



PARANINFO DIGITAL

MONOGRÁFICOS DE INVESTIGACIÓN EN SALUD

ISSN: 1988-3439 - AÑO VII – N. 19 – 2013

Disponible en: <http://www.index-f.com/para/n19/171d.php>

PARANINFO DIGITAL es una publicación periódica que difunde materiales que han sido presentados con anterioridad en reuniones y congresos con el objeto de contribuir a su rápida difusión entre la comunidad científica, mientras adoptan una forma de publicación permanente.

Este trabajo es reproducido tal y como lo aportaron los autores al tiempo de presentarlo como COMUNICACIÓN DIGITAL en "CUIDADOS Y TECNOLOGÍA: UNA RELACIÓN NECESARIA" I Congreso Virtual, IX Reunión Internacional de Enfermería Basada en la Evidencia, reunión celebrada del 21 al 22 de noviembre de 2013 en Granada, España. En su versión definitiva, es posible que este trabajo pueda aparecer publicado en ésta u otra revista científica.

Título **Negative pressure therapy vs. moist wound healing in chronic wounds: A systematic review**

Autores Rui Pedro *Gomes Pereira*, João Manuel *Pimentel Cainé*,
Maria de Oliveira *Carvalho Rito*

Centro/institución Nursing School, University of Minho

Ciudad/país Braga, Portugal

Dirección e-mail ruipereira@ese.uminho.pt

RESUMEN

Background: Wound healing is a complex process which results in the demand for repair and restoration of the functionality of the tissues. The failure of this process presents as a challenge raising the need to search for new techniques to treat the wound.

Methods: We conducted a systematic review through several databases and repositories, using the MeSH terms: "negative pressure/NPWT/vacuum assisted closure/VAC/VAC therapy/wound healing/chronic wounds/moist wound healing". The selection criteria were based on relevance, methodology and current level of evidence.

Results: The study provides a quantitative comparison of negative pressure wound therapy and moist wound healing in chronic wounds, using data about the healing time and variations in the dimension of wounds.

Discussion: Data analysis indicates the negative pressure therapy as the most effective in reducing the size of the wound, thus allowing shorter total healing as compared with moist wound healing.

Conclusion: There is evidence supporting negative pressure wound therapy's efficacy but it is important to carry out further experimental studies for evaluating the effectiveness of its wider implementation.

TEXTO DE LA COMUNICACIÓN

Introduction

A chronic wound characterized by poorly healing is a great challenge, both for the patient and for health professionals, often becoming an important factor in reducing the quality of life of the individual and increasing the costs in the Health Care Systems. The treatment of such wounds requires from health care professionals knowledge, experience and training in the use of dynamic tools and updated in treating the wound.^{1,2} Negative Pressure Therapy (NPT) has contributed to improved results in the treatment of wounds leading to great changes in clinical practice over the last decade.³

This is a technique defined by creating a negative pressure environment in the wound bed by the use of a mechanical device. This stimulates blood flow which allows a faster granulation, removal of exudates and other debris and more effective approximation of edges.⁴

This review finds its relevance in need to appropriate and incorporate more complex techniques such as NPT in daily practice of health professionals as they face emerging challenges.

In this sense it manifests itself as an objective to understand which mean healing time / oscillation of the dimensions of chronic wound when applied to NPT as well other therapies already widespread as Moist Wound Healing (MWH).

The starting point for this systematic review was based on the following research question:

In patients with chronic wounds which mean healing time / fluctuation in the dimensions of the wound in the application of Negative Pressure Therapy compared to Moist Wound Healing?

For formulation of the research question was used Model Patient / Problem, Intervention, Comparison, Outcome, Design (PICOD) according with Table 1.

Table 1. *Research question decomposed according to the PICOD model*

P	Patients With Chronic Wounds
I	Negative Pressure Therapy
C	Moist Wound Healing
O	The mean healing time / oscillation in the dimensions of the wound
D	Experimental studies, reviews of experimental studies and guidelines

Methodology

We conducted a systematic literature review to verify the effectiveness of the NPT compared to MWH in the healing process of chronic wounds. The research was oriented to guidelines, experimental studies and systematic reviews of experimental studies (with

or without meta-analysis), comparing the NPT vs. MWH published between the period 1 January 2007 and 27 June 2012.

Electronic databases were systematically analyzed: EBSCOHOST (CINAHL Plus with Full Text; MEDLINE with Full Text; Cochrane Database of Systematic Reviews; MedicLatina; Academic Search Complete), Scopus and ISI Web of Knowledge, using the MeSH terms and the following keywords in Portuguese, English and Spanish:

- “pressão negativa / terapia por pressão negativa / NPT / cicatrização/cicatrização em meio húmido / feridas crónicas”;
- “negative pressure / NPT / vacuum assisted closure / VAC / VAC therapy / wound healing / chronic wounds/moist wound healing”;
- “terapia de presión negativa / presión negativa / cicatrización / cicatrización en ambiente húmedo / heridas crónicas”.

The research has extended to sites like “Wounds International” and repositories: Open Access Scientific Repository of Portugal, Open Repository of University of Minho and the System for Information on Grey Literature in Europe (SYGLE).

The results of the survey [*Figure 1*] revealed 1371 studies of which 124 were excluded for showing up in duplicate. Of the remaining (1247), we selected only those that were available in open access (248).

These were subjected to a first test of evidence that included the following questions dichotomous response (yes / no):

- The paper addresses the topic of research interest (NPT)?
- The study was published in selected language (Portuguese, English and Spanish)?
- This is a study that directly involves humans as subjects?
- The study is directed to the selected population (age ≥ 18)?
- The study was directed to the treatment of chronic wounds?
- The methodology is clearly described?

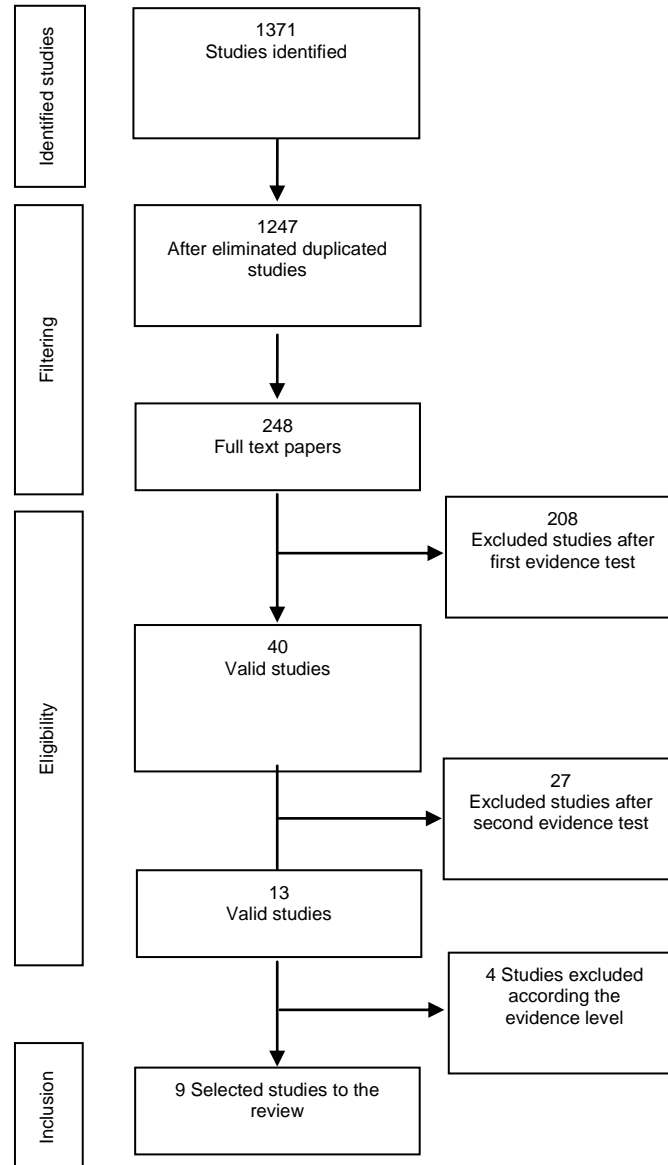
Through an affirmative answer to all the above items we incorporated 40 studies for consideration in the second test of evidence.

This was implemented through the studies analysis by two researchers independently, and in case of disagreement in the evaluation, discussed with a third researcher. Through this test were excluded studies that primarily addressed the following topics:

- Pre / post- operative excerpts;
- Pain and quality of life;
- Studies of cost / benefit analysis;
- Revisions to experimental studies of low quality;
- Preparation for surgery;
- Studies of application security;
- Infected wounds and infection;
- Wounds post amputation.

At this stage of the analysis process remaining 13 studies. Of these, two studies were excluded for low degree of scientific evidence. To validate the remaining papers we used the AGREE II⁵ instrument, PRISMA STATEMENT⁶ and CONSORT 2010⁷, which were applied by five researchers independently. As a result of using the AGREE II two guidelines with lower scores were excluded.

Figure 1. Selection of studies flowchart based on the proposal of PRISMA Statement (2009)



Results

There were selected studies comparing healing process between TNP and MWH in chronic wounds, addressing specific data on healing time and wound dimensions over the period analyzed. Pressure ulcers and diabetic foot ulcers are classified as chronic wounds and were included in the sample. Thus, the analysis includes a comprehensive picture of the studies conducted in patients with TNP. The *table 2* contains summarized data concerning the healing time and the dimensions of the wound in the two types of treatment.

Table 2. Studies findings synthesis

Studies	Healing time	Wound dimensions
Xie, McGregor, Dendukuri (2010)2	Diabetic Foot NPT (days) – 23 MWH (days) – 43	Diabetic Foot ulcers Depth NPT (%/day) = -0.9 MWH (%/day) = -0.1 Volume NPT (%/day) = -1 MWH (%/day) = 0 Ulcers pressure Depth NPT (%/day) = -0.8 MWH (%/day) = -0.7 Volume NPT (%/day) = -1.2 MWH (%/day) = +1 Length NPT(%/day) = -0.8 MWH(%/day) = -0.5 Width NPT(%/day) = -1 MWH(%/day) = -0.5
Lavery, Boulton, Niezgoda, Sheehan (2007)8	Diabetic foot Follow-up 12 weeks NPT – 23.9% of wounds healed MWH – 39.5% of wounds healed Follow-up 20 weeks NPT – 32.8% of wounds healed MWH – 46.3% of wounds healed	No data
Suisa, Danino, Nikolis (2011)9	NPT (days) – 22.8 (average); 45; 56; 16; 29 (median). MWH (days) – 42.8 (average); 56; 77; 20; 45 (median).	Área NPT (%/day) = -1.2; -1.1; -1.3; -0.3; -0.7 MWH (%/day) – +0.4; -0.8; +0.1; -0.3; +0.2 Volume NPT (%/day) = -4.2; -1.9; -1.2; -1.3 MWH (%/day) – 0; -0.7; -1; -1.5
Boogaard, Laat, Spauwen, Schoonhoven (2008)10	Pressure Ulcers NPT (days) – 16; 6 MWH (days) – 20; 7	Pressure Ulcers Volume NPT(%) = -57; -78 MWH (%) = -42; -30
Noble-Bell, Forbes (2008)11	Diabetic foot ulcers NPT – 21 days earlier then MWH NPT - 20 days earlier then MWH	Diabetic foot ulcers Depth NPT (%/day) = -1.8 MWH (%/day) = +0.3 Volume NPT (%/day) = -2.1 MWH(%/day) = 0 Length NPT (%/day) = -1.5 MWH (%/day) = +0.2 Width NPT (%/day) = -0.5 MWH (%/day) = +0.1 Area NPT (%/day) = -0.6; -0.3; -0.8 MWH (%/day) = +0.2; -0.1; -0.4
Ubbink, Westerbos, Nelson, Vermeulen (2008)12	Diabetic foot NPT (days) – 22.8 MWH (days) – 42.8	Diabetic foot Area NPT (cm2) = -109 to -88.4 MWH (cm2) = -94.8 to -85.3 Pressure Ulcers Volume NPT (%) = -51.8 MWH (%) = -42.1
Nain, Uppal, Garg, Bajaj, Garg (2011)13	Diabetic foot ulcers Follow-up 4 weeks NPT – 60% wounds healed MWH – 20% wounds healed	Diabetic foot ulcers Follow-up 4 weeks Area NPT (cm2) = -16.14 MWH (cm2) = -5.9
Nakayama (2010)14	Pressure ulcers NPT – 56.3 days wounds healed MWH – 1 a 72 months without healing results	No data

For a better understanding and comparison of the data relating to the size of the wound we defined it as the amount of oscillation in relation to the percentage of surface area / volume / depth / length / width per day. Three studies¹⁰⁻¹³ have values for the total time of healing, however do not provide behavioral values by calculating the average / size percentage per day, presenting areas in cm² measures^{12,13} and fluctuation in volume percentage.^{10,12} Are not mentioned in these studies the initial dimensions of the wounds or the time it is performed the evaluation, so it is not possible to set a daily value, which prevents the comparison. Two studies^{8,14} do not provide data related to the dimensions of the wound. All selected studies produce data concerning the healing time.

Discussion

For conducting this review we selected nine studies of scientifically relevant (one guideline, two systematic reviews with meta-analysis, four systematic reviews and two experimental studies), which produced a comparison between NPT and MWH in chronic wounds.

Diabetic foot

One study⁸ indicates that after 12 weeks of treatment the percentage of healed wounds is 39.5% when used NPT as opposed to 23.9% for group with MWH. The study revealed that even after 20 weeks of treatment with NPT the percentage of healing of wounds is 46.3% as opposed to 32.8% with MWH. Another study¹³ also compares the percentage of wounds healed after 4 weeks with favorable results for the NPT 60% to 20% similarly to HMR. Two studies show the average number of days until healed 20 days², 12 and 21 days¹¹ difference in healing, favorable for NPT.

The variations in the dimensions of the wounds are presented in synthesis [Table 3] having considered the extreme values for all variables.

Table 3. Wound dimensions (diabetic foot ulcer)

Wound dimension	NPT (%/day)	MWH (%/day)
Area	-0.8 to -0.3 5	-0.1 to +0.2 5
Volume	-2.1 to -1 3,5	0 3,5
Depth	-1.8 to -0.9 3,5	-0.1 to +0.3 3,5
Length	-1.5 5	+0.2 5
Width	-0.5 5	+0.1 5

Pressure Ulcer

For the healing time a study¹⁰ relates averaging 6 to 16 days for NPT for 7 to 20 days to MWH. A different study⁸, after checking the ineffectiveness of MWH (1 to 72 months) have started NPT with positive results obtained in 56.3 days. Using the same format, the variations in the dimensions of the wounds are also presented in synthesis [Table 4] having considered the extreme values for all variables.

Table 4. *Wound dimensions (pressure ulcer)*

Wound dimension	NPT (%/day)	MWH (%/day)
Volume	-1.2 3	-13
Depth	-0.8 3	-0.73
Length	-0.8 3	-0.53
Width	-1 3	-0.53

Chronic Wounds

One study⁹ did not differentiate between chronic wounds, presenting healing time between 16 and 56 days for the NPT and from 20 to 77 days for MWH. Once again, the variations in the dimensions of the wounds are presented in synthesis [Table 5] having considered the extreme values for all variables.

Table 5. *Chronic wounds dimension*

Wound dimension	NPT (%/day)	MWH (%/day)
Area	-1.3 to -0.3 2	-0.3 to +0.4 2
Volume	-4.2 to -1.2 2	-1.5 to 0 2

In all studies, it was found unanimously a decreased time to healing of chronic wounds using NPT compared with MWH. Regarding the wound area was analyzed in this study of patients with wounds of mixed etiology⁹ and the study of patients with diabetic foot ulcer¹¹ we verified a higher decrease in wound area in patients subjected to NPT compared with MWH. The volume was evaluated in five trials^{2,9-12} and we observe that the MWH led to a lower reduction in volume of the wound. Regarding the depth of the wound, in the study of patients with pressure ulcers² data are not statistically significant, but in patients with diabetic foot ulcers in two studies^{2,11} there are greater decrease in depth of wounds in patients receiving NPT. As the length showed that in patients with diabetic foot ulcers^{2,11} NPT had healed wounds percentages more favorable compared with MWH. In pressure ulcers differences between groups were not significant. The width of the wounds was observed in two studies^{2,11} evidencing that in diabetic foot ulcers an increase in the width of the wound MWH in patients with pressure ulcers are not significant differences between the two groups treatment. The guideline¹⁵ analyzed refers to the types of wounds that may be effective NPT with relation to MWH, checking that in chronic wounds such as pressure ulcers (grade III and IV), diabetic foot ulcers and venous ulcers (very exuding), this therapy can be effective in controlling exudates, stimulation of granulation tissue and increased healing rate.

Limitations of the review

Some of this study limitations are related to the lack of comparability of data obtained in some of the studies analyzed and therefore cannot be extrapolated. Some studies showed figures for the total time of healing, however, did not provide data that supports the calculation of average / percentage of dimensions per day, exposing areas results in cm² and volume changes in percentage terms. Another limitation is that some of the studies do not provide outcomes representative of the dimensions of the wound.

Conclusions

Wound care is often complex and lengthy, sometimes confusing and often very expensive. However, the enormous advances in perception of processes and phenomena involved in various stages of healing and the constant development of technologies have enhanced these processes. However, the incidence and prevalence of chronic wounds is still extremely high particularly in the most disadvantaged populations.

The results of this systematic review suggest that there is scientific evidence about the use of NPT in reducing the mean time to healing in chronic wounds. However, given the variety of the studies designs and findings considered to be necessary to make for further experimental studies that comparing NPT with MWH in chronic wounds. In this regard future studies should be considered with controlled and randomized samples, determining also a higher accuracy of the benefit of these treatments.

In short term, the most important challenge in the treatment of chronic wounds is a differential diagnosis, the definition of an appropriate strategy considering the intrinsic and extrinsic factors of the person, taking into account the responsible management to achieve positive results.

Bibliography

1. Casey G. Chronic Wound Healing: Leg Ulcers. Kai Tiaki Nursing, Vol. 17, p. 24-9, 2011.
2. Xie, X, McGregor M, Dendukuri N. The clinical effectiveness of negative pressure wound therapy: a systematic review. *Journal of Wound Care*, vol. 19, p. 491-97, 2010.
3. Harding K. Vacuum assisted closure: recommendations for use. *International Wound Journal*, vol. 5, sup. 4, 2008.
4. Dealey C. Tratamento de Feridas: Guia para Enfermeiros, 1^a ed., Lisboa, Climepsi, 2006.
5. Brouwers M, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, Fervers B, Graham ID, Grimshaw J, Hanna S, Littlejohns P, Makarski J, Zitzelsberger L. For the AGREE Next Steps Consortium. AGREE II: Advancing guideline development, reporting and evaluation in healthcare. *Can Med Assoc J*. 2010.
6. Moher D, Liberati A, Tetzlaff J, Altman DG. The PRISMA Group. The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *PLoS Med* 6(7): e1000100. 2009.
7. Schulz KF, Altman DG, Moher D. For the CONSORT Group. CONSORT 2010 Explanation and Elaboration: updated guidelines for reporting parallel group randomized trial. *BMJ* ;340:c869. 2010.
8. Lavery Y, Boulton A, Niezgoda, Sheehan P. Comparison of diabetic foot ulcer outcomes using negative pressure wound therapy versus historical standard of care. *International Wound Journal*, vol. 4, p. 103-13, 2007.
9. Suissa D, Danino A, Nikolis A. Negative-pressure therapy versus standard wound care: a meta-analysis of randomized trials. *Plastic Reconstructive Surgery Journal*, vol. 128, p. 498-503, 2011.
10. Boogaard M, Laat E, Spauwen P, Shoonhoven L. The effectiveness of topical negative pressure in the treatment of pressure ulcers: a literature review. *European Journal of Plastic Surgery*, vol. 31, p. 1-7, 2008.

11. Noble-bell G, Forbes, A. A systematic review of the effectiveness of negative pressure wound therapy in the management of diabetes foot ulcers. *International Wound Journal*, vol. 5, p. 233-42, 2008.
12. Ubbink DT, Westerbos SJ, Nelson EA, Vermeulen H. A systematic review of topical negative pressure therapy for acute and chronic wounds. *The British Journal Of Surgery*, vol. 95, p. 685-92, 2008.
13. Nain, P, Uppal SK, Garg R, Bajaj K, Garg S. Role of Negative Pressure Wound Therapy in Healing of Diabetic Foot Ulcers. *Journal of Surgical Technique and Case Report*, vol. 3, p. 17-22, 2011.
14. Nakayama M. Applying negative pressure therapy to deep pressure ulcers covered by soft necrotic tissue. *International Wound Journal*, vol. 7, p. 160-6, 2010.
15. Bollero, D; Driver, V; Glat, P. The role of negative pressure wound therapy in the spectrum of wound healing. *Ostomy Wound Management*, vol. 56, sup. 5, 2010.