people?

This review considered studies that included adult and aged patients with burns who underwent negative pressure wound therapy.

Studies that explored the use of negative pressure wound therapy in burn healing were considered.

Studies in which interventions occurred in the hospital environment were analyzed.

Experimental and quasi-experimental study designs were considered, including randomized controlled studies, non-randomized controlled studies, before and after, and interrupted time series studies. In addition, analytical observational research, including prospective and retrospective, case-control, and cross-sectional analytical cohorts were considered for inclusion. This review also considered the inclusion of descriptive observational study designs, including case series, individual case reports, and descriptive cross-sectional studies. Research that did not have a clear methodology, that was carried out in animals or in laboratory, review studies, and opinion articles were excluded.

After searching the databases, the publications found were exported to the Rayyan Software by two independent researchers to remove duplicates, screen, and select the studies. Initially, titles and abstracts were screened and then full texts, taking into account the inclusion criteria adopted in the review protocol. Potentially relevant studies were recovered in full and their citation details were imported.

The reasons for excluding the studies were mentioned and reported in the flowchart (Figure 1). When reading the texts by title and abstract, the reviewers diverged in relation to five articles and reached a consensus afterwards. The results and research flow were fully reported and organized in a flowchart of Preferred Reported Items for Systematic Reviews and Meta-Analyses — PRISMA[13].

Data extraction was obtained through a Microsoft Excel form, as recommended by the Joanna Briggs Institute. This form was appropriate for the purpose of the review and included: title of publication, year of publication, location of the study, objectives of the study, methodology and important results. A pilot test of the instrument was performed to identify whether the data extraction answered the research questions appropriately and there was no need to improve it.

Data analysis was performed after reading the selected texts to extract information that could answer the research question. Data were presented in charts, figures and tables using descriptive statistics.

RESULTS

The search identified 106 publications in the analyzed databases and the gray literature, 96 publications in PubMed, four publications in the VHL, which had texts from the Latin American and Caribbean Health Sciences Literature (LILACS) and the Spanish Bibliographic Index in Health Sciences (IBECS), excluding Medline publications; in addition to three articles published in *Scielo* and three in the CAPES Thesis Database.

In the first selection stage, two duplicates were removed and, after reading the titles and abstracts, 57 publications were excluded. Of the 44 articles selected for the full-text evaluation, 39 did not meet the eligibility criteria. After this process, five articles were selected.

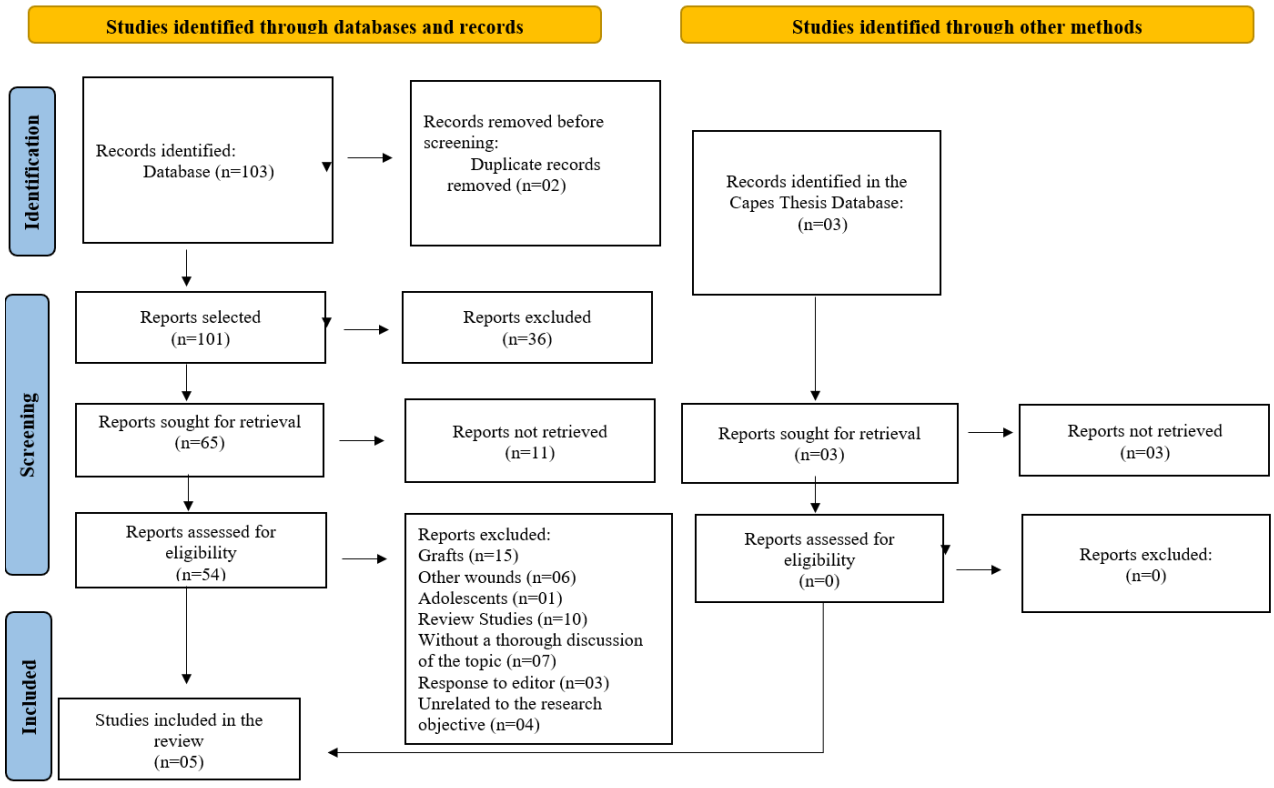

Figure 1. Flowchart for the selection of review articles, Rio de Janeiro (RJ), 2021.

The PRISMA methodology was adopted to report the systematization of the selection, screening and inclusion process of the studies, and data were shown in the flowchart (Figure 1). The main reasons why full-text articles were excluded were: the use of NPWT for better adherence of grafts; ineligible participants; review studies; studies without a thorough discussion of the topic; studies with responses to the editor, use of NPWT at home.

The five articles selected in this review included clinical trials, case reports, and prospective and retrospective studies. Most were published in English (90%), between 2008 and 2020, in the following countries: China, Egypt, Turkey, and Germany. Chart 2[14-18] shows the characteristics and detailed description of the studies.

REVIEW OF THE FINDINGS

This study provides an overview of NPWT in burns of hospitalized adults and aged people. The articles point out that thermal agents (T2, T3, T4), chemical agents (T1, T3), and electrical agents (T3), and an undisclosed cause (T5) caused burns in different body surfaces such as hands, chest, lower and upper limbs, and face.

The study population comprised adult and aged men and women, 60 men aged 18 to 25 years (T1); 45 male and female patients aged 20 to 40 years (T2); 35 female and male patients aged 33 to 65 years (T3); five patients, three men and two women, with a mean age of 23 years (T4); and, finally, in the last article analyzed (T4), two male patients were 53 and 38 years old.

As for the intervention adopted, NPWT and other therapies, such as dressings with silver sulfadiazine (T1) and microcurrent electrical stimulation (T2) were compared. In addition, other interventions were adopted. For example, the application of NPWT in acute burns (T3, T4, and T5).

The NPWT application covered the period from 6 to 14 days (T3), 21 days (T1, T2, T5), 28 days (T5), and 84 days (T4). The negative pressure applied to the wound bed ranged from 75 mmHg to 150 mmHg.

Chart 2. Characterization of the studies included.

ID	Title	Year/country	Objectives	Methodology	Effectiveness of NPWT on healing
T1	Clinical effects of vacuum sealing drainage in the treatment of alkali burn wounds[14].	2020/China	Preliminary observation of the effects of negative pressure sealant drainage on alkaline burns.	Prospective randomized controlled study with 60 men with alkaline burns (caustic soda) with a mean age between 18 and 75 years. Two groups with 30 participants each, one undergoing treatment with silver sulfadiazine and the other with NPWT, with a pressure of -80 mmHg. 21-day treatment performed in both cases.	The application of VSD technology on clinical alkaline burn wounds can effectively promote the removal of residual caustic soda, reduce the damage caused by caustic soda to skin tissues, shorten the healing time of wounds, remove inflammatory mediators, reduce the pain of dressing change, and reduce the total cost of treatment.
T2	Negative pressure wound therapy versus microcurrent electrical stimulation in wound healing in burns[15].	2019/Egypt	To compare the efficacy of negative pressure wound therapy (NPWT) with that of microcurrent electrical stimulation (MES) on wound surface area, length of stay (LoS) and colony count of wounds in patients with burns.	Randomized clinical trial with 45 patients with thermal burns divided into three groups: patients receiving NPWT, patients receiving MES, and patients receiving standard wound care. Use of the NPWT device with pressure of -125 mmHg, for five minutes on and two minutes off, for a period of 24 hours, three times a week for a total of three weeks.	This study on NPWT showed evidence of a reduction in the wound surface (not exceeding the microcurrent electric stimulation), a decrease in the growth of the bacterial load and the acceleration of wound healing.
T3	Efficacy of negative pressure wound therapy in the management of acute burns[16].	2018/Turkey	To evaluate the results and effectiveness of NPWT in the treatment of acute (electrical, chemical and thermal) burns	Retrospective study in 38 patients undergoing NPWT from -75 to -150 mmHg, with dressing changes every 72 hours. NPWT was used until the wound surface and granulation were eligible for surgical closure.	Increased granulation formation, reduction of edema, bacterial load, the number of wound debridement sessions, time of wound closure, and hospital stay.
T4	Use of negative pressure wound therapy in burn patients[17].	2016/Taiwan	To propose an improved technique of NPWT to manage burn patients.	Clinical trial with 05 patients admitted to the intensive care unit because of burns caused by a dust explosion with a total burn surface area between 60 and 90% who received treatment with NPWT of -125 mmHg, adjusted to a minimum pressure of -75 mmHg in case of pain, with continuous treatment, changed 2x/week.	It helps promote healthy granulation tissue growth, monitor and record wound exudate, and prepare the wound bed for grafting; after grafting, NPWT helps adhesion to the wound bed and attain skin graft. In addition, it decreases the dressing change time, which, in turn, has the potential to reduce postoperative infection rates by providing protection against external contaminants and pain in patients. It also reduces external workload and pain in patients, the workload of health providers, and health costs.
T5	Wound therapy using the vacuum-assisted closure device: clinical experience with novel indications[18].	2008/ Switzerland and Germany.	To show case reports of NPWT use in chest and nerve bone tissue	Case report of patients with deep third-degree burns to the face, chest, and lower extremities with dressing change every 3 days on average.	Exudate secretion and edema reduction; decreased level of inflammation and C-reactive protein; reduction of wound size and stimulated granulation tissue formation, wound healing of one of the patients after NPWT and graft fixation; reduced infection rate.

NPWT: negative pressure wound therapy.

The main results showed that negative pressure wound therapy in burns was effective in healing thermal, chemical, and electrical burns, optimizing healing time, promoting healthy granulation tissue formation, reducing edema and infection, and draining and monitoring edema. Table 1 summarizes the results.

DISCUSSION

Burn injury treatment is a dynamic and complex process that requires the development of a treatment plan that provides a better environment to promote healing and reduce complications[19]. Thus, the nursing team must always be updated and trained in treating patients with burns, to minimize complications and mortality rates[20].

To accelerate the wound healing process, NPWT is an important adjuvant treatment for complex wounds. NPWT is indicated for wounds of various etiologies, it has been increasingly used, including in burn treatment, and involves several mechanisms of action[7].

An important step in wound healing is granulation tissue the formation. Thus, using dressings promotes an environment that provides this tissue formation. In this review, 60% of the studies (T3, T4, T5) highlighted that NPWT helps tissue formation in burns. This occurs because NPWT induces the formation of new blood vessels, the deposition of connective tissue and cell matrix, which together form granulation tissue[7]. In addition, the negative pressure deforms the cytoskeleton — in the form of traction — in endothelial cells, inducing the formation of growth factors — which Argenta and Morykas, in the original studies, have proven that this is helpful in this step[21].

In addition, another important fact pointed out in T1 and T2 was that NPWT reduced inflammatory mediators of the wound (40%), such as tumor necrosis factor alpha (TNF-α), interleukin 8 (IL-8), and C-reactive protein. The use of NPWT clears pro-inflammatory cytokines and proteolytic enzymes that are present in the wound exudate, resulting in the control of the acute inflammatory response[7].

The excess of moisture in the injury interferes with the healing process, because in addition to macerating the edges and hindering the process of putting them together, it promotes an ideal environment for the proliferation of microorganisms[7]. Thus, the reduction of edema and drainage of the exudate is a relevant aspect and is demonstrated by 40% (T3 and T5) and 60% (T1, T4, and T5) of the studies that evaluated the use of NPWT, respectively. The mechanism of action involves the application of sub-atmospheric pressure in a closed system with continuous aspiration, removing the exudate through the gauze or foam dressing that covers the wound bed with a suction device, maintaining the moisture necessary for the healing process[7,22].

The removal of excess fluid in the interstitial space increases the supply of nutrients and oxygen to the tissues, which helps the healing process[21]. In addition, the drainage of the exudate reduces the burn damage caused by caustic soda because it removes it from the lesion, reducing the possibility of future harms caused by its impregnation in the tissues.

Infection is a frequent complication in patients who have burns because there is a change in their immune system. When the skin is injured, the tissue covering the body is compromised and, consequently, the protection against external agents. This makes individuals more susceptible to invasions by pathogenic microorganisms. In addition, other factors favor

Table 1. Main results of the scope review, Rio de Janeiro (RJ), 2021.

Main results	n	%
Healing time acceleration/Wound dimension reduction	4	80
Inflammatory mediator reduction	2	40
Pain reduction on dressing changes	2	40
Bacterial load decrease/Infection reduction	4	80
Helps granulation tissue formation	3	60
Edema reduction	2	40
Exudate drainage and monitoring	3	60

Source: Prepared by the authors, 2021.

infection, such as prolonged hospital stays, inappropriate use of antimicrobials, invasive procedures, and immunosuppression caused by thermal agents[5]. Thus, as mentioned in T2, T3, T4 and T5 (80%), NPWT is important to control infection because it is a type of occlusive dressing that forms a barrier against external agents, minimizing the manipulation of dressings and reducing infection levels. In addition, bacteria compete for nutrients and oxygen that would be used for wound healing, which slows down the healing process[7].

Pain is one of the main complaints of patients during dressing change[5]. Articles T1 and T4 showed that NPWT was associated with pain reduction (40%). Usually, the foam used in NPWT adheres to the wound bed, causing pain and bleeding on its removal. This is caused by the hyperstimulation generated by the vacuum, which can damage adjacent blood vessels and lead to hypertrophy of granulation tissue[7,23].

Thus, it is recommended that the NPWT be turned off hours before changing the dressing, and isotonic saline solution be instilled to moisten the foam or gauze to reduce adherence to the bed, facilitating removal, and generating less trauma and consequently less pain to the patient. Another option to manage the patient's pain would be to place a non-adherent film, such as petrolatum gauze, between the wound bed and the foam to reduce pain. However, this may reduce the pressure applied to the wound bed[7].

Another important point to be discussed and about which the authors have not reached a consensus is the intensity of the negative pressure used in the wound bed, ranging from -50 mmHg to -150 mmHg. While values below -50 mmHg are insufficient and do not lead to satisfactory results, pressures greater than -150 mmHg can be harmful and cause pain to the patient[21].

The finding that NPWT aims to accelerate the healing time of injuries is described in 80% of the articles in this review (T1, T2, T3, T5). The reduction of wound dimensions occurs through the centripetal force caused by the negative pressure that approximates the edges of the wounds, which contracts the tissue and reduces their dimensions[7]. In addition, reduced healing time is a consequence of a set of factors already presented, such as edema reduction and exudate drainage, granulation tissue formation, infection reduction, among others, also corroborated by several authors[7,21,23,24].

The low number of articles included, articles in Mandarin, and Chinese databases without access are the limitations of the study. The topic should be further addressed and disseminated, based on the performance of significant clinical studies that demonstrate the effectiveness of NPWT and care, the use of NPWT, its applicability. Also, contraindications should be systematized. This would help clarify knowledge gaps to accumulate scientific evidence to suggest this adjuvant treatment for burns.

Thus, it would be possible to use this technology to optimize the healing process safely and effectively, becoming a guiding source for nursing professionals and other health categories.

CONCLUSION

Burn treatment using negative pressure is a promising method, as it promotes the formation of granulation tissue and reduces inflammatory mediators, edema, and infection. In addition, it also promotes healing and reduces pain and length of hospital stays, with positive impacts on the patient and clinical practice.

Conflict of interest: None

Authors' contribution: pCPS: conceptualization, data curation, formal analysis, funding acquisition, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review & editing. BMFBP: writing – first draft, writing – review and editing, research, methodology, supervision, validation, visualization. EMP: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. RGR: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. VGMG: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. HFG: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. LFM: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. RPS: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. NVDOS: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. PCSTA: methodology, resources, supervision, validation, visualization, writing – original draft, writing – review & editing. CCPC: conceptualization, data curation, formal analysis, funding acquisition, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review & editing.

Data availability statement: All data were generated or analyzed in the present study.

Funding: not applicable.

Acknowledgements:not applicable.

REFERENCES

1. Moreto RW. Cuidados de enfermagem no atendimento pré-hospitalar à vítima de queimaduras [Internet]. In: Anais do Congresso Nacional de Iniciação Científica CONIC-SEMESP; 2017, São Paulo, Brasil. São Paulo (SP); 2017 [accessed 08 Apr. 08]. Available from: https://www.conic-semesp.org.br/anais/files/2017/trabalho-1000024370.pdf
2. World Health Organization. Burns [Internet]. Genebra: WHO; 2018 [Accessed 15 Jun. 2022]. Available from: https://www.who.int/news-room/fact-sheets/detail/burns
3. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Especializada. Cartilha para tratamento de emergência das queimaduras [Internet]. Brasília: Ministério da Saúde; 2012 [accessed 01 Mar. 2023]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/cartilha_tratamento_emergencia_queimaduras.pdf
4. Carboni RM, Santos GL, Carboni Júnior IC, Silva DFT, Bussadori SK, Fernandes KPS, Mesquita-Ferrari RA. Therapy for patients with burns – an integrating review. Rev Assoc Med Bras (1992). 2019 Nov;65(11):1405-12. https://doi.org/10.1590/1806-9282.65.11.1405
5. Brasil. Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos. Membrana de biocelulose no tratamento de: lesões cutâneas com perda de pele, úlceras venosas e arteriais, lesões por pressão, queimaduras de segundo grau e áreas doadoras de enxerto. Brasilia: CONITEC; 2018.
6. National Association of Emergency Medical Technicians NAEMT, Crespo ARPT, Lima DS, Bonfim AKS, Vasconcelos CRM, Domingues CA, Lima DPA, Silva DP, Santana ELS, Bassols JV, Sueoka JS, Eifler L, Stefanelli R, Silvestre RTR, Masuko TM, Islabão AG. Lesões por queimadura. In: National Association of Emergency Medical Technicians NAEMT, Crespo ARPT, Lima DS, Bonfim AKS, Vasconcelos CRM, Domingues CA, Lima DPA, Silva DP, Santana ELS, Bassols JV, Sueoka JS, Eifler L, Stefanelli R, Silvestre RTR, Masuko TM, Islabão AG. PHTLS: atendimento pré-hospitalar traumatizado. 8ª ed. São Paulo: Elsevier; 2017. p. 406-28.
7. Lima RVKS, Coltro PS, Farina Júnior JA. Terapia por pressão negativa no tratamento de feridas complexas. Rev Col Bras Cir. 2017; 44(1):81-93. https://doi.org/10.1590/0100-69912017001001
8. Nunes RB, Müller Neto BF, Cipriano FEG, Coltro PS, Farina Júnior JA. Fechamento de fístula brônquica com uso da terapia por pressão negativa: um tratamento viável e custo-efetivo. Rev Col Bras Cir. 2016;43(4):292-4. https://doi.org/10.1590/0100-69912016004007
9. Costa CCP, Souza NVDO, Peres EM, Vieira MLC, Santos JC, Cardoso RSP. Os sentidos de ser enfermeiro estomaterapeuta: complexidades que envolvem a especialidade. ESTIMA, Braz J Enterostomal Ther. 2020;18:e0620. https://doi.org/10.30886/estima.v18.825_PT

10. Conselho Federal de Enfermagem. Resolução COFEN nº 581/2018. Atualiza, no âmbito do Sistema Cofen/Conselhos Regionais de Enfermagem, os procedimentos para Registro de Títulos de Pós-Graduação Lato e Stricto Sensu concedido a Enfermeiros e aprova a lista das especialidades [Internet]. Diario Oficial da União; 2018 [accessed 11 Nov. 2022]. Available from: https://www.cofen.gov.br/resolucao-cofen-no-581-2018/

11. Conselho Federal de Enfermagem. Resolução COFEN nº 567/2018. Regulamenta a atuação da equipe de enfermagem no cuidado aos pacientes com feridas [Internet]. Diario Oficial da União; 2018 [accessed 02 Nov. 2022]. Available from: https://www.cofen.gov.br/resolucao-cofenno-567-2018/

12. Peters MD, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil, H. Chapter 11: scoping reviews (2020 version) [Internet]. In: Aromataris E, Munn Z, eds. Joanna Briggs Institute Reviewer´s Manual; 2020 [accessed 04 Feb. 2021]. Available from: https://edisciplinas.usp.br/pluginfile.php/7315963/mod_resource/content/1/manual_capitulo_revisao_escopo_JBIMES_2021April.pdf

13. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R, Glanville J, Grimshaw JM, Hróbjartsson A, Lalu MM, Li T, Loder EW, Mayo-Wilson E, McDonald S, McGuinness LA, Stewart LA, Thomas J, Tricco AC, Welch VA, Whiting P, Moher D. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. https://doi.org/10.1136/bmj.n71

14. Huang CG, Jia ZG, Gu ZQ, Zhao P, Lyu GZ. Clinical effects of vacuum sealing drainage in the treatment of alkali burn wounds. Zhonghua Shao Shang Za Zhi. 2020 Jul 20;36(7):534-9. https://doi.org/10.3760/cma.j.cn501120-20200115-00024

15. Ibrahim ZM, Waked IS, Ibrahim O. Negative pressure wound therapy versus microcurrent electrical stimulation in wound healing in burns. J Wound Care. 2019 Apr 2;28(4):214-9. https://doi.org/10.12968/jowc.2019.28.4.214

16. Kement M, Başkran A. Efficacy of negative pressure wound therapy in the management of acute burns. Ulus Travma Acil Cerrahi Derg. 2018 Sep;24(5):412-6. https://doi.org/10.5505/tjtes.2017.78958

17. Teng SC. Use of negative pressure wound therapy in burn patients. Int Wound J. 2016 Sep;13 Suppl 3(Suppl 3):15-8. https://doi.org/10.1111/iwj.12641

18. Koehler C, Niederbichler AD, Jung FJ, Scholz T, Labler L, Perez D, Jandali A, Comber M, Kuenzi W, Wedler V. Wound therapy using the vacuum-assisted closure device: clinical experience with novel indications. J Trauma. 2008 Sep;65(3):722-31; discussion 731. https://doi.org/10.1097/01.ta.0000249295.82527.19

19. Silva AKA, Oliveira TF, Lima FMP. Inovações tecnológicas no tratamento de queimados. Portal do Núcleo de Pesquisas e Inovação tecnológica em Reabilitação Humana [Internet]. Fortaleza: UFC Inovafisio; 2020 [accessed 08 Sep. 2022]. Available from: https://inovafisio.ufc.br/pt/inovacoes-tecnologicas-no-tratamento-de-queimados

20. Trancoso KS, Reis CL, Lima JL. A efetividade do uso de curativos a base de prata em queimaduras: uma overview. In: 2nd International Nursing Congress, Good Practices of Nursing Representations in the Construction of Society [Internet]; 09-12 mai 2017 [accessed 20 Sep. 2022]; Aracaju: Universidade Tiradentes; 2017. Available from: https://eventos.set.edu.br/index.php/cie/article/viewFile/5880/2270

21. Argenta LC, Morykwas MJ. Vacuum-assisted closure: a new method for wound control and treatment: clinical experience. Ann Plast Surg. 1997;38(6):563-76; discussion 577. PMID: 9188971.

22. Silva JWL, Santos LSA, Silva MLA, Araújo CSB, Moura MERB, Pereira VCS, Landim CNA, Silva CRL. Manejo da terapia por pressão negativa (TPN) em lesões complexas. Braz J Dev. 2020;6(2):6949-58. https://doi.org/10.34117/bjdv 6n2-117

23. Oliveira MC, Andrade AYT, Turrini RNT, Poveda VB. Terapia por pressão negativa no tratamento de infecção do sítio cirúrgico em cirurgia cardíaca. Rev Bras Enferm. 2020;73(5):e20190331. https://doi.org/10.1590/0034-7167-2019-0331

24. Santos TL, Silva ANB, Souza MBV, Costa MPS, Rocha JCR, Holanda MGP, Costa CV, Costa SDM, Carmo BKO, Oliveira DSF, Santos TLC, Veloso NF, Teixeira RC, Reis DLA, Fonseca HTA. Terapia por pressão negativa no tratamento de feridas. REAS. 2019;31:e1231. https://doi.org/10.25248/reas.e1231.2019