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EVALUATİON OF THE EFFECT OF OXYGEN PLASMA ON THE HEALİNG OF DİABETİC WOUNDS

Arman Ghayour Vahdat[1],Hannane Azimizonouzi [2].Farzaneh Esmaeiliaminlouei[3].Seyed Salman Seyedein[4]Mehrdad Fojlaley[5]

[1]inventor member of turkısh ınventors and ınnovators assocıatıon ,Turkey
[2]Medıcın faculty , cerrah Pasa unıversıty , Istanbul,Turkey
[3] Agriculture engineering Islamic azad university,mahabad branch.Mahabad Iran
[4]lecturer of imamreza international university.Mashhad.Iran
[5]Associate Professor ,Brousels capital university ,Brousels ,Belgium
Corresponding email:mehrdad.fojlali@gmail.com

Abstract :

Diabetes is a common and debilitating disease of humans that can cause serious problems for the organs. One of these problems is chronic and refractory wounds that usually occur in the soles of the feet of these patients. This complication is also called Diabetic foot. This study aims to see whether there is an effect of plasma therapy on the wound healing phase of diabetic ulcers in patients with diabetes mellitus at van hospital . This research is quassy experiment with samples in this study amounted to 20 patients diabetes mellitus at van City hospital. This research was conducted from 04 until 18 October 2020. Sampling by total sampling method. The analysis used paired t-test (dependent). The result of this research is the age of patient of diabetes mellitus patient at van cıty hospital most of the aged between 56-65 years as many as 12 respondents (60,0%) and gender of patient of diabetes mellitus mostly female are 11 respondent (55,0%) . The result of paired t test is obtained p-value 0.000 <α = 0,05. This shows that there is influence of plasma therapy to phase wound healing diabetic ulcer in patient of diabetes mellitus at van cıty hospıtal . The results of this study can provide benefits for the community, especially reponden that as an input that plasma can serve as a new treatment alternative in addressing the problems of diabetic wounds with modern wound care so convincing to the public that diabetic wounds can be cured.

İntroduction :

Diabetes is a common and debilitating disease of humans that can cause serious problems for the organs. One of these problems is chronic and refractory wounds that usually occur in the soles of the feet of these patients. This complication is also called Diabetic foot.

Problems with the feet of people with diabetes are due to two major problems that diabetes causes. These two problems are peripheral nerve disorders and decreased blood flow to the limbs.

Vascular disorders cause ulcers in the foot of a person with diabetes. The sole of the foot is the farthest part of the body from the heart and receives less blood than other tissues in the body. This is why in cold weather the first place the limb cools is the foot.

In the long run, diabetes causes a decrease in blood flow throughout the body, but this problem manifests itself more in the foot than elsewhere. This causes the wounds that regularly occur on the feet of all people due to environmental damage, but heal quickly, do not heal in the feet of these people because wound healing requires nutrients and oxygen that reach the tissues through the blood.

The germs also find a favorable environment and start working on the wound and cause infection. Due to the reduced blood flow in the foot, white blood cells are less likely to go to the wound and the tissue's immune defenses are reduced. Diabetes itself also lowers the body's immune defenses in general. This spreads the infection to the wound and delays its healing.

Another problem for diabetics is the dysfunction of the peripheral nerves, which reduces the sense of touch in their feet. This loss of sensation causes dryness and cracks in the skin that provide the basis for scarring. On the other hand, the patient notices less environmental damage due to reduced sensation. For example, the foot is placed near a hot object and burns without being noticed, or it goes on the winning object and gets injured. When the skin is damaged, the patient does not notice it for a long time due to the disturbance in the sense of pain, and this causes the infection to develop in the wound.

Nerve disorders in the feet of diabetics can cause paralysis of the soleus muscles in the long run, and this paralysis causes various deformities in the foot. Deformity of the foot, in turn, causes more pressure when walking on certain parts of the sole of the foot, and these pressures provide the basis for pressure ulcers. Visual disturbances, which is a complication of diabetes, can also contribute to this complication. Slowly Low vision causes the patient to not be able to see the front of his foot well and puts the foot in inappropriate positions, which increases the likelihood of injury to the foot. Find resistant to treatment. Diabetic foot ulcers occur in about 5-7% of people with diabetes. These sores eventually cause amputation in 5% of people with diabetes.

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Infection of the soles of the feet in these patients is initially limited to the skin, but after a while it spreads to the deep tissues and bones of the soles of the feet, causing a bone infection or osteomyelitis. More than one microbe is active in these patients' foot infections, but the most common is Staphylococcus aureus.
Diabetes and the ability of negative oxygen ions as a powerful and unique element in reviving the circulatory system and strengthening the body's defense system has been able to somehow eliminate the deficiencies of lack of proper insulin in the blood for diabetes and finally a number of problems and Control the deficiencies of diabetes and treat it in some cases. As in the medical community, it is referred to as infant oxygen and is aware of its capabilities in the body and plays an important role in the nature of the body's self-healing. Generally, the human body at an early age produces this organic element in self-production, which increases the nature of the body's self-healing in fighting diseases and eliminating them in youth, and over time, with age, its production decreases and eventually stops. As a person gets sick earlier in life and recovers later. In addition to diabetics, active oxygen boosts the immune system of the elderly.

Relieving clogged arteries and improving circulatory disorders in diabetes:

These very common disorders have a common cause and they are known problems of lack of proper and complete blood supply to the arteries and coordination. The most prominent disease in this regard is diabetes. Diabetes is a complex disease that presents with vascular disorders in many parts of the body, such as the retina, kidneys, nerves, and disorders related to carbohydrate metabolism. Cases of circulatory problems in diabetes. Tissues such as the skin that contain blood vessels are compromised and are more susceptible to possible injuries and infections.

Wound healing and disinfection

Diabetics are always worried about wounds in their body, and due to the many consequences that occur in the absence of insulin, it makes the conditions for wound healing difficult and causes distress for this group of loved ones. The main mechanism of treatment of diabetic wounds is repair and damage to the arteries and nerves, and in the meantime, active oxygen has the ability to initiate angiogenesis, repair and development of arteries. Oxygen is a divalent molecule that is stable in itself, and if we apply the necessary energy to the o2 molecule, it causes the oxygen molecule to break down and turn it into oxygen oxygen or active oxygen, in other words, baby oxygen. Due to the fact that reactive oxygen alone does not have an identity and definition in nature, it quickly reacts with the surrounding microorganisms and oxidizes and destroys them, and finally, in addition to disinfection, reactivates reactive oxygen or oxygen atoms. And is converted to oxygen. According to the above rule, oxygen increases the desired range and causes unimaginable tissue repair. course, it should be noted that active oxygen is unstable and turns into oxygen after 20 minutes, and therefore it is not portable and should be used during production.

The presence of oxygen atoms in the blood causes a tremendous 54% increase in the ATP molecule. When the undeniable role of this molecule in signaling between cells in the retina is investigated. Unsurprisingly, these molecules play an important role in the proper functioning of the five senses. For example, the receptors for the ATP molecule found in retinal cells. They receive light in the eye. It strengthens and improves vision, and in the form of a perfect rotation of the retinal nerves, these molecules and valuable substances called acetylcholine are used to send their information to the brain processing centers in an extraordinary way. Increased oxygenation to tissues: Of course, humans under normal circumstances due to the key molecule, DPG23 is the stimulus for red blood cells to oxygenate the tissues. And because the key molecule, DPG23 is sufficient in the circulatory system of diabetics There is no oxygen supply to the tissues and it has the usual consequences of this complication. Improve tissue oxygenation by complete red cells.

Diabetic ulcers can become diabetic foot gangrene. Diabetic feet require long healing time and conprehensive multidisciplinary handling, ranging, and revascularization surgery, but to date none have satisfactory. This encourages the search for methods that stimulate the acceleration of wound healing, one with the method of plasma and ozone theraphy. The use of ozone as a complementary/alternative theraphy is now popular in several countries and has been used since 1992 as a molecule that has enourmous energy. Ozone can meninaktifikasi bacteria, viruses, fungi and some tipes of protozoa, this can happen because of the ion, ion radical ozone degradation results in water in the form of hidrogen peroxide (HO2) and hydroxyl (HO) [2].
The infection of ozone in healding diabetic wounds is antimicrobial, it is generally belived that bacteria are destroyed by the protoplasm oxidation process. The oxidation of protoplasm will damaged the capsid or outer skin of the microorganism, which comprises an unsaturated bond of phostolipid or lipoprotein, then penetrates into the cell membrane acts with cytoplasmic substances and converting a closed DNA plasmid cycles into an open DNA crystal,

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which can reduce the efficiency of bacterial politation, directly effect cytoplasmatic integrity and impair some degree of metabolic complexity.

Based on research conducted by Anichini et.al.; on the effects of local ozone therapy on diabetic foot ulcers treated on 34 clients, reported 53% clientsoutcomes were cured in 20 weeks, 34% clients experienced a reduction in surface area of more then 50% [3].
Another study was conducted by Megawati et.al., on the effectiveness of modern modification dressing and ozone therapy wound healing in patients with pressure ulcer in wocare clinic bogor conducted on 16 clients, devided into two groups . It's treatment groups and groups control [4].
The result of the study in the use of modern modification of dressing and ozone therapy more effectively to wound healing compared to use modern dressing alone in patients with pressure ulcers. Bassed on a preliminary survey that researchers conducted with two nurses at the Alhuda Wound Care Clinic in Lhokseumawe. The nurse said every patients who is treated is advised to take ozone therapy and treat wound at least 5-8 times.
Some patients who do therapy, when they feel the condition of the wound is better, the patient doesn't come or break the therapy and sometimes they come back when the wound conditions worsen. After that, the patient rountinely to follow oxyen ozone therapy, until the the wound healed.
Early interviews that researchs did with three patients said they choose ozone therapy because it was suggested by family members and health workers and the patient said wound healing was faster with ozone therapy. The nember of visits of patients who come to therapy is amounted to 8 to 10 peolpe/day.
Based on this background, research is conducted to determine the effect of ozone therapy on diabetic wound healing face in patients with diabetes mellitus at AL Huda Wound Care Clinic of Lhokseumawe city in 2016.

Material and method

Machine designe :

Oxygen is a stable, divalent molecule and is self-sustaining. But if we inject that energy, it breaks it down and during a natural process at the time of energy release, it turns into a trivalent molecule of ozone (O3) (for a better understanding of the subject, for example if we inject energy into three O2 molecules) The molecule is converted to O3), which is rapidly broken down by the toxic gas molecule ozone (O3) into an oxygen or reactive oxygen atom (O1) and an oxygen molecule (O2). The oxygen plasma produced in this process, because it is very active, reacts with pollutants and microorganisms in the environment and oxidizes it after bonding[10].
In this research, plasma capacitors are used in series to generate electromagnetic flux. The high voltage power supply with a voltage of 600 volts is fed to the probe of the thorns by capacitive inductor circuits and produces electromagnetic arcs (fiure1). Ambient air is blown into the capacitor channel by an air pump, and after leaving this flux, the oxygen in the air is converted to reactive oxygen. The magnetic field created by these circuits produces a negatively charged plasma or oxygen environment that is active oxygen to lose its negative charge and combine with other elements to oxidize them, since all microbes Harmful elements and elements for human respiration and health are all microorganisms, oxidized by this gas and destroyed.

Figure 1.designed device

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The research design machine used. The study was conducted at van city hospital in turkey The population in this study were all patients with diabetes mellitus with diabetic wounds from january to august 2020 as many as 101 people. According to Dempsey for studying was done univariate

Results

The result of research of respondents characteristic is found that most of respondent age between 56-65 years old is 12 respondents (60,0%) and female is 11 respondents (55,0%), it can see on the first table.

Table 1. Distribution of Frequency Characteristics of Respondents.

No.	Characteristics	f	%
1.	Age		
	46-55 years	8	40,0
	56-65 years	12	60,0
	Genders		
2.	Man	9	45,0
	Women	11	55,o
	Total	20	100

Pre and post plasma therapy can known that phase wound healling diabetics before (pre-test) given plasma theraphy mostly in the inflammatory phase as much as 13 respondents (65,0%) and after given partial plasma therapy big on phase as much poliferation 8 respondents (40,0%) can be seen on table 2.

Table 2. pre post plasma terapy (n=20)

No	Fase	Pre-	test	Post-	Test
		N	%	N	%
1.	Inflammation	13	65,0	7	35,0
2.	Poliferation	15	25,0	8	40,0
3	Remodelling	2	100	5	25,0
	Totality	20	100	20	100

Simple with a regorous experiment, can use a minimun sample size of 10 to 20 subject. Samples in this study were 20 patients with diabetes mellitus with diabetic wounds.

The influence of plasma therapy taking the healing phase of diabetik wounds in patients with diabetes mellitus.
The result of statistical test shows that the value of p value 0,000 ($p<0,05$) so that it can concluded that there is a difference between diabetic injury before plasma therapy is given with diabetic wound after given plasma therapy with t value = 12, 073 > t table = 1,724 with q= 0,05 then ho rejected, thus ha accepted.
It can be concluded that there is an effect of plasma therapy on the phase of diabetic wound healing in patient with diabetes mellitus at Al Huda Woundcare clinic in Lhokseumawe city 2017 (Ha accept).

Table 3. Pre Post plasmaTherapy (n=20)

No	Variable	Mean	Standart Deviation	Standart Error	P value	N	t
1	The wound Diabetic before azone therapy is given	48,65	8,00	1,811			
2	The Wound diabetic after ozone therpy	37,05	9,960	2,227	0,000	20	12,07

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DISCUSSIONS

The effect of plasma therapy on healing phaseof diabetic healing on diabetes mellittus patient.
The result showed that there was an effect of plasma therapy on diabetic wound healing phase in diabetes mellitus patient VAN city hospital before and after plasma therapy, with data analysis (Pairred T Test), obtained P-Value 0,000 shows a value less than α =0,005.
Diabetic feet requiry long healing time and comprehensive multidiciplinary handling, ranging from blood glucose control, daily local wound care, antibiotic therapy, and revascularization surgery, but to date none have been satisfactory.
This encourages the search for methods that stimulate the accaleration of wound healing, one with the methode of plasmatherapy.plasma therapy in addition to being used as an atiseptic, oxygen plasma is also said to have antiviral, anty fungal, and antiprotozoa effects. plasma is able to oxidize various type of bacteria, spores,fungi, yeasts, and other organic matter. The plasma effect on bacteria is to integration of bacteria cell capsules by oxidation of phospolipids and lipoproteins, then penetrate into cell membranes, react with cytoplassmic substances and convert circulates of closed DNA, plasmic into opened DA circulate which can reduce the effecincy of bacterial prolifaration, directly effect cytoplasmic integrity and distupts some degree of netabolic complexity. In addition, plasma can also improve the distribution of oxygen and the release of growth factors are usefull in accelerating wound healing [6].

Based on research result, it is known that 55% patient are diabetic wounded female. This is accordance with research by Ferawati which show s hormoral changes in women entering of menopouse [7]. According to researchers, gender is one of the risk factors for the occurence of wound diabetic especiallly for the women.
The results of this study indicate that patients with diabetic injuries are most prevalent in the age group of 56 to 65 years as many as 60% .

According Lipsky, on of the risk factors are diabetic ulcers is age, where age is a factors taht cannot be changed [8]. The older the age, the physicological function of the body decreased. According to researhers, age is closely related to the increase in blood sugar levels, so the more age increases the higher the prevalence of diabetes.
Research conducted by Megawati et.al. [4] on the effectiveness of modern modification dressing and plasma therapy on wound healing in patients with pressure ulcers in Wocare Clinic Bogor conducted on 16 clients, devided into two group namely the treatment group and the control group. The result of this study is the use of modern modification dressing and plasma therapy more effective againts wound healing compared with the use of modern dressing alone in patient with pressure ulcers.
Another research conducted by Restuningtyas [9], there is the effect of combination of modern wound care with ozone bagging on diabetic ulcer healing process in client diabetes mellitus at Nurmalam Jember Hospital with P value 0.000 < 0,05.

Based on the result of the study, it can be concluded that the effect of plasma therapy on diabetic wound healing process in patients with diabetes mellitus in accelerating wound healing not only required primary therapy but also required additional therapy or referred to as complementary therapy, one of which is oxygen plasma therapy.

Conclusions

Based on the result of tthis research, the result of this research can be concluded the phase of diabetic wound healing before (pre-test) was given as many as 13 respondents (65,0%) plasma therapy on inflamatory phase. Phase of diabetic wound healing after (post-test) was given plasma therapy as many as 12 respondents (60,0 %) in the remodeling phase. There is an effect of plasma therapy on the healing phase of diabetic ulcer wounds in patients with diabetes mellitus van city2020 with data analysis (Paired T Test) obtained value

References

[1] WHO, “Diabetes; fact sheet, department of sustainable development and healthy environments, regional office for sputh-east asia,” 2016. [Online]. Available: https://www.who.int/. [Accessed: 01-Oct-2017].
[2] N. A. Zafhira, “Pengaruh waktu inkubasi dan dosis ozon pada disinfeksi hama bakteri xanthomona oryzae pv oryzae dengan kombinasi proses ozonisasi dan adsorpsi dengan zeolit alam,” Universitas Indonesia, 2012.
[3] R. Anichini et al., “ozone-therapy in treatment of diabetic foot ulcers: a suggestive approach in wound bed preparation: 199,” Eur. J. Clin. Investig. Suppl., vol. 33, pp. 46–47, 2003.
[4] V. N. Megawati, H. M. Hakimi, and S. Sumaryani, “Efektifitas modifikasi modern dressing dan terapi ozon terhadap penyembuhan luka pada pasien dengan pressure ulcer di Wocare Clinic Bogor.” 2015.
[5] P. A. Dempsey, Riset Keperawatan: Buku Ajar dan Latihan/Penulis. Jakarta: EGC, 2007.
[6] A. Dewiyanti, H. Ratnawati, and S. Puradisastra, “Perbandingan Pengaruh Ozon, Getah Jarak Cina (Jatropha Multifida L.) dan Povidone Iodine 10% terhadap Waktu Penyembuhan Luka

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

[7] I. Ferawati, "Faktor-Faktor Yang Mempengaruhi Terjadinya Ulkus Diabetikum Pada Pasien Diabetes Melitus Tipe 2 Di Rsud Prof. Dr. Margono Soekarjo Purwokerto." Skripsi. Purwokerto. Kementerian Pendidikan Dan Kebudayaan Universitas …, 2014.
[8] B. A. Lipsky et al., "2012 Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections," Clin. Infect. Dis., vol. 54, no. 12, pp. e132–e173, 2012.
[9] A. Restuningtyas, "Pengaruh kombinasi perawatan luka modern dengan ozon bagging terhadap proses penyembuhan ulkus kaki daibetik pada klien diabetes mellitus di Rumah Rawat Luka Nirmala Jember," Universitas Jember, 2016.
[10] Inactivation Efficiency of Bioaerosols Using NANO-oxygen Plasma Air Purification Device (Bioaerosol Removal from Air with NANO-Oxygen Plasma Air Purification System)Emmett Imani, M Fojlaley - European Journal of Molecular & Clinical Medicine, 2021
[11] Design and Evaluation of Air Ionizer with Plasam System and its Applications
MFRNN Abad, R Piran, MAM Banadaki - Trans. Royal Soc. London, 1788