

## The use of vacuum dressing in the treatment of pressure wounds: An integrative review.

A utilização de curativo a vácuo no tratamento de lesão por pressão: Uma revisão integrativa

El uso de vendajes de vacío en el tratamiento de las heridas por presión: Una revisión integrativa.

### RESUMO

Objetivo: Averiguar o uso de terapia de pressão negativa em lesão por pressão e repercussões no ambiente intra-hospitalar. Método: revisão integrativa nas bases de dados Pubmed e Scielo com publicações de 2000 a 2020 com os descritores, "pressão negativa como terapia de feridas", isolado ou associado com "lesão por pressão" e "úlceras por pressão" e seus correspondentes em inglês: "negative pressure as wound therapy"; "pressure injury" e "pressure ulcer". Foram selecionados artigos relevantes sobre o tema, agrupando resumidamente suas recomendações. Resultados: Estudos indicam que a terapia a vácuo promove estímulo do tecido de granulação, angiogênese, maior fluxo sanguíneo e diminuição de exsudato. Indicado para feridas complexas, lesões por pressão, queimaduras, feridas necrosantes, entre outras. Contraindicado para osteomielite, sobre vasos sanguíneos e malignidade na ferida, entre outras. Conclusão: Os estudos encontrados demonstram, em sua maioria, o funcionamento fisiológico da terapia e ainda são insuficientes sobre a aplicação do método na prática.

**DESCRIPTORES:** Lesão por pressão; curativo a vácuo; Cicatrização; Ferimentos e Lesões.

### ABSTRACT

Objective: To investigate the use of negative pressure therapy in pressure injuries and repercussions in the in-hospital environment. Method: integrative review in Pubmed and Scielo databases with publications from 2000 to 2020 with the descriptors, "negative pressure as wound therapy"; isolated or associated with "pressure injury" and "pressure ulcer" and their correspondents in English: "negative pressure as wound therapy"; "pressure injury" and "pressure ulcer". selected Relevant articles on the topic were selected, briefly grouping their recommendations. Results: Studies indicate that a stream of therapy increases granulation, increased angiogenesis and increased growth. Indicated for the problem, problems for the problem, necrotizing wounds, among others. Contraindicated for osteomyelitis, on blood vessels and wound malignancy, among others. Conclusion: The studies found, for the most part, the functioning of the therapy method and are still insufficient on the application of practice in practice.

**DESCRIPTORS:** Pressure injury; vacuum dressing; Healing; Wounds and Injuries.

### RESUMEN

Objetivo: Investigar el uso de la terapia de presión negativa en las lesiones por presión y sus repercusiones en el ambiente hospitalario. Método: revisión integradora en las bases de datos Pubmed y Scielo con publicaciones de 2000 a 2020 con los descriptores, "presión negativa como terapia de herida", aislada o asociada a "lesión por presión" y "úlceras por presión" y sus correspondientes en inglés: "presión negativa como terapia de heridas"; "lesión por presión" y "úlceras por presión". seleccionados Se seleccionaron artículos relevantes sobre el tema, agrupando brevemente sus recomendaciones. Resultados: Los estudios indican que una corriente de terapia aumenta la granulación, aumenta la angiogénesis y aumenta el crecimiento. Indicado para el problema, problemas para el problema, heridas necrotizantes, entre otros. Contraindicado para osteomielitis, sobre vasos sanguíneos y malignidad de heridas, entre otros. Conclusión: Los estudios constataron, en su mayoría, el funcionamiento del método terapéutico y aún son insuficientes sobre la aplicación de la práctica en la práctica.

**DESCRIPTORES:** Lesión por presión; vendaje al vacío; Cicatrización; Heridas y Lesiones.

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**INTRODUÇÃO**

Patient safety is a topic discussed globally and should be seen as a prerequisite for the quality of care, given that adverse events in the care process can have serious consequences for the patient, causing damage that is often disabling.<sup>1</sup>

The idea of reducing adverse events and adopting good practices provide effective nursing care and safer management. Health indicators are presented as numerical variables related to the care process. The incidence of pressure injuries (PI) is considered one of the negative indicators of the quality of care provided by health and nursing services, and its prevention is important considering the context of the global movement for patient safety.<sup>1</sup>

Worldwide, millions of clients annually are victims of disabling injuries and deaths as a result of unsafe health practices. The term pressure ulcer, formerly called pressure ulcer, can be present in intact or broken skin, painful or not. It is characterized as localized damage to the skin or soft tissues, usually over a bony prominence, and may be related to the use of medical devices/artifacts or other factors such as microclimate, nutrition, peripheral perfusion, comorbidities and your condition.<sup>2</sup>

The literature reveals that the incidence of PI is still high, ranging from 23.1% to 59.5%, mainly in patients admitted to Intensive Care Units (ICU). A cross-sectional study, carried out in a university hospital, demonstrated that the prevalence of PI was 40%, with higher rates in ICU.<sup>(3,4)</sup>

One of the treatment options studied is negative pressure, also called vacuum dressing, initially investigated by Morykwas et al. in 1997. The work derives from studies with negative pressure that suggest improvement in healing, since it promotes increased blood flow and local hyperemia. Vacuum dressing is a widely accepted therapy for many types of infected wounds. A recent study concluded that the quality of life is significantly impacted in the first week and that at the end of the treatment the results are superior to the control group.<sup>(5-7)</sup>

Given the relevance of this treatment method and the need to better understand it, this study aims to investigate the use of negative pressure therapy in pressure injuries and its repercussions in the in-hospital environment.

**METHOD**

This is an integrative review, defined as a “method that aims to synthesize results obtained in research on a topic or issue, in a systematic, orderly and comprehensive manner.”<sup>(8)</sup>

Primary studies were approached with different methodologies. Six stages were approached: 1) Identification of the theme and elaboration of the guiding question; 2) Establishment of criteria for inclusion and exclusion; 3) Definition of information to be extracted from studies and categorization of studies; 4) Critical analysis of included studies 5) Interpretation of results; 6) Presentation of the integrative review and synthesis of the obtained content.<sup>(8)</sup>

The elaboration of the research question was guided by the PICO strategy, in a modified form, as shown in Table 1. Thus, the guiding question was “Does the use of a vacuum dressing promote accelerated healing of pressure injuries?”

The search was carried out from February to March 2021, with the collaboration of two researchers independently in the Pubmed and Scielo databases. In order to systematize the search in the databases, descriptors in health sciences (DeCS) were listed, as well as their equivalents in English. Shown in Table 1.

To evaluate the studies found, the titles and abstracts were initially observed, and those that, due to the adoption of the inclusion and exclusion criteria, were not sufficient, were read in full. Inclusion criteria were: Published articles that addressed the theme of vacuum dressing in the treatment of pressure injuries in the proposed period from 2000 to 2020, in Portuguese and English. Articles published with the theme of vacuum dressing in the treatment of pressure injuries outside the period from 2000 to 2020 were excluded, as well as duplicate articles in the Scielo and Pubmed databases. The articles in-

**Table 1 – Description of the PICO strategy for elaborating the research question, selection of descriptors and non-controlled terms used in the search. Brasília, Federal District, Brazil, 2021.**

P	Patient with pressure injury who received vacuum treatment. (population)	Lesão por pressão; curativo a vácuo; Cicatrização; Ferimentos e Lesões Or Pressure injury; Vacuum dressing; Healing; Wounds and Injuries.
I	Vacuum bandage (intervention)	Vácuo or vacuum; aspiração or aspiration;
C	Comparison	Não se aplica
O	Outcome after vacuum dressing. (outcome)	Terapêutica; or Therapy; Vácuo or vacuum

Source: the authors, 2022

cluded in the study were read in full and the evidence was grouped in order to summarize its recommendations.

**RESULTS**

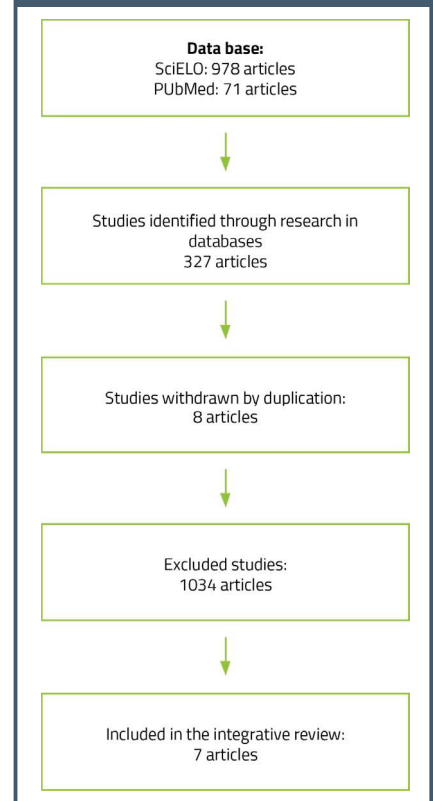
Following the PICO strategy and related descriptors, as shown in Table 1, the review found 978 articles on the Scielo platform and 71 articles on the PubMed platform. After reading the titles and abstracts and applying the inclusion and exclusion criteria, a sample of 7 articles was obtained. The articles selected for the review were grouped in Table 2 with the aim of indicating more details of each one and enabling the comparison between the information available in the literature.

**DISCUSSION**

Negative pressure treatment aims at healing mainly in humid environments, using controlled subatmospheric pressure and applied locally. This type of therapy is composed of a soft surface material that can be gauze or foam, under which pressure is applied and the exudate is removed. This soft material must be in contact with the wound bed, in order to cover the entire length of the lesion.<sup>(9)</sup>

The material is covered by a preferably transparent film that completely

**Figure 1. Article selection flowchart according to Prisma.**



Source: the authors, 2022

occludes the wound. Subsequently, a suction probe is connected to this system and to the exudate reservoir, which is adapted to a computerized device in

order to program parameters to provide negative pressure in the wound bed, this device is also capable of detecting possible air leaks through the dressing and can also indicate system replacement.<sup>(9)</sup>

Studies indicate that the application of negative pressure therapy involves biological and physical effects, among the biological effects we have the change in the conformation of the cellular cytoskeleton causing deformation that is responsible for triggering cell proliferation and angiogenesis. Stimulation of the formation of granulation tissue as there is an increase in the number of capillaries in the wound bed, in addition to the deposition of connective tissue and extracellular matrix that together form the granulation tissue. Reduction of the local inflammatory response by the clearance of pro-inflammatory cytokines and proteolytic enzymes present in the wound exudate, which are responsible for the degradation of the extracellular matrix and for apoptosis.<sup>(9-11)</sup>

Among the physical effects, studies indicate an increase in blood flow with a consequent stimulus to the formation of granulation tissue. Reduction of edema and control of exudate, promoting the restoration of vascular and lymphatic flow, improving local perfusion and better supply of nutrients and oxygen. Reduction of the dimensions of the wound by approaching the edges by means of centripetal force, leading to a decrease in its dimensions by tissue contracting. Bacterial load clearance, but this subject is controversial in the literature, while some studies show a decrease in bacterial load with the use of negative pressure, others do not show significant changes in bacterial load.<sup>(9,12,13)</sup>

Among the indications observed in the literature for negative pressure in the treatment of injuries, we can observe positive results both in randomized and controlled clinical studies and in prospective and retrospective cohorts. It is indicated for complex wounds, pressure injuries, traumatic surgical wounds,

burns, diabetic wounds, venous ulcers, inflammatory wounds, radiation wounds, skin grafts, to optimize graft integration into the wound bed, open abdomen, prevention of complications,

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instillation of solutions into contaminated or infected wounds.<sup>(9)</sup>

As a contraindication to the use of vacuum therapy we can mention: use in

fistulas to organs or cavities, malignancy in the wound, untreated osteomyelitis, non-enteric or unexplored fistulas, necrotic tissue with eschar present in the wound and placement on blood vessels or exposed organs.<sup>(14)</sup>

Pressure injuries as in this study are caused by pressure mainly maintained between a bony prominence and the patient's bed, or shear with the sheet, this type of pressure leads to tissue ischemia and necrosis. This type of injury is more associated with patients with restricted mobility, including patients under prolonged sedation. Among the main sites of development of lesions, we can mention the sacral, sciatic, trochanteric, calcaneal and occipital regions.<sup>(9)</sup>

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Pressure injury is considered a serious adverse event within health institutions, being essential the training of care teams is an important action to reduce the data. Despite increasingly identifying the use of innovative therapies in the treatment of wounds, it is important that knowledge about pressure injury prevention is disseminated and that the health team, especially the nursing team, is equipped with scientific knowledge in order to prevent the appearance of injuries, thus, a study carried out on the knowledge of nurses about protocols for the prevention of pressure injuries revealed that many were aware of the existence of a protocol, however, of these, less than half were able to inform which protocol it would be. Without foundation and foundation, the care provided to patients is compromised.<sup>(16)(17)</sup>

Table 2. Description of the main results obtained by the studies included in the sample (n=6), Brasília, Federal District Brazil 2022.

Reference	Year of publication	Authors	Objective	Results
9	2017	<ul style="list-style-type: none"> <li>▪ RENAN VICTOR KÜMPEL</li> <li>▪ SCHMIDT LIMA</li> <li>▪ PEDRO SOLER COLTRO</li> <li>▪ JAYME ADRIANO FARINA JÚNIOR</li> </ul>	To review the literature on NPT (negative pressure therapy) in the treatment of complex wounds, with emphasis on its mechanisms of action and main therapeutic indications.	<p>Change in the conformation of the cytoskeleton that triggers a potent stimulus to cell proliferation and angiogenesis</p> <ul style="list-style-type: none"> <li>- Stimulation of the formation of granulation tissue</li> <li>- Decreased local inflammatory response</li> <li>- Increased blood flow to the wound</li> <li>- Reduction of edema and control of exudate</li> <li>- Reduction of wound dimensions</li> <li>- Bacterial load clearance</li> </ul>
10	2005	<ul style="list-style-type: none"> <li>▪ Shao-Zong Chen,</li> <li>▪ Jing Li,</li> <li>▪ Xue-Yong Li and</li> <li>▪ Long-Shun Xu</li> </ul>	To study the mechanism by which vacuum-assisted closure induces an increase in blood flow and reduces edema in skin wounds.	Vacuum therapy was found to promote capillary blood flow velocity, increase capillary caliber and blood volume, stimulate endothelial proliferation and angiogenesis, narrow endothelial spaces, and restore capillary basement membrane integrity.
11	2006	<ul style="list-style-type: none"> <li>▪ You Su Sun</li> <li>▪ Ricardo Zeri</li> <li>▪ L WileyNifong</li> <li>▪ William A Madeira</li> </ul>	To investigate the effect of vacuum therapy on the systemic distribution of the inflammatory cytokines interleukin (IL)-6, IL-8, IL-10 and transforming growth factor beta1.	Therapy resulted in earlier and greater IL-10 peaks and maintenance of IL-6 levels compared to saline-wetted gauze controls, who showed decreased IL-6 values in the first hour (both at p<0.05). No other treatment-based differences were detected.
12	2010	<ul style="list-style-type: none"> <li>▪ Deva Boone</li> <li>▪ ElissaBraitman</li> <li>▪ Cynthia Gentic</li> <li>▪ John Afthinos</li> <li>▪ Jawad Latif</li> <li>▪ Emilia Sordillo</li> <li>▪ George Todd</li> <li>▪ John C. Lantis II</li> </ul>	The present study used an infected wound model to test the effect of negative pressure therapy on bacterial load..	Negative pressure wound therapy with standard foam or silver foam produced significant improvements in local wound appearance. This occurred despite a persistently high level of bacterial infection; thus, the improvement in healing of these infected wounds cannot be explained by a change in bacterial load.
13	2012	<ul style="list-style-type: none"> <li>▪ Vidro Graeme E</li> <li>▪ JagdeepNanchahal</li> </ul>	To evaluate and summarize the clinical and experimental evidence of how these methodological variations influence wound healing when using negative pressure therapy.	Both foam and gauze efficiently transmit pressure. While some preclinical evidence suggests that foam may preferentially promote cell proliferation, there is no clear evidence to favor a wound filler. Most wound contractions occur within the first -50 mmHg and physiological optimization can be achieved within -80 mmHg. There is insufficient evidence to credit negative pressure therapy with reduced bacterial colonization of the wound.
14	2014	<ul style="list-style-type: none"> <li>▪ RK Batra</li> <li>▪ VeenaAseeja</li> </ul>	A young, non-diabetic male presented with a large sacral eschar after high-dose inotropes in an intensive care unit for the treatment of severe hypotension. His wound was debrided and instead of flap surgery on such an infected wound, he was treated with VAC therapy.	Complete wound healing was achieved in 6 weeks and at half the cost of flap surgery. Furthermore, the chances of flap failure and its related complications have been eliminated.
15	2003	<ul style="list-style-type: none"> <li>▪ Marcus B Wanner</li> <li>▪ Franz Schwarzl</li> <li>▪ Beni Strub</li> <li>▪ Guido A Zaech</li> <li>▪ Gerhard Pierer</li> </ul>	The clinical impression that pressure ulcers heal faster with vacuum-assisted closure was tested and compared with the traditional wet-to-dry/wet-to-wet technique with gauze soaked in Ringer's solution changed three times a day.	No differences were found in the time to reach 50% of the initial wound volume between the two methods. The vacuum-assisted group took an average (SD) of 27 (10) days and the traditional group 28 (7) days. Both methods were equally effective in forming granulation tissue.

Source: the authors, 2022

## CONCLUSION

It was observed that there are more studies related to the physiology and

functioning of the vacuum therapy mechanism and few studies related to demonstrating the use of the technique and its real effectiveness in practice. The studies found still have dichotomies and

are not very conclusive. It is important to encourage scientific research related to the technique experiment, especially in pressure injuries, as it can prove to be very promising.

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