The Effect of Ozone Therapy Stimulation on Diabetes Wound Healing Process

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Abstract

Health problems that are currently developing include diabetes mellitus (DM) with various complications including diabetic ulcers. Diabetic ulcers are the main cause of prolonged pain and even amputation in DM patients. Diabetic wounds are a complication of diabetes that often occurs in the extremities, increasing morbidity and lessens the patient's personal satisfaction. Ozone therapy is one method used to speed up the healing process for diabetic ulcers. This study plans to examine the impact of ozone treatment feeling on diabetic injury mending. The exploration strategy utilizes a semi exploratory technique with a pretest and posttest non-identical benchmark group plan. The testing strategy is a non-likelihood inspecting method.The population in this study were all patients suffering from diabetic wounds who received wound care at the Edwcare clinic in Langsa city. The respondents of this study were patients suffering from diabetic wounds who received wound care at the Edwacare wound care center in Langsa City, Indonesia consisting of 28 respondents who received modern wound care dressings and 28 respondents received wound care combined with modern dressings and ozone therapy. The research instrument for assessing wound severity used the Bates-Jensen Wound Assessment Tool. Data analysis used the Friedman and Kruskal Wallis tests. Based on the research results, it was found that there was a more significant effect between wound care using a combination of modern dressings and ozone therapy with a Mean Rank value of 39.75 compared to wound care that only received modern dressing wound care with a Mean Rank value of 17.25 with a value of p -value <0.05. The conclusion is that the effect of ozone stimulation significantly influences the healing process of diabetic wounds and is recommended as a nursing intervention that can be applied in treating diabetic wounds.

Keywords: Diabetes mellitus, diabetic wounds, ozone therapy, stimulation

INTRODUCTION

Diabetes mellitus is a significant medical condition overall that has impacted the existences of many individuals all through the world. This chronic metabolic disorder, which is also referred to as the "mother of all diseases," is characterized by high blood glucose levels as a result of the pancreas not producing enough insulin, which has a long-term negative impact on health (Berbudi et al., 2019; Burgess et al., 2021). The prevalence of diabetes (DM) has significantly increased over the past few decades, primarily as a result of the ongoing rise in the incidence of type 2 DM. As per World Wellbeing Association measurements, in excess of 422 million grown-ups overall experienced DM in 2014 and the commonness of DM is supposed to increment. increase. keep on expanding (Lovic, 2020).

The Internasional Diabetes Federation estimates that on 2021, as many as 537 million people will experience the ill effects of diabetes, and this number is supposed to reach 643 million out of 2030, and 783 million out of 2045.Indonesia is in third place in the Southeast

Asia region with prevalence was 11.3%. The World Health Organization (WHO) estimates that the number of DM sufferers in Indonesia is high, namely 8.4 million in 2000, experiencing a spike of around 21.3 million in 2030. The World Diabetes Association also estimates that the prevalence of DM will rise from 9.1 million in 2014 to 14.1 million in 2035 in Indonesia (Resti & Cahyati, 2022).

Diabetic foot ulcers (DFU) have turned into a significant medical condition in diabetes patients (Akhtar et al., 2022). DFU are one of the main complications and causes of morbidity in diabetes patients (Dadfar et al., 2023; Silva et al., 2021). Diabetic foot ulcers can also cause decreased functional status, infection, hospitalization, non-traumatic amputation and even death (Anzali et al., 2023; McDermott et al., 2023; Ozturk & Kocyigit, 2023). It is estimated that impaired diabetic wound healing affects around 25% of all diabetes mellitus patients (Burgess et al., 2021). Around 15% of diabetics will experience diabetic foot ulcers, of which around 18.6 million people worldwide suffer from diabetic foot ulcers every year and 0.14- 0.24 of them undergo non-traumatic removal of a ulcerated foot because of disease or bone entanglements. Associated with foot ulcers caused by diabetes Shabhay (2021), Raja (2023), Armstrong (2023) which pose a major threat to diabetes mellitus sufferers which includes patient well-being and even death if not treated properly. An effective approach to overcome the above problems, one of which is ozone therapy (Ozturk & Kocyigit, 2023; Bomfim et al., 2021).

Data on diabetes mellitus sufferers from the health profile of Aceh province in 2021, diabetes mellitus sufferers in Aceh province reached 184,527 sufferers. Langsa city is geographically located in East Aceh. In East Aceh Regency in 2021 the number of DM sufferers reached 4,883 DM sufferers (Acehinfo, 2022), where patients with diabetes are very at risk of developing diabetic foot wounds, so effective treatment is needed to prevent complications more severe (Fonna et al., 2023). Treating diabetic injuries is a significant test and forces a weighty monetary and social weight on patients and their families (Faraji et al., 2021).

Ozone gas has highly reactive antimicrobial and antioxidant properties (Dhamnaskar et al., 2021) what's more, is broadly utilized as a corresponding treatment for different skin illnesses, including mending wounds, bedsores, diabetic foot, and diseases (Kim et al., 2014). Ozone treatment is powerful in speeding up injury recuperating in diabetic foot ulcers (DFU) by diminishing irritation, expanding development factor levels, further developing oxidative pressure status, shortening mending time, and working on long haul visualization (Sun et al., 2023). Ozone is likewise frequently utilized as a strong treatment for different skin sicknesses,

including irresistible skin illnesses, wound mending, dermatitis, dermatitis, psoriasis, axillary osmidrosis, diabetic foot. Moreover, ozone can instigate and manage leukocytes and macrophages so it emphatically affects the injury recuperating process (Liu et al., 2022).

METHOD

This examination is a quantitative exploration, semi trial strategy with a non-identical gathering plan. This study intends to decide the impact of ozone treatment excitement on the mending system of diabetic injuries. The location of this research was carried out at the Edwcare clinic located at Jl. Ahmad Yani No 5, Paya Bujok Seulemak, Kec. Langsa Baro, Langsa City, Aceh 24355 which was carried out in July-August 2023.

Population is the total number of objects to be studied based on predetermined criteria. The population in this study were all patients suffering from diabetic wounds who received wound care at the Edwcare clinic in Langsa city, Aceh, Indonesia which was carried out in July-August 2023.

Sampling in this study was carried out using non-probability techniques using Power Analysis version 4.1.9.4 with power (1-β err prob) = 0.90; αerror probability = 0.05; effect size (d) = 0.84 so that 25 individuals comprised group 1's samples, and 25 individuals comprised group 2. The number of samples in this study was increased by 10% to 56 individuals after taking into account the exclusion criteria. The consideration standards for this study were diabetic injury patients who got twisted care at the Edwcare facility, matured 19-60 years and patients who had never gone through ozone treatment. All wounds other than diabetic wounds and patients who withdrew from the study met the study's exclusion criteria.

The autonomous variable in this study is ozone treatment excitement, while the reliant variable in this study is diabetic injury mending. The instrument utilized in this study was the Bates-Jensen Wound Evaluation Apparatus (BJWAT) which comprises of 13 appraisal things including wound size, wound profundity, wound edges, twisted opening under sound tissue (GOA), kind of corruption tissue, sort of exudate, number of exudate, variety around the injury, edematous tissue, solidifying of fringe tissue, granulation tissue, and epithelialization.

Data were analyzed using SPSS software. Bivariate analysis was carried out to test the differences between 2 groups that received different treatments. Comparative tests Because the data did not follow a normal distribution, the non-parametric Kruskal Wallis test was used to accomplish this. The objective was to ascertain the differences in the control group's and the intervention group's wound healing processes prior to and following the intervention. The Friedman test was completed to analyze the distinctions in the injury mending process when

the consolidated mediation of current injury care and ozone treatment in the intercession gathering and present day twisted care in the benchmark group.

RESULTS

Table 1 provides a summary of the characteristics of the study's respondents.

Table 1 Frequency Distribution, Percentage and Average Characteristics of Respondents in (n=56)

Characteristics	Control		Intervention	
	n	%	n	%
Age				
26-35	2	7,1	0	0
36-45	21	75,0	14	50,0
46-55	2	7,1	7	25,0
56-65	3	10,7	7	25,0
Mean±SD	42,46±6,49		48,61±7,69	
Gender				
Man	19	67,9	24	85,7
Woman	9	32,1	4	14,3
Marriage Status				
Married	26	92,9	24	85,7
Divorced	2	7,1	4	14,3
Education				
Junior High School	5	17,9	2	7,1
Senior High School	20	71,4	23	82,1
D3/Bachelor	3	10,7	3	10,7
Work				
Housewife	4	14,3	1	3,6
Civil servants/BUMN	0	0	2	7,1
Self-employed	13	46,4	15	53,6
Employee	6	21,4	4	14,3
Farmer	5	17,9	6	21,4
Wound Location				
Hands	12	42,9	10	35,7
Foot	16	57,1	18	64,3
Wound pattern				
Irregular	12	42,9	10	35,7
Elongated	9	32,1	7	25,0
Round/oval	3	10,7	9	32,1
Concave/bowl	4	14,3	2	7,1
Score BJWAT				
Pretest (Mean±SD)	58,42±3,21		58,42±3,72	
Post-test(Mean±SD)	55,61±3,61		49,32±3,42	
Blood sugar levels				
Pretest (Mean±SD)	173,96±38,16		183,29±35,22	
Post-test(Mean±SD)	153,54±17,22		165,29±31,85	

In light of table 1 above, it is realized that the qualities of respondents in view of the typical age in the benchmark group were 42.46 (SD= 6.49) and in the mediation bunch it was 48.61 (SD= 7.69). Men were the predominant gender in both the control group and the

intervention group, with 19 men in the control group (67.9%) and 24 men in the intervention group (85.7%). Attributes of respondents in light of conjugal status: 26 individuals in the benchmark group were hitched (92.9%) and 24 individuals in the mediation bunch were hitched (85.7%). Twenty high school graduates comprised the control group (71.4%), while 23 people comprised the intervention group (82.1%).

Attributes of respondents in view of sort of work in both the control and mediation bunches were for the most part independently employed, specifically 13 individuals (46.4%) in the benchmark group and 15 individuals (53.6%) in the mediation bunch. The area of the injuries is dominatingly in the legs. In the benchmark group there were 16 individuals (57.1) and in the mediation bunch there were 18 individuals (64.3%). Wound designs shifted however were overwhelmed by sporadic injury designs, in particular 12 individuals (43.9%) in the benchmark group and 10 individuals (35.7%) in the mediation bunch.

In the control group, the average blood sugar level before the intervention was 173.96 (SD 38.16), and the average blood sugar level after the intervention was 153.54 (SD 17.22). In the mediation bunch the typical glucose level before was 183.29 (SD 35.22) and after 165.29 (SD 31.85). Wound arranging in light of the BJWAT appraisal acquired a normal score in the benchmark group before the mediation was 58.42 (SD 3.21) and after the intercession was 55.61 (SD 3.61). In the mediation bunch before the strategy it was 58.42 (serious wounds) and after the method it was 49.32 (extreme wounds). Examination of the impact of ozone excitement on the diabetic injury mending cycle should be visible in tables 2 and 3 underneath.

Table 2 Independent test results of changes in BJWAT at week 2 to week 5 of diabetic wound care

Difference BJWAT	Group	*N*	*Mean Rank*	*Asymp. Sig.*
Difference between weeks 1 and 2	Intervention	28	30,11	0,43
	Control	28	26,89	
Difference between weeks 1 and 3	Intervention	28	38,05	0,00
	Control	28	18,95	
Difference between weeks 1 and 4	Intervention	28	39,39	0,00
	Control	28	17,61	
Difference between weeks 1 and 5	Intervention	28	39,75	0,00
	Control	28	17,25	

Kruskal Walli test.

In table 2 above, it is known that the mean rank for the difference in BJWAT in the first and third weeks, the difference in BJWAT in the first and fourth weeks, and the difference in BJWAT in the first and fifth weeks have significant differences. Huge contrasts in changes in the injury mending process happened from week 3 to week 5 with the Asymp. Sig esteem. of 0.00 (0.05), the null hypothesis is rejected, indicating that patients' wound healing processes differ. patients getting wound care. present day dressing (control bunch) with a mix of current dressing and ozone treatment (intercession bunch).

However, it was discovered that the BJWAT scores for the first and second weeks differed asymptotically. Sig. The null hypothesis cannot be rejected because the value is 0.43 (>0.05), indicating that there is no significant difference in the rate at which patients heal from wounds treated with modern dressings alone or with a combination of modern dressings and ozone therapy. The statistically insignificant difference in mean rank values—26.89 in the control group and 30.11 in the intervention group—indicates this.

Table 3 Results of BJWAT dependent difference test at week 2 to week 5 of diabetic wound care

Group		Difference between weeks 1 and 2	Difference between weeks 1 and 3	Difference between weeks 1 and 4	Difference between weeks 1 and 5	Asymp. Sig.
Modern dressing	*Mean Rank*	1,95	2,52	2,50	3,04	,005
	N	28	28	28	28	
Modern dressing + Ozon	*Mean Rank*	1,02	2,02	2,96	4,00	.000
	N	28	28	28	28	

Friedman test

Based on table 3 above, it is known that modern wound care dressings and combination wound care of modern dressings and ozone therapy have equally significant effects (Asymp.Sig.<0.05). However, the mean rank value of the difference between BJWAT in the first week and the fifth week in the modern dressing + ozone therapy combination group (4.00) shows a significant change so it can be concluded that the effect of the combination of modern dressing and ozone therapy is more significant compared to modern dressing wound care alone.

DISCUSSION

Based on the results of this study, it is known that modern wound dressing treatment with ozone therapy shows significant results with an Asymp.Sig. value of 0.00 at the 3rd week, 4th week and 5th week (table 2) and it is concluded that there is a difference Wound healing process between patients who received modern wound care dressings (control group) with a combination of modern dressings and ozone therapy (intervention group).

This is in accordance with research led by Izadi et al., (2019) which involved 200 patients matured 18-85 years with diabetic foot ulcers going from levels 1 to 4 as per the Wagner order were separated into two gatherings, to be specific the mediation bunch got a mix of ozone treatment and standard treatment for diabetic ulcers, while the benchmark group got a blend of ozone treatment and standard treatment diabetic ulcer. simply routine care for diabetic feet. The findings showed that the average healing time was 69.44 minutes, which was significantly shorter than the healing time in the control group. The consequences of this study support the viability of ozone treatment particularly in its far reaching use in recuperating DFU and lessening the chance of contamination and removal.

This is additionally in accordance with research directed by Rahayu et al., (2018) with respect to mix of current dressing and ozone sacking treatment to accelerate the diabetic injury process, it shows that at week 2, week 3, week 4 and week 5 of the control and mediation bunches from pretest to post test IV the p esteem was <0.05, importance there was massive contrast in BWAT scores. Twisted care with current dressings changes the situation with the injury, bringing about great circumstances for the recuperating system of diabetic injuries. Understanding not only the cellular and tissue components surrounding the wound but also the fluids is crucial because of the biological and physiological effects on wound dressing performance. Wounds are tracked down in the extracellular climate so it is important to keep up with and pick the right dressing so the state of the injury is kept up with in order to establish a decent climate for the injury recuperating process (Cullen & Gefen, 2023).

Another concentrate likewise showed comparative outcomes, where the semi exploratory examination expected to decide the impact of ozone treatment on the recuperating period of diabetic ulcer wounds in diabetes mellitus patients at the Al Huda Wound Care Center, Lhokseumawe City in 2016, including 20 diabetes mellitus patients. The consequences of the examination utilizing the matched t test got a p-worth of $0.000 < \alpha = 0.05$. This shows that there is an impact of ozone treatment on the mending period of diabetic injuries in diabetes mellitus patients (Alhuda et al., 2019).

In table 3 it is known that the average decrease in BJWAT values in the combination group of modern dressing and ozone therapy from week 1 to week 2 (1.02), week 1 to week 3 (2.02), week 1 to week 4 (2, 96) and week 1 to week 5 (4.00) with Asymp.Sig.0.00 (<0.05). Thus, It very well may be presumed that the utilization of ozone treatment joined with present day dressings meaningfully affects mending diabetic injuries.

Research conducted by (Megawati et al., 2019) used a quasi-experimental approach involving decubitus ulcer patients at the Wocare Bogor Clinic with a sample size of 16, of which 8 samples were in the experimental group and 8 samples were in the control group. The instrument used is the Bates Jansen Wound Assessment. Wound care using modern dressings and ozone therapy was not given to the intervention group and ozone was not given to the control group. Treatment is carried out every 3 days for 2 weeks. The consequences of measurable tests utilizing Free t showed a worth of $\alpha = 0.000 < 0.05$ and it was presumed that the utilization of changed present day dressings and ozone treatment was more powerful in injury mending contrasted with the utilization of current dressings in patients with decubitus pressure wounds.

Using a non-equivalent control group design, pre- and post-test experiments were carried out by Mardiyono et al., (2019) involving 25 respondents, 11 respondents were gathered into the benchmark group, specifically the gathering that got standard injury care and 14 respondents in the mediation bunch, in particular the gathering that utilized a mix of present day dressings and ozone treatment with a centralization of 60-100ug/ml for 15 minutes utilizing an appendage pack for 13 days. with five estimations. It was determined that modern dressing therapy with ozone was superior for reducing bacteria around the wound and accelerating healing in diabetic ulcer patients during the inflammatory period. Data processing using a computer system with a General Linear Model revealed a p value of 0.05.

This is in accordance with research led by Hidayat, (2021) regarding the provision of ozone therapy in the healing process of diabetic wounds, ozone can stimulate anti-oxidants so that diabetic wounds quickly granulate and close. Ozone therapy is able to kill all kinds of gram-positive and gram-negative bacteria, including bacteria that are resistant to antibiotics, in accordance with previous research. The impact of ozone treatment on microscopic organisms is to disturb the honesty of the bacterial cell container through oxidation, bringing about cell recovery and speeding up the injury recuperating process (Naziyah et al., 2022). The wound environment is kept moist by contemporary dressings. The dressing should be closed or occlusive to keep the wound moist (Megawati et al., 2019) furthermore, upheld by the organization of ozone treatment which has been demonstrated to mend diabetic foot ulcers with

great injury conclusion in the ozone treatment bunch which is essentially quicker than the recuperating time (Izadi et al., 2019).

CONCLUSION

In light of the consequences of the examination above, it very well may be presumed that cutting edge dressing wound care (Asymp.sig.0.03) and modern wound dressing + ozone therapy (Asymp.sig.0.00) have equally significant meaning. However, it can be said that the effect of Modern dressing + ozone therapy has a more significant difference compared to just using Modern dressing wound care alone. This research is the basis for implementing diabetic wound care with ozone stimulation and can be applied as a nursing intervention, especially diabetic wound care.

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