

# Knowledge on therapies for pressure ulcer: an integrative review

## Conhecimento acerca das terapias para lesão por pressão: revisão integrativa

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### ABSTRACT

**Objective:** to analyze the evidences on therapies for the treatment of pressure ulcers. **Methods:** integrative review with articles published between 2014 and 2019 in SciELO, MEDLINE, LILACS, BDENF, IBECs and CINAHL databases. The descriptors used were: pressure ulcer, therapeutics and nursing care. **Results:** twelve articles were found that met the study's objectives. Data from the eligible studies were extracted using the data collection instrument. After this step, they were categorized and synthesized, in a descriptive way, and listed in four categories: professionals' knowledge about therapies; adequate management of therapies; therapies with biophysical agents; and non-conventional therapies. **Conclusion:** the analyzed articles reflect on the use of some therapies and strategies to treat pressure ulcers. The various therapies addressed in the research on the treatment of these ulcers proved to be effective, however, they are insufficient to ensure their wide and safe use.

**Descriptors:** Pressure Ulcer; Nursing Care; Therapeutics; Review.

### RESUMO

**Objetivo:** analisar as evidências acerca das terapias para tratamento das lesões por pressão. **Métodos:** revisão integrativa com artigos publicados entre 2014 e 2019 nas bases de dados SciELO, MEDLINE, LILACS, BDENF, IBECs e CINAHL. Os descritores utilizados foram: lesões por pressão, terapêutica e cuidados de enfermagem. **Resultados:** encontrados 12 artigos que atenderam ao objetivo do estudo. Os dados dos estudos elegíveis foram extraídos por meio do instrumento de coleta de dados. Após essa etapa, os mesmos foram categorizados e sintetizados, de forma descritiva, e elencados em quatro categorias: conhecimento dos profissionais sobre as terapias; adequado gerenciamento de terapias; terapias com agentes biofísicos; terapias não convencionais. **Conclusão:** os artigos analisados refletem sobre a utilização de algumas terapêuticas e estratégias para tratar as lesões por pressão. As diversas terapias abordadas nas pesquisas sobre o tratamento dessas lesões se mostraram efetivas, no entanto, são insuficientes para garantir a sua ampla e segura utilização.

**Descritores:** Lesão por Pressão; Cuidados de Enfermagem; Terapêutica; Revisão.

## Introduction

Pressure ulcers are an important public health problem due to their high rates in bedridden and hospitalized individuals, which hinders their recovery, increasing the risk for the development of different complications. Furthermore, they reflect on the health care system as they generate high costs for the state, as well as for families, institutions and society, generating also physical and emotional suffering for the individual, since it reduces their independence, the execution of their daily activities, impacting on their quality of life<sup>(1)</sup>. They are called lesions on the skin and/or underlying tissues due to pressure alone or associated with friction and/or shear, often located on bony prominences in people with impaired physical mobility<sup>(2)</sup>.

In order to adequately prevent and treat pressure ulcers, the National Pressure Ulcer Advisory Panel (NPUAP), the European Pressure Ulcer Advisory Panel (EPUAP) and the Pan Pacific Pressure Injury Alliance (PPPIA) have recently published new international guidelines with recommendations for the development of public policies, education and research on treatment and prevention of Pressure injuries<sup>(2)</sup>. Even with the existence of protocols with recommendations regarding the prevention of this type of injury, when its development is inevitable, adherence to good therapeutic practices is necessary in order to reduce the negative outcomes and prevent the progression of its severity. The pressure ulcer is a problem that must be considered in all professional areas, highlighting Nursing for its effective care, as it follows the patient's evolution in full time, becoming responsible for the preservation of the risks that the lesions may entail. The range of factors related to the onset of pressure ulcers is evidenced in numerous studies and, to treat these causes, it is essential to include nursing care combined with the involvement of high level of information and knowledge<sup>(3)</sup>.

In this context, it is justified to analyze the avail-

able evidence in the literature about the treatments used in pressure ulcers, since the choice of appropriate treatment favors proper healing, reduces the hospitalization process and patient damage, and contributes to the quality of care. Under this aspect, the search for scientific evidence through integrative literature review about the treatments for Pressure injuries allows a broad analysis of the available therapies for adequate treatment by nurses, when these lesions are present. This study aimed to analyze the evidence on therapies for pressure ulcers treatment.

## Methods

This is an integrative literature review, which aims to synthesize the results obtained in research on an object or issue, in a systematic, organized and comprehensive way<sup>(4)</sup>. The research was developed through six phases described as follows: 1) elaboration of the guiding question; 2) search for available literature; 3) data collection; 4) critical analysis of the included articles; 5) discussion of the results and 6) synthesis of the review. To formulate the research question, the PICo<sup>(5)</sup> strategy was used, which consists of identifying P= participant, I= intervention, C= control, O= outcome. An answer was sought to the following question: what is the evidence in the literature on treatments for pressure ulcers? Thus, in this study we have: P: pressure ulcer patients; I: types of treatment; Co: care context.

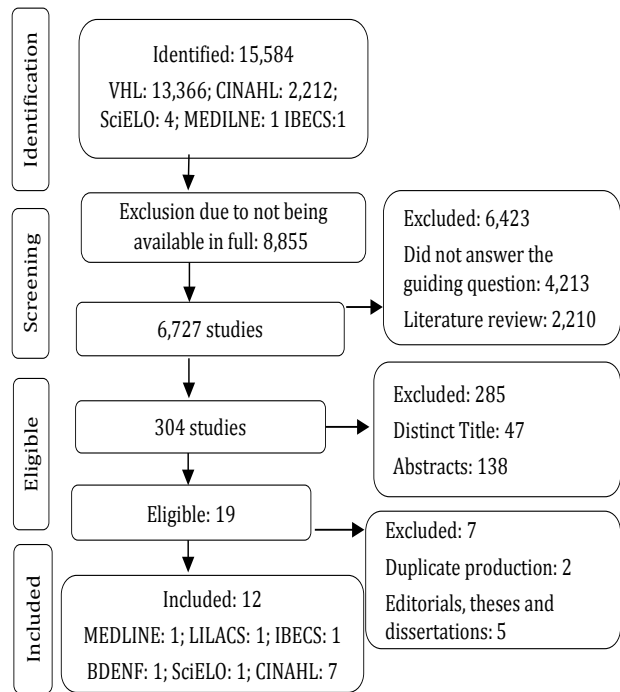
The search in the databases Scientific Electronic Library Online (SciELO), Medical Literature Analysis and Retrieval System Online (MEDLINE), Índice Bibliográfico Español en Ciencias de la Salud (IBECS), Cumulative Index to Nursing and Allied Health Literature (CINAHL). The Virtual Health Library (VHL) used the Latin American and Caribbean Health Sciences Literature (LILACS) and the Nursing Database (BDENF).

The choice of these databases was motivated by the fact that they have national and international publications with impact, breadth of the search spec-

trum, and diversity of indexed journals. Data were collected by a researcher between March and May 2020, using the following Health Sciences Descriptors (DeCS) of the VHL and the Medical Subject Headings (MeSH) of the National Library: pressure ulcer, treatment/therapy, nursing/nursing care. These descriptors were combined with Boolean operators AND and OR in different ways to allow a broad search. For the search on the SciELO and IBECS platforms the Portuguese descriptors combined with the Boolean operator “AND” were used: “pressure ulcer” AND “treatment” AND “nursing care”. Searches in MEDLINE, CINAHL and LILACS databases were combined in the following ways: “pressure ulcer” AND “therapy”, “pressure ulcer” AND “nursing care”, “nursing care” AND “pressure ulcer” OR “therapy”, “pressure ulcer” OR “therapy” OR “nursing care”.

Inclusion criteria were articles in Portuguese, English, and Spanish, published between 2014 and 2019, as these were publications that discussed more recent treatments for the lesions and were available in full. Dissertations, theses, literature reviews, editorials, congress abstracts, and publications that did not answer the guiding question of this review and duplicate productions were excluded. Twelve articles were incorporated for analysis and discussion. The article selection process is described in the flowchart (Figure 1), according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)<sup>(6)</sup>.

The eligible studies were read in full by the three researchers independently by reading the title and abstract, and disagreements were determined by conformity. Data from the studies were extracted descriptively using an instrument developed by the authors that gathered some information from the selected publications, such as: author, year and country of publication, type of study, and objectives. Based on the reading, a descriptive and synthesized analysis of the main evidence of the studies was performed, and these were discussed in four categories.



**Figure 1** – Flowchart of the database search. Salvador, BA, Brazil, 2020

## Results

Regarding the origin of the publications, it was observed that six (50.0%) were national publications, two (16.6%) were from Spain and four (33.3%) were published in Asia, Qatar, United Kingdom and Turkey. As for the professional category, the studies on pressure ulcers treatment were published by nurses and other healthcare professionals corresponding to six (50.0%) published by nurses, four (33.3%) by physicians and two (16.6%) by physical therapists, however, one was published in a nursing journal. Regarding the time frame from 2014 to 2019, the year 2017 concentrated the largest number of publications, five (41.6%), followed by the year 2019 with three (25.0%); the years 2015 and 2017 had the same number of publications, or in other words, one (16.6%) each, and the year 2018, two publications (16.6%). Regarding the type of study, case studies predomina-

ted with six (50.0%), followed by exploratory descriptive studies with two (16.6%) and cohort and randomized studies with two (33.3%) each. Subsequently, a thematic synthesis was performed with construction of a synoptic table with description of the data and main results of the studies (Figure 2).

Authors/Year/Country	Type of study	Objectives of the study	Treatments used
Tickle 2015/Europe	Case Study	Describe the effects of topical oxygen for treatment of stage 2,3 and 4 pressure ulcers.	Application of a hemoglobin spray to patients with pressure ulcer stages 2,3,4 at every dressing change for 4 weeks with previously instituted dressings.
Buzzi et al. 2016/Brazil	Cohort study	To evaluate the therapeutic benefits of the bioactive <i>Calendula officinalis</i> Plenusermax® extract in the treatment of stage 2 and 3 pressure ulcers.	Cleaning of the lesions with 0.9% saline solution, followed by application of the spray to the lesions, twice a day, leaving it to dry for 5 minutes. Occlusion and fixation with sterile gauze and micropore.
Mohammed 2016/Qatar	Case Study	Describe the treatment of a stage 3 and 4 CLP with the use of natural honey.	Daily application of natural honey produced by bees native to Russia, which has undergone rigorous laboratory testing, using a dressing impregnated with glycerin and sterile gauze.
Almeida et al. 2017/Brazil	Exploratory descriptive	Investigate the effects on the treatment of stage 2 and 3 pressure ulcers using the high frequency generator.	Application of electrical stimulation to pressure ulcers by means of a portable high-frequency generator and alternating current operation for two months.
Milcheski et al. 2017/Brazil	Cohort study	To evaluate the brief hospitalization protocol applied to 20 patients with 25 stage 4 pressure ulcers in the Complex Wound Group of a hospital.	Surgical technique, standardized with flap grafting in pressure ulcers in patients who met the inclusion criteria of the protocol.
Polat et al. 2017/Turkey	Case Study	To investigate the use of the fly larvae of the <i>Lucilia Sericata</i> specimen in 36 patients with stage 2 and 3 pressure ulcers resistant to conventional treatments.	Application of sterile maggots directly on the wound. Cover with sterile gauze. Removal of larvae after being kept on the wound for 48 to 72 hours, reducing its frequency as improvement occurs.
Raju et al. 2017/Asia	Randomized	To evaluate the effect of continuous ultrasound therapies on the healing of pressure ulcers stages 1, 2 and 3, randomized into 2 groups of patients.	Treatment with continuous ultrasound with frequency 3 MHZ, for 10 minutes daily. Fifteen patients were submitted to conventional dressings with daily changes, cleaning with saline solution. Both patients were oriented as to the care of the lesions.
Souza et al. 2018/Brazil	Case Study	To evaluate the effectiveness of high-voltage electrical stimulation in a patient with sacral pressure injury.	Application of a silicone rubber electrode soaked in saline solution over the lesion. The electric current was applied for 45 minutes/session, three times a week, for four weeks, totalizing twelve sessions.
Farré 2018/Spain	Case Study	To describe the healing process of lesions with the use of dressings made with hydropolymer technologies for lesions in the sacral and calcaneal region.	Cleaning the wounds with saline, applying zinc oxide to the perilesional skin as protection, collagenase for enzymatic debridement, and covering with hydropolymers to manage exudate
Ferreira et al. 2018/Brazil	Exploratory descriptive	To verify nurses' knowledge about the use of collagenase in pressure ulcers.	Not applicable.
Chamorro et al. 2019/Spain	Randomized	Compare the effectiveness of polyurethane and hydrocolloid dressings after eight weeks of treating stage 2 pressure ulcers.	Cleaning with saline solution, drying the edge with sterile gauze, and occluding as recommended for lesion sizes with a cover (hydrocolloid group) or cover (hydrocellular group), with changes 2 to 4 times a week as needed.
Santos et al. 2019/Brazil	Exploratory descriptive	To evaluate the healing process of a stage 3 pressure ulcer in a patient seen at a Family Health Unit.	Evaluation, cleaning of the lesion with saline solution and application of hydrogel to the lesion bed and application of barrier cream to the edges of the lesion.

**Figure 2** – Characterization of the articles. Salvador, BA, Brazil, 2020

## Discussion

The articles analyzed reflect on the use of some therapies to treat lesions. A limitation of the study is the reduced number of publications on the subject, especially those involving other topical therapies that are widely used and safe to use according to indication, impregnated or not with antimicrobials, such as fibers and hydrofibers, activated carbon, nanocrystalline silver impregnated dressings and gauze impregnated with polyhexamethylene biguanide (PHMB). In this regard, it is worth mentioning the scarcity of studies that also address other adjuvant therapies such as Negative Pressure Therapy, Hyperbaric Oxygen Therapy and Ozone Therapy.

To proceed to a broad discussion of the articles, thematic categories were organized based on the contents that emerged in the publications, as follows: 1) professionals' knowledge about therapies; 2) adequate management of therapies; 3) therapies with biophysical agents; 4) non-conventional therapies. The remaining references used in the discussion included consensus documents that discuss treatments on pressure ulcers. The discussion of these categories will provide insight into the appropriate use of pressure ulcer therapies, contributing to proper patient care management. This research points to the need for further studies, preferably randomized clinical trials for the evaluation of treatments that are commonly used in practice, however, lack scientific support for their use, since many studies/case reports were found, which are considered studies with a low level of evidence.

To ensure the quality of care, health professionals need to keep themselves constantly updated. Nowadays, with therapeutic advances and the use of various products, knowledge about prevention, treatment, and good practices is essential, as well as keeping up to date on recent treatments and practice recommendations based on scientific evidence.

Regarding the treatment of pressure ulcers, Collagenase is an example of topical therapy, being

routinely used aiming to cure the lesion. However, when choosing a product, the professional needs to know the substance action mechanisms for its correct use. Thus, only one study that verified the professionals' knowledge about the use of collagenase concluded that only a small sample of the subjects studied presented the definition of the substance as described in the literature. Most respondents called collagenase an autolytic debridement, moving their definitions away from the real concept of such compound<sup>(7)</sup>. Collagenase is an enzymatic preparation obtained from filtrates of *Clostridium histolyticum* that digest collagen, but are not active against keratin, fat or fibrin.

To remove devitalized tissues from the lesion, there are several debridement techniques, some of which help advance wound healing, such as mechanical or surgical debridement, which is based on the removal of non-viable tissue using manual techniques<sup>(7)</sup>. However, this procedure should only be performed in the presence of adequate perfusion of the lesion, suspicion or evidence of biofilm in the wound bed. The most common techniques used for debridement of pressure ulcers are surgical/cutting, conservative cutting, autolytic, enzymatic, larval and mechanical<sup>(2)</sup>.

On the other hand, the lack of preventive measures taken by the team was also pointed out by nurses as a predictive factor for the risk of developing lesions. When untreated, pressure ulcers may reach an advanced stage as they evolve, thus the identification performed by nurses ensures early intervention determining the best therapy<sup>(7)</sup>.

Sometimes, there is no resolution of the pressure ulcer during hospitalization, and many patients are discharged from the hospital, requiring continuous assessments by the multi-professional team in specific outpatient clinics and even at home for follow-up treatment. In the category about appropriate management of therapies, some studies demonstrated effectiveness in treatment. One study described the effectiveness of a perioperative care protocol managed by the plastic surgery team for individuals with pressure ulcers, aiming for a short hospital stay to close the le-

sions in only one surgical moment. It is noteworthy that the treatment chosen for closure and correction was surgical<sup>(8)</sup>. Surgical intervention is recommended for individuals with stage 3 or 4 pressure ulcers that do not heal with adequate treatments, or for those who require faster ulcer closure<sup>(2)</sup>. The method of intervention selected in this study was debridement with wide bursectomy and scraping to clinically viable bone, with immediate reconstruction using a fascio cutaneous locoregional flap. The use of fascio cutaneous flaps has become routine in the service, since they provide adequate coverage, providing complete wound irrigation, with a good filling, besides providing better infection control<sup>(8)</sup>.

Another study also described the effectiveness of the treatment of stage 4 pressure ulcers through multidisciplinary work performed with a user at a Family Health Unit. The healing process was evaluated with the use of adequate dressings for the treatment. After assessing the lesion, the treatment instituted was cleansing with 0.9% saline solution and application of a hydrogel dressing on the bed of the lesion, essential fatty acids and barrier cream on the edges. Thus, they concluded that there was a significant improvement in the lesion healing process<sup>(9)</sup>. The use of hydrogel is recommended in the treatment of shallow and minimally exudative pressure ulcers, as well as dry beds of ulcers that are not clinically infected<sup>(2)</sup>.

In addition to the option for surgical treatment, the appropriate management of therapies was also evidenced in studies comparing the effectiveness of dressings used for the treatment of lesions. Currently, modern and effective technologies are available in the market, contributing to the appropriate management of therapy. The choice of the appropriate dressing provides very important advantages for wound management, the patient and the health care professional.

A case study described the effectiveness of a polyurethane dressing for the treatment of two stage 2 pressure ulcers. After removal by debridement of devitalized tissue present in the ulcer, the lesion was cleaned with 0.9% saline solution, with subsequent

application of this dressing to control the excess exudate. By changing the dressings three times a week, the presence of granulation tissue was observed, as well as a decrease in lesion size<sup>(10)</sup>. It is noteworthy that this study also adopted measures for maintenance of skin integrity, prevention of new lesions and nutritional support.

Also noteworthy is a multicenter randomized study involving 169 patients with stage 2 pressure ulcers that compared the efficacy of polyurethane dressings with hydrocolloid dressings. Corroborating the previous study, wound cleansing therapy with 0.9% saline solution was adopted. One group of patients was covered with the polyurethane dressings and the other group used the hydrocolloid dressings. The result revealed that the group of patients who used the polyurethane dressings showed a higher percentage of healing in the eight weeks of treatment in a shorter mean healing time when compared to the group that received the hydrocolloid dressing<sup>(11)</sup>. Foams are indicated for treatment in stage 2 pressure ulcers in the presence of exudate and in stage 3 with little depth. Gelling foams are recommended for highly exudative lesions<sup>(2)</sup>.

Polyurethane foams have a hydrophilic structure that controls fluid absorption by expanding the cells as it absorbs exudate and prevents leakage and maceration of the perilesional skin. They also have high capacity for autolytic debridement<sup>(11)</sup>. Hydrocolloids are indicated to treat stage 2 non-infected pressure injury in areas of the body free of dislocation or sinking<sup>(2)</sup>. Thus, the results support the use of polyurethane dressings for patients with stage 2 ulcers who are not terminal and who do not have type I diabetes in primary care and in long-term care because these dressings provide a higher healing rate, shorter healing time, and are preferred by patients and nurses<sup>(11)</sup>.

It can be understood that the appropriate management of therapies presented in this category involves the choice of treatment, which can be surgical or topical and with the use of new dressings. The follow-up of outpatient and home treatment was

highlighted as a strategy to monitor the evolution of lesions to define the most effective therapy, also considering the prevention of new lesion.

Several physical agents have been researched for the treatment of pressure ulcers. All of them confer some type of biophysical energy in order to stimulate healing. The most commonly used types of biophysical agents are energy from the electromagnetic spectrum; acoustic energy; mechanical energy<sup>(2)</sup>. A descriptive study conducted with three patients with stage 2 and 3 lesions evaluated the efficacy of electrical stimulation treatment by applying a high-frequency generator twice a week in a total of 16 sessions. The technique of sparking at 100.0% intensity was chosen for the study, and the cauterizing electrode around the entire perimeter of the lesion was placed one centimeter away from the tissue to promote sparking and avoid contact with the lesion and contamination of the electrode<sup>(12)</sup>.

The use of direct contact electrical stimulation is recommended to facilitate wound healing in recalcitrant stage 2 pressure ulcers as well as in stage 3 and 4 pressure ulcers<sup>(2)</sup>. The study highlighted the effectiveness of the electrical stimulation therapy after obtaining the following results: patient A (stage 2 lesion) had a 100.0% reduction of the lesion after 16 applications; patient B (stage 3 lesion) had a 64.5% reduction; and in-patient C (stage 2 lesion) a 100.0% reduction of the lesion extension occurred<sup>(12)</sup>.

The use of high-voltage electrical stimulation was noted in another study for the treatment of a pressure ulcer in the sacral region. It consisted of applying electrical stimulation to the ulcer three times a week, for a total of 12 sessions. During the treatment period, the ulcer did not present any type of infection. The study highlighted a progressive improvement related to the characteristics and aspects of the ulcer: the coloration remained reddish and the borders became more regular, demonstrating a favorable environment for healing. These observed changes are expected, since electrical stimulation favors angiogenesis, reducing

inflammation, therefore, evolving to the process of tissue remodeling<sup>(13)</sup>.

Another modality of therapy using biophysical agents is ultrasound. A randomized clinical study using 30 patients divided into two groups evaluated the effect of continuous ultrasound therapy on the healing of pressure ulcers. A significant reduction in the time from stage 2 and 3 ulcers to stage 0 was observed in the study group. Thus, it was concluded that ultrasound is effective and has been used to increase blood flow, secondarily increasing oxygen supply and macrophages to the area<sup>(14)</sup>. The effective use of this therapy is not fully understood in the literature, mainly due to the small number of randomized studies on this treatment.

It is understood that therapies with biophysical agents are used in clinical practice as treatment for pressure ulcers. Although some case studies have shown some degree of effectiveness, the use of these resources should be cautious and supervised by trained professionals, since there are no records of robust scientific evidence that prove the total effectiveness of their use.

When it comes to unconventional therapies, one study evaluated the efficacy of *Lucilia sericata* larvae in 33 patients with stage 2 and 3 pressure lesions that were resistant to other conventional therapies. Thus, of the total, 29 ulcers were healed in four to eight applications of larvae over a short duration (one to two months). Seven wounds healed in three to four months with 10 to 14 applications. The necrotic tissues were completely removed. The odor of the wound disappeared after the larval application. It was therefore concluded that this therapy is rapid, inexpensive, and can be used successfully to treat ulcers regardless of the underlying cause<sup>(15)</sup>.

Plants are also employed in the treatment of diseases, including wounds and skin conditions. An observational clinical cohort study was found that evaluated the therapeutic benefits of the bioactive extract of *Calendula officinalis* in the treatment of

pressure ulcers. Forty-one patients with ulcers were evaluated biweekly for 30 weeks. The liquid healing agent based on the active ingredient *Phytolenus Plenusdermax*<sup>®</sup>, for topical use by spray, was applied twice a day, after previous cleansing of the lesion with sterile saline solution. Regarding healing time, a minimum of eight weeks was required for complete healing of the lesions, and after 30 weeks, 88.0% of the wounds were completely healed. No adverse events were observed during treatment. In the overall context, these elements show that *Plenusdermax*<sup>®</sup> favors the healing of chronic injury through its antimicrobial and anti-inflammatory action, effective for the prevention of tissue damage<sup>(16)</sup>.

In addition to plant extracts, another product widely used since ancient times and with diverse therapeutic properties is honey. Dressings impregnated with clinical grade honey are recommended for the treatment of stage 2 and 3 pressure ulcers, ensuring the possibility of patient allergies to the product. Appropriately irradiated honey-based products can be safely used by people allergic to bees or bee stings<sup>(2)</sup>.

A case study described the treatment of a patient with stage 3 and 4 pressure ulcers treated with natural honey produced by bees native to the Primorsky Krai region of Russia. The natural honey was applied to the lesions daily. By the sixth week, a further 80.0% reduction of the lesion was observed, and the lesions were fully healed within 3 months of treatment. The study concluded that the use of natural honey in the treatment of the lesions provided a moist environment, improving granulation, inhibiting bacterial growth and preventing colonization in both wounds. It also highlights the possibility of treating these stages 3 and 4 lesions in primary care, thus reducing expenses, improving quality of life and avoiding hospital infections<sup>(17)</sup>.

Another treatment modality found when discussing non-conventional therapies for pressure ulcer treatment is Topical Oxygen Therapy. A pilot study was conducted with 18 patients with pressure ulcers

and used topical application directly on the lesion of a hemoglobin spray - Granulox at each dressing change for four weeks. The percentage of granulation tissue prior to the spray was found to range from zero to 100.0%; exudate levels decreased in all 18 wounds after the spray was introduced. All patients reported an improvement in pain score during evaluation. Although the clinical benefits of the spray are clearly evident in this and previous studies, the small sample size studied constitutes weak evidence for the efficacy of the product<sup>(18)</sup>.

Corroborating this thought, the routine use of topical oxygen therapy for the treatment of pressure ulcers is not recommended due to the scarcity of scientific evidence to support or challenge its use<sup>(2)</sup>. Therefore, although these studies have achieved effective results for the treatment of pressure ulcers, they are insufficient to ensure the broad and safe use of these therapies.

## Conclusion

Pressure ulcer treatment is broad and has progressively been the target of several researches for the discovery of new therapeutic modalities. Even with the emergence of new technologies related to dressings and devices, it can be noticed that products that were used since ancient times are currently in the scope of some studies, even if in an incipient way. The articles analyzed reflect on the use of some therapies and strategies to treat pressure ulcers. It is noteworthy, therefore, that these studies, although they have achieved effective results for the treatment of pressure ulcers, are insufficient to ensure the wide and safe use of these therapies.

## Collaborations

Azevedo RF, Garcia RMP, and Calasans MT contributed to the design of the project, analysis and interpretation of the data, writing of the article, relevant critical review of the intellectual content, and final approval of the version to be published.



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