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Hyperpolarized Light Therapy Versus Traditional Wound Care On Different Wound Types

Dalia Galal El Sayed

P.T Department for Surgery, Faculty of Physical Therapy, MTI University, Egypt.

Abstract

Background and Aim: Dismissing hyperpolarized light as an adjuvant therapy for wounds and technique distinctions in the trials locks in hyperpolarized light are the reasons for many predicaments and inconsistencies. The point of this study was to set up the impacts of hyperpolarized light treatment in wounds. The purpose of this study is to investigate the effectiveness of Hyperpolarized light in patient with different wound types.

Methods: Thirty patients with different wound injuries typeswere participated in the study, and were divided randomly into two equal groups. Group (A) received Hyperpolarized light and traditional wound care Group (B) received traditional wound care only. Both groups were assessed before treatment, after two weeks of treatment and after four weeks of treatment in terms of wound management.

Results: By performing Paired Simple t-test for both two groups pretreatment and after 2 weeks of treatment, P Value is 0.000 so it was below 0.05, There was a significant difference between control and experimental group. By performing Repeated Measure ANOVA test for the pretreatment, after 2 weeks and after 4 weeks of treatment, P Value is 0.001 so it is below 0.05, There was a significant difference between control and experimental group. There was a significant improvement in Group A which received Hyperpolarized Light and Traditional Wound Care.

Conclusion: The effects of hyperpolarized light as an adjuvant therapy for different wound were satisfactory. After 4 weeks of treatment, 15 patients with differentwound types showed a significant improvementin the wound healing process, so it could be useful to apply hyperpolarized light in the treatment of different wound types.

Key words: Wound care, Hyperpolarized light, Phototherapy.

Introduction

Detection of wounds as early as conceivable from any teaches is crucial so that measures and a plan can be put into put quickly. Wound care patients ought to be surveyed at a least each week by nurture or the PT who is taught in wound care. The wholesome status of the wound needs to be surveyed by the dietitian and/or nutritionist. Research facility comes

about ought to be monitored, such as pre-albumin, hematocrit and hemoglobin levels, and other blood test comes about that are pointers of postponed wound recuperating **(Vinayagasundaram et al., 2009).**

An intrigue approach to wound care is crucial to neutralize the expanding predominance of wounds, rising costs, and decreases in repayment in domestic care. Research bolsters a noteworthy decrease in fetched with an intrigue approach **(Bedell et al., 2003).** Cost-savings may be accomplished with the physical therapy and nurture sharing the part of wound care clinician and with the PT having the capabilities to offer other successful treatment choices such as modalities and sharps debridement. In expansion, this may decrease nursing visit utilization. "There are substantial qualitative investigate considers illustrating positive outcomes and the esteem of comprehensive, multidisciplinary wound care. The wound care literature proliferates with inquire about portraying improved quantitative results coming about from comprehensive, multidisciplinary care" (Association for the Progression of Wound Care**([AAWM] 2011).**

Polarized light treatment, a kind of phototherapy, may be a linearly polarized and polychrome light treatment. This light therapy contains an entirety range of obvious beams, infrared A and B rays as well. Polarized light comes from refraction of common light through the particular covered mirrors and admitted this light through photo channel framework. Biologic impacts of this physical methodology are well known: improvement of the cell membrane exercises, increasing speed of the generation of the adenosine triphosphate (ADP) in mitochondria, return to normal cell layer potential which was irritated, stimulation of the regenerative processes. Additionally, fibroblast proliferation and statement of collagen might be quickened by this kind of physical treatment**(Durović A, et al.2008).**

Methods

Design

The present study was a prospective randomized single blind study with 30 male and female participants with differentwound types , randomly assigned to one of two treatment groups: The patients in the experimental group were treated usingstandard wound cleaning and dressing and hyperpolarized light therapy.The standard wound care cleaning and dressing only were used in the controlgroup.

Participants

The present study was performed on 30 Participants with second to third degree wound lesionthat were treated in MG Clinic that was specialized in wound and surgery physical therapy and rehabilitation. Thirty male and female patients undergoing physical therapy treatments were participated in the study .There were free from any pathological condition like limb infection, local or proximate malignancy, and anti-coagulated patients. Their mean age was 42 years. Patients with psychological conditions were excluded from the study .

Material and Measurement Tools

Hyperpolarized Light

A linearhyperpolarized light source (Bioptron light) with the taking after specialized characteristics was utilized**(Fig 1)**: wavelength: 400–2000 nm. control thickness: 40 mW/cm2; light vitality: 2,4 J/cm2. Hyperpolarized light treatment was performed for 1 month3times per week, at a remove of 10 cm**(Figure 1).**All treatments were performed between 4 and 7h p.m. The total treatment endured four weeks. All wounds were cleaned utilizing 2% hydrogen peroxide. The standard dressing inferred application of a dressing with typical normal saline (NaCl), at that point a dry cloth, following it a cotton fleece and cement strip..

Fig. 1Shows Bioptron Light Therapy

Wound Care

- The standard wound care using normal Saline Solution (NaCl) for wound cleaning, at that point a dry cloth, following it Bivatracin (Local Antibiotic Spray), a cotton fleece and cement strip.
- Application of wound care was performed daily weather at Clinic or at home.

BATES-JENSEN WOUND ASSESSMENT TOOL (BWAT)

Wound evaluation is subordinate on capable perception of quantifiable and quantitative factors. Utilize of a standardized wound evaluation instrument guides clinicians to evaluate wound characteristics in an orderly and steady way, encouraging communication. It is expected that indeed amateur learners can give steady, exact appraisals when given with enlightening for utilize. Be that as it may, numerous medical caretakers are a visual learner, which is the overwhelming learning fashion for grown-ups **(Harris et al., 2015).**

The BWAT consists of the following:

- The BWAT consists of 13 wound characteristics: size, visible depth, wound edges, undermining and tunneling processes, necrotic tissue type and amount, exudate type and amount, surrounding skin discoloration, peripheral tissue edema, peripheral tissue induration, granulation tissue and epithelialization **(Appendix A) (Bates-Jensen et al. 2019).**
- Each item has 5 categories of characteristics, one of which must be chosen as the most appropriate.

- The 13 wound characteristic item scores can be summed (with no weighting) for a total score ranging from 13 to 65 (profound tissue degeneration).
- It provides objective, numerical scores before, during, and after treatment and at the time of healing.
- It is validated and reliable**(Bates-Jensen et al.1992,Bates-Jensen and McNees, 1995, Bolton et al. 2004).**

Procedure

Patients who met the criteria for inclusion were allocated randomly to 2 groups, after initial evaluation patients began the treatment on the first day after assessment. Patients received 3 sessions per week for 1 month.

The following ethical issues were being considered:

- Before starting treatment, the physiological benefits of this method of treatment were fully explained to all patients.
- All measurements of each patient were taken for comparison before starting treatment.
- All measurements of each patient were taken after 2 weeks of treatment and 4 weeks of treatment.

Group (A) (n=15) received Hyperpolarized Light and Wound Carein the following steps:

- Patients were asked to be in comfortable position during wound cleaning and preparation.
- Patientswere asked to be in comfortable position during application of Hyperpolarized Light.
- Both patients and therapist worn a protective mask during application of treatment (COVID - 19 protection issue).
- The therapist applied the Hyperpolarized light around the affected wound (Fluren) 10 min, 10 cm distance apart.
- Followed by Blue lens for another 10 min.
- Followed by Purple lens for another 10 min**(Figure2).**

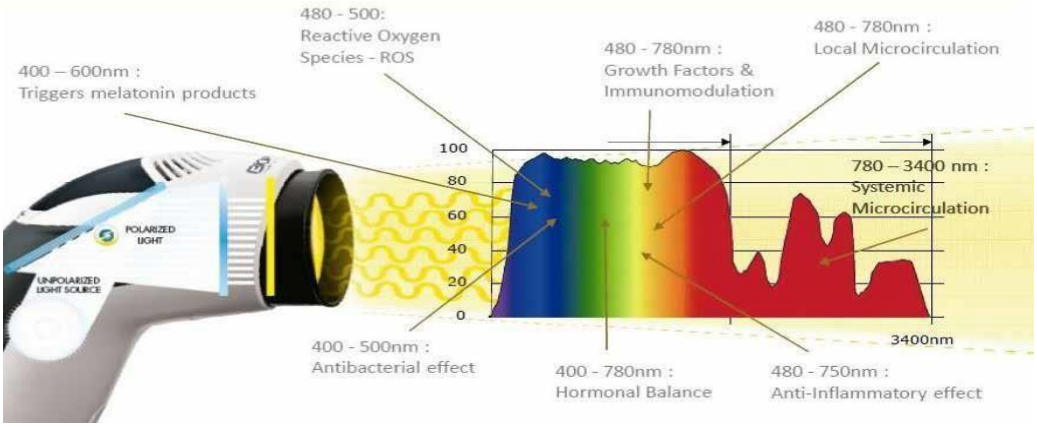

Fig. 2 Color Therapy and Bioptron

- Patients were asked to be relaxed for 5 minutes
- Use Saline Solution for wound cleaning and Bivatracin Topical Antibiotic Spray 150 ml as an antibiotic agent.
- Apply Dressing by using Topical Eye Patch.

Group (B) (n=15) received Wound Care in the following steps:

- Patients were asked to be in comfortable position during wound cleaning and preparation.
- Use Saline Solution for wound cleaning and Bivatracin Topical Spray 150 mlas an antibiotic agent.
- Apply Dressing by using Topical Eye Patch.

Wound Assessment

Assessment of wound was applied by using **BATES-JENSEN WOUND ASSESSMENT TOOL (BWAT).** Measurements are applied 3 times beforetreatment, after 2 weeks and after 4 weeks of treatment.

Data Analysis

- Statistical analyses were performed using **SPSS 24.0**
- **Simple statistics** for Patients Characteristics.
- **Paired Simple t-test** for pretreatment and posttreatment 1.
- **Repeated Measure ANOVA** was performed to compare between experimental and control group. P-value<0.05 was considered statistically significant. Differences with P values ≤ .05 were considered also statistically significant. Continuous variables were summarized as means and standard deviations.

Results

A total of 30males and females' patients were participated in the current studythe groups were homogenous in terms of age and sexof patients, and duration of hyperpolarized light therapy. At thestart of the treatment, there was no significant differencebetween groups regarding total **BWAT score (Table 1).**

Table 1 demonstrate Patients Characteristics of both Experimental and Control Group

Patients Characteristics	Experimental Group (n= 15)	Control Group (n=15)
Age years (X ± SD)	(49.9±16.3)	(45.7±13.4)
Gender n (%) Males Females	 11(73.3%) 4(26.6%)	 8(53.3%) 7(46.6%)
Total BWAT First Score (X ± SD)	(41.6±7.6)	(36.3±8.6)

By performing **Paired Simple t-test** for both two groups pretreatment and after 2 weeks of treatment, P Value is 0.000 so it was below 0.05, There was a significant difference between control and experimental group.

By performing **Repeated Measure ANOVA test** for the pretreatment, after 2 weeks and after 4 weeks of treatment, P Value is 0.001 so it is below 0.05, There was a significant difference between control and experimental group. There was a significant improvement in Group A which received Hyperpolarized Light and Wound Care**(Figure 3,4).**
Note: The researcher considered time and program are independent variables.

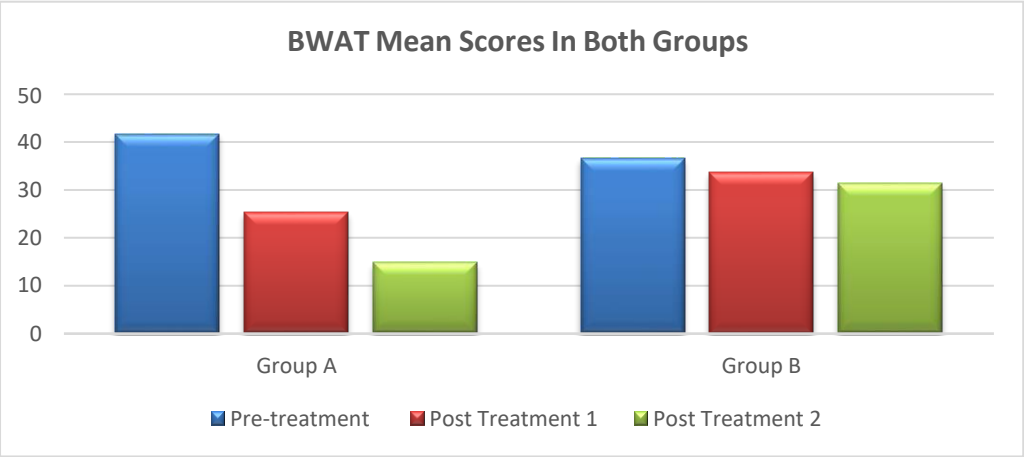

Fig.3 shows a significant improvement in BWAT mean scores in Group A.

Pre-treatment

Post 2 Weeks of Treatment

Post 4 Weeks of Treatment

Fig. 4 shows Infected wound Stage III before treatment and after treatment

Discussion

Management of wound is an important clinical problem. Variations in patient's features and wound management make difficult systematic clinical observation. There is a clear accord in requiring further researches **(Verbelen, 2007).**The current research proved that patients with different wound types had significant improvement after 4 weeks of treatment with Hyperpolarized light and wound care **(Figure 3,4).**

Comparing to control group, without polarized light, thepatients in the experimental group had diminishing majorityof BWAT tool parameters: the 13 wound characteristics: size, visible depth, wound edges, undermining and tunnelling processes, necrotic tissue type and amount, exudate type and amount, surrounding skin discoloration, peripheral tissue oedema, peripheral tissue induration, granulation tissue and epithelialization surface of wound and total BWAT score.

Wound healing process is depended on the vascular and cellular activity. Vasomotion is an occasional narrowing and dilatation of small blood vessels. It is attributed to local metabolic needs, vascular myogenic responses and neurogenic controls. Wounds develop due to insufficient blood supply and removal of metabolites when pressure exceeds capillary blood pressure for a sufficient time **(Jan et al., 2008).** Besides the fibroblast and macrophage activity, human wound associated lymphocyte populations are modulated during a healing process A role of proteoglycans (glypican and syndecan) during the inflammation and cell proliferation in chronic ulcers was also established. Protective function of human skin is well-known **(Boyce et al.,2000).** Because of that the researcherapplied the therapy always in the same time. Hyperpolarized light was found to trigger human cellular and humoral guards. It is considered that hyperpolarized light modifies the polar heads of a lipid bilayer in the cell membranes.

In the previous researches, other electrotherapeutic modalities were used to eliminate wound size and depth like ultrasound, pressure reduction measures, special casting, low-energy laser therapy, ultraviolet therapy, low-frequency current, electrical stimulation, hyperbaric oxygen therapy**(Priebe,2002).** The current and future researches suggested that hyperpolarized light has a positive effect in treatment of wound healing. In further research of Wound healingand hyperpolarized light therapy, we should use other clinical toolsfor baseline and more comprehensive assessment.

Conclusion

The effects of hyperpolarized light as an adjuvant therapy for different wound were satisfactory. After 4 weeks of treatment, 15 patients with differentwounds showed a significant improvementin the wound healing process, so it could be useful to applyhyperpolarized light in the treatment of different wound types.

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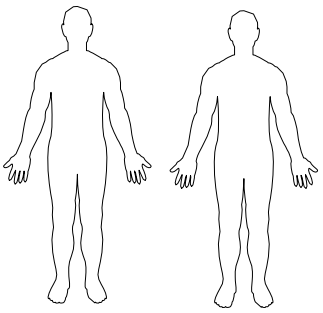
Appendix A

BATES-JENSEN WOUND ASSESSMENT TOOL **NAME**

Complete the rating sheet to assess wound status. Evaluate each item by picking the response that best describes thewound and entering the score in the item score column for the appropriate date.

Location: Anatomic site. Circle, identify right **(R)** or left **(L)** and use **"X"** to mark site on body diagrams:

____ Sacrum & coccyx ____ Lateral ankle
____ Trochanter ____ Medial ankle
____ Ischial tuberosity ____ Heel Other Site

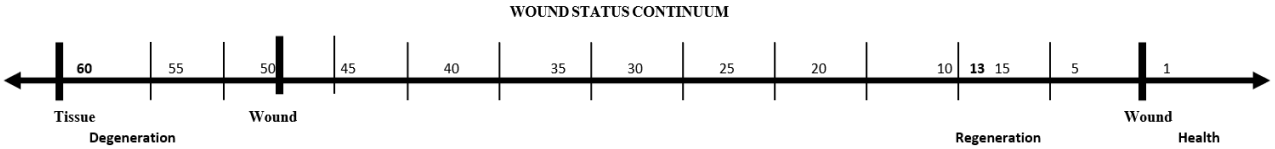


Shape: Overall wound pattern; assess by observing perimeter and depth.Circle and date appropriate description:

____ Irregular ____ Linear or elongated
____ Round/oval ____ Bowl/boat
____ Square/rectangl ____ Butterfly Other Shape

Item	Assessment	Date Score	Date Score	Date Score
1. Size	1 = Length x width <4 sq cm 2 = Length x width 4--<16 sq cm 3 = Length x width 16.1--<36 sq cm 4 = Length x width 36.1--<80 sq cm 5 = Length x width >80 sq cm			
2. Depth	1 = Non-blanchable erythema on intact skin 2 = Partial thickness skin loss involving epidermis &/or dermis 3 = Full thickness skin loss involving damage or necrosis of subcutaneous tissue; may extend down to but not through underlying fascia; &/or mixed partial & full thickness &/or tissue layers obscured by granulation tissue 4 = Obscured by necrosis 5 = Full thickness skin loss with extensive destruction, tissue necrosis or damage to muscle, bone or supporting structures			
3. Edges	1 = Indistinct, diffuse, none clearly visible 2 = Distinct, outline clearly visible, attached, even with wound base 3 = Well-defined, not attached to wound base 4 = Well-defined, not attached to base, rolled under, thickened 5 = Well-defined, fibrotic, scarred or hyperkeratotic			
4. Under-mining	1 = None present 2 =Undermining < 2 cm in any area 3 = Undermining 2-4 cm involving < 50% wound margins 4 = Undermining 2-4 cm involving > 50% wound margins 5 = Undermining > 4 cm or Tunneling in any area			
5. Necrotic Tissue Type	1 = None visible 2 = White/grey non-viable tissue &/or non-adherent yellow slough 3 = Loosely adherent yellow slough 4 = Adherent, soft, black eschar 5 = Firmly adherent, hard, black eschar			
6. Necrotic Tissue Amount	1 = None visible 2 = < 25% of wound bed covered 3 = 25% to 50% of wound covered 4 = > 50% and < 75% of wound covered 5 = 75% to 100% of wound covered			

Item	**Assessment**	**Date Score**	**Date Score**	**Date Score**
7. Exudate Type	1 = None 2 = Bloody 3 = Serosanguineous: thin, watery, pale red/pink 4 = Serous: thin, watery, clear 5 = Purulent: thin or thick, opaque, tan/yellow, with or without odor			
8. Exudate Amount	1 = None, dry wound 2 = Scant, wound moist but no observable exudate 3 = Small 4 = Moderate 5 = Large			
9. Skin Color Sur-rounding Wound	1 = Pink or normal for ethnic group 2 = Bright red &/or blanches to touch 3 = White or grey pallor or hypopigmented 4 = Dark red or purple &/or non-blanchable 5 = Black or hyperpigmented			
10. Peripheral Tissue Edema	1 = No swelling or edema 2 = Non-pitting edema extends <4 cm around wound3 = Non-pitting edema extends ≥4 cm around wound 4 = Pitting edema extends < 4 cm around wound 5 = Crepitus and/or pitting edema extends ≥4 cm around wound			
11. Peripheral Tissue Induration	1 = None present 2 = Induration, < 2 cm around wound 3 = Induration 2-4 cm extending < 50% around wound 4 = Induration 2-4 cm extending ≥ 50% around wound 5 = Induration > 4 cm in any area around wound			
12. Granu-lation Tissue	1 = Skin intact or partial thickness wound 2 = Bright, beefy red; 75% to 100% of wound filled &/or tissueovergrowth 3 = Bright, beefy red; < 75% & > 25% of wound filled 4 = Pink, &/or dull, dusky red &/or fills ≤ 25% of wound5 = No granulation tissue present			
13. Epithe-lializa-tion	1 = 100% wound covered, surface intact 2 = 75% to <100% wound covered &/or epithelial tissueextends >0.5cm into wound bed 3 = 50% to <75% wound covered &/or epithelial tissueextends to <0.5cm into wound bed 4 = 25% to < 50% wound covered 5 = < 25% wound covered			
	TOTAL SCORE			
	SIGNATURE			



Plot the total score on the Wound Status Continuum by putting an "X" on the line and the date beneath the line. Plotmultiple scores with their dates to see-at-a-glance regeneration or degeneration of the wound.