Combination of Wound Treatment and Massage for Healing Diabetic Foot Ulcers

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Abstract

Background: Diabetic ulceris also called diabetic foot ulcers, estimated that 25-50% of cases of diabetic ulcers are a common reason to be hospitalized, and 1 out of 7 patients with Diabetic Mellitus will be experienced diabetic ulcers throughout their lifetime. This study aimed to determine the effect of combination of wound treatment and massage for healing diabetic foot ulcers in Magelang, Central Java, Indonesia.

Method: Method of this research is a true experimental design. True experimental design, pre-and posttest with control group. There were two groups in the research, treatment group and control group. The treatment group received wound treatment and massage while the control group only got wound treatment. The total number of respondent was 42. A t-test was employed to determine if there is a significant difference between treatment and control group.

Results: It is resulted that in the first three weeks of the study, there was no differences of wound healing progress between treatment and control group. The significance difference was in the fourth week ($p = 0.013$, $t= 2.591$). The average mean in the treatment group was 8.81 while in the control group was 11.29.

Conclusions: The combination of wound treatment and massage is very effective for healing diabetic ulcer wounds. It is recommended to apply massage to areas of the extremity that are prone to neuropathy to prevent complications, especially diabetic ulcers.

Keywords: *Wound treatment, massage therapy, DM, diabetic ulcer.*

Introduction

Diabetes ulcer is a complication that often occurs in diabetes mellitus (DM), which has a complex impact and causes a real disability for sufferers.[1,2] It is estimated that 25-50% of diabetic ulcers cases asa common reason for patients with DM to be hospitalized, and 1 out of 7 patients with DM will be experienced diabetic ulcers throughout their lifetime. More than 40-70% of cases of limb amputation were associated with DM due to diabetic ulcers. It also has an impact on reducing the quality of life of sufferers, the health service system and the community.[3]Patients with DM are prone to diabetic ulcers, but the healing phase is long, this is caused by many factors, including the thin layer of subcutaneous and skin layers in the legs, slowing blood flow to the peripheral, the amount of blood resistance due to micro-angiopathy and neuropathy.[2,5] Treatment of diabetic foot ulcers includes debridement of the wound to remove necrotic tissue and impurities in the wound, management of infection with antibiotics, revascularization if indicated, and wound off-loading, and amputation. The presence of neuropathy results in obstruction of the conduction system and demyelinisasi of the nervous system. Peripheral nerve disorders that affect all limbs of the patient's body, but which often affects in general is the lower extremities that can cause problems in the cutaneous system, namely the occurrence of diabetic ulcers.[3,6]

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Wound treatment with a combination of massage therapy in diabetic ulcers can overcome the presence of ischemic and neuropathic diseases, so it can improve peripheral tissue perfusion by increasing blood circulation to the periphery, transporting oxygen and nutrients to the peripheral/distal area which has slowed wound healing in DM with diabetic ulcer.[1,2,4]

Massage therapy is effective in the healing process of diabetic ulcer wounds, especially in wounds that have a delayed healing phase due to neuropathy and decreased perfusion impact of micro-angiopathy.[7]It can stimulate and facilitate the blood flow and oxygen supply to the wound area, so that the environment of the wound area gets enough oxygen and has an impact on wound circulation and stimulates the wound healing process, especially in the inflammatory phase to proliferation.[1,4,8,9]

Method

Study Site: The study was conducted in some selected hospitals in Magelang, Central Java, Indonesia. The respondents were selected in the home care, surgical clinic of the hospitals.

Study Setting: This research used true experimental design, pre-test-post-test control group design. There were two groups in the research, treatment group and control group. The criteria to select subject as the control group if the respondent has ulcers that cannot be combined with a massage due to the location of the ulcers such as on the buttocks, head and thigh area. While the criteria for the treatment group if the respondent has ulcers on the upper part of the proximal area, in this case ulcers in the distal area of the upper or lower extremities. The treatment group received wound treatment and massage while the control group only received wound treatment.

Data collection procedure: To be selected as the subject of the study, authors used inclusion criteria, which were DM patients with diabetic foot ulcers; the condition of diabetic foot ulcers was in grade 1-3; patients with insulin and HbA1C level more than 5.7%. Respondents who met the inclusion criteria were divided into treatment and control group. The total number of respondents were 40 people.

The treatment and control group were assessed every week as long as four weeks. The adjustment of four weeks due to determine the effectiveness of combined massage therapy in diabetic foot ulcers that have delayed wound healing, this occurs due to neuropathy and decreased perfusion impact of micro-angiopathy. The massage therapy by using electric water massage with continuous pressure. The time used for massage as long as 15 minutes, where the massage water will automatically stop after 15 minutes. The pressure used when conducting massage should be adjusted to the thickness of the patient's skin. The massage procedure is conducting every three days, and the evaluation of the development of the wound condition is conducting every week.

Data and statistical analysis: A t-test was employed to determine if there is a significant difference between treatment and control group. The study used 95% confidence interval (CI), and significance was assessed at alpha 0.05. The difference of wound healing condition was assessed every week for four weeks.

Ethical consideration: The study was approved by the Health Research Ethics Committee *Poltekkes Kemenkes Semarang* (No: 248/EA/KEPK/2020). We conducted the study with agreement of the respondents. The aims, risks, and benefits of the study were explained to each participant, and they were asked to sign a consent form prior to enrolment in the study. All personal information of the respondents involved in the study have been kept confidential.

Results

In the first three weeks of the study, there was no differences of wound healing progress between treatment and control group. The significant differences in the two groups can be seen in the week four.

Table 1. The condition of wound healing (n= 40) every week for 4 weeks

Week	Group	Mean	SD
1	T (n= 20)	15.95	3.217
	C (n= 20)	17.62	3.413
2	T (n= 20)	14.14	3.245
	C (n= 20)	15.86	3.005
3	T (n= 20)	11.81	3.043
	C (n= 20)	13.71	3.289
4	T (n= 20)	8.81	2.839
	C (n= 20)	11.29	3.334

Table 2. The progress of wound healing between treatment group and control group

Week	df	Sig
1	40	0.111
	39.86	0.111
2	40	0.083
	39.77	0.083
3	40	0.058
	3976	0.058
4	40	0.013
	39.01	0.013

Discussion

Massage therapy in this study was not indicated to the wounds in the inflammatory phase because the pressure of the massage can cause damage to new blood vessels, bleeding and damage to fibrin tissue, as well as damage to new tissue in the wound. The study resulted that the combination of wound treatment and massage therapy is effective in the healing process of diabetic foot ulcers.

Figure 1. The condition of diabetic foot ulcers of respondent after four weeks of treatment

In the fourth week of the healing progress, the wound enters the phase of proliferation, it is the re-epithelialization process, the formation of collagen synthesis and angiogenesis.[10] Angiogenesis acts as a nutrient and oxygen carrier which is a component needed for the process of repairing injured skin tissue. In the area of injury, *phobroblasts* produce collagen and *glycosaminoglycans* and proteoglycans which are the main components of extra cellular matrices.[8,9,11]

Massage therapy is effective in the healing process of diabetic ulcer wounds, especially in wounds that have a delayed healing phase, especially in diabetic ulcers due to neuropathy and decreased perfusion impact of micro-angiopathy.[8,9]Massage therapy can stimulate and facilitate blood flow and oxygen supply to the wound area, so that the environment of the wound area gets enough oxygen and has an impact on wound circulation and stimulates the wound healing process, especially in the inflammatory phase to proliferation.[1,4,8,12]

Massage therapy can increase skin temperature in the treated body area. The increase of body temperature indicates the increase of blood flow to the treated area.[1,12–14] The increase of blood flow causes an increase of oxygen and nutrients to the area of the body being intervened.[12]When massage is applied to the threatened area, the blood flow will increase to other organs. This is useful to improve muscle performance and wound healing process in the area of injury. With massage

can affect blood vessels with superficial blood vessel dilatation and increase average blood flow. When massage is applied to an area of the body, the blood flow will increase to other body organs.[15]

Conclusion

The combination of wound treatment and massage is very effective for healing diabetic ulcer wounds especially in wounds that have a delayed healing phase. It is recommended to apply massage to areas of the extremity that are prone to neuropathy to prevent complications, especially diabetic ulcers. For nurses and patients in massage therapy with water massage/electric massage is expected to pay attention to the pressure in the system according to the thickness of the patient's skin so as not to hurt if high pressure.

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Conflict of Interest: None

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References

1. Tsourdi E, Barthel A, Rietzsch H, Reichel A, Bornstein SR. Current Aspects in the Pathophysiology and Treatment of Chronic Wounds in Diabetes Mellitus. BioMed Res Int Pathog. 2013;2013:1–6.
2. Singh N, Armstrong DG, Lipsky BA. Preventing Foot Ulcers in Patients With Diabetes. Clin Rev. 2005;293(2):217–28.
3. Mendes AL, Junior VH, Miot HA. Diabetes mellitus and the skin. An Bras Dermatol. 2017;92(1):8–20.
4. Hajtalebi H, Iurigh HK, Hajtalebi HR. Case Report Treatment of Diabetic Foot Ulcer in a 58-year-old Turkman Patient based on Iranian Traditional Medicine. Trad Intrgr Med. 2016;1(4):151–9.
5. Jeffcoate WJ, Vileikyte L, Boyko EJ, Armstrong DG, Boulton AJM. Current Challenges and Opportunities in the Prevention and Management of Diabetic Foot Ulcers. Diabetes Care. 2018;41(April):645–52.
6. Ji L, Bai J, Sun J, Wang Z. ScienceDirect Nursing care for diabetic toe ulcers: A case series report and literature review. Int J Nurs Sci. 2016;3:1–5.
7. Isworo A, Suharsono, Sitepu FY. The relationship between psychoeducation and the decrease in family burden of diabetes mellitus patients, Magelang, Indonesia. Indian J Public Heal Res Dev. 2019;10(8):1940–4.
8. Cohen M. The Effectiveness of Massage Therapy. 2014.
9. Chiro-Med Rehab Centre. How can massage therapy improve your circulation? [Internet]. 2020 [cited 2020 Jun 30]. Available from: https://www.chiro-med.ca/article/how-can-massage-therapy-improve-your-circulation/
10. Sitepu FY, Depari E, Aditama W, Halim R, Isworo A, Hot B, et al. A Survey of the Knowledge of Surveillance Officers and Outbreak Investigation Team toward COVID-19 in North Sumatera Province, Indonesia. Open Access Maced J Med Sci. 2020;8(T1):55–60.
11. Aumiller WD, Dollahite HA. Pathogenesis and Management of Diabetic Foot Ulcers. JAAPA. 2015;28(5):28–34.
12. Soto PA, Eberman LE, Demchak TJ, Peebles C. Comparison of Blood Flow Changes with Soft Tissue Mobilization and Massage Therapy. J Altern Complement Med. 2014;20(12).
13. Cristina A, Gonzalez DO. Wound healing - A literature review. An Bras Dermatol. 2016;91(5):614–20.
14. Okonkwo UA, DiPietro LA. Diabetes and Wound Angiogenesis. Int J Mol Sci. 2017;18(7).
15. Silva NCM da, Chaves E de CL, Carvalho EC de, Carvalho LC, Iunes DH. Foot reflexology in feet impairment of people with type 2 diabetes mellitus: randomized trial 1. Rev Latino-Am Enferm. 2015;23(4):603–10.