RESPONSE OF RTOG SCALE AND DERMOSCOPY TO PHOTON THERAPY FACE MASK ON DERMATITIS POST HEAD AND NECK RADIOTHERAPY

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ABSTRACT

Background: Among the most prevalent side effects of radiotherapy for the head and neck (HN) tumors is radiation dermatitis. **Purpose of the Study:** This study was conducted to investigate the impact of photon therapy in reducing dermatitis during radiotherapy in patients with HN tumors. **Methods**: A randomized controlled trial (RCT), 60 HNC patients were included and were given radiotherapy (RT) with or without chemotherapy. They were randomized into two groups of equal number, control group (CG) as well as study group (SG). Throughout radiotherapy, both groups received standard nursing care, which consisted of health education, skin self-care, as well as a skin protective agent. The patients in the study group were treated with photon therapy (3x/week) for 6 weeks with a total of 18 sessions. The severity of skin reactions was assessed by the criteria of the Radiation Therapy Oncology Group (RTOG) and dermoscopy for both groups were recorded. **Results:** The incidence of (RTOG scale) was significantly higher in the control group (CG) than in the photon therapy (SG) group. The dermoscopy score (including erythema, scaling, and pigmentation) also showed a significant reduction in photon therapy group (SG) than control group (CG). **Conclusion**: This randomized controlled trial demonstrated that photon therapy could be efficient in decreasing the incidence of acute radiation dermatitis in HNC patients undergoing radiation therapy based on RTOG scale and dermoscopy measurements.

Key Words: Head and neck cancer – Radiation therapy – Radiation dermatitis – Photon therapy – Dermoscopy – RTOG scale.

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INTRODUCTION

Each year, there are 550,000 additional cases of HN cancer (HNC), making it the 7th most frequent cancer worldwide. In addition, it's the seventh leading cause of death, which results in 380,000 deaths every year. [1] Newly reported HNC cases

represented 8% and resulted in 10.2% of deaths among all cancer types in 2020. [2] In Egypt, HNC represents about 17% of all malignant tumors. [3]

HNCs commonly manifest in the following anatomical locations: hypopharynx, oropharynx, nasopharynx, larynx, oral cavity, paranasal sinuses, as well as nasal cavity.[4] Over 90%of HNCs are squamous cell carcinomas (SCCs), the most frequent type of HNC. Adenocarcinoma (AC), mucoepidermoid carcinoma (MEC), adenoid cystic carcinoma (ACC), malignant mucosal melanoma, lymphoma, sarcoma, as well as other uncommon malignancies are a variety of cancer types**.**[5]

Radiation therapy (RT) alone is the main line of treatment in early cases of HNC while combined concurrent chemotherapy and radiation therapy (CCRT) is the main treatment of advanced cases. Highly conformal dose distributions are one of the benefits of intensity modulated radiation therapy (IMRT), along with reduced toxicity, shorter treatment periods, and fewer monitoring units. [6]

Desquamation is the process by which the superficial cells of the epidermis (the top skin layer) are lost and substituted with stem cells from the basal layer. The skin's ability to self-renew is compromised immediately after exposure to radiation therapy, as stem cells in the epidermis' basal layer are disrupted. [7] This process persists during RT, impairing the skin's barricade function thus delaying the wounds healing. Erythema, dry skin, flaking skin, itching, folliculitis (skin rash), as well as hyperpigmentation are all clinical manifestations of these underlying alterations in the skin's structure and vasculature. Water loss, chemical compounds, asthma, UV radiation, as well as infections can all become more problematic when the skin's barrier function and also cutaneous immune system are weakened. [8]

The severity of acute dermatitis is found to be dose dependent. A fibrosis score of 2 or higher at 6 months using RTOG criteria is related with radio-dermatitis of grade 3 or higher at the end of RT.[9]

Mild erythema can progress to moist desquamation as well as ulceration in cases of acute dermatitis. Patients may complain from pain during this acute stage. Fibrosis as well as telangiectasias are late side effects that can appear weeks to years following RT. It is hypothesized that more acute dermatitis would occur with IMRT than with 2-3DCRT as a greater volume of skin will be treated with an intermediate dosage. [10]

If radiation therapy is paired with chemotherapy, found that toxicity increases. According to a study by **Cooper et al.,** 77% of patients who had chemoradiotherapy experienced acute toxicity of grade 3 or higher, compared to 34% of patients who got radiotherapy alone. [11]

Photon therapy Light-emitting diodes (LEDs) are among semiconductor tools that generate non-coherent, non-collimated, as well as narrow-spectrum lights (about 255–1300 nm) whenever a forward voltage is performed. LED devices, such as blue (420–440 nm), red (630–680 nm), yellow (590–595 nm) LED lights, in addition to near-infrared (LED-NIR; 750– 1200 nm). [12] Acne vulgaris, wounds, psoriasis disorders, and skin rejuvenation can all be controlled with the use of red LED lights due to their anti-inflammatory, anti-keratinocyte proliferative, pro-apoptotic, and pro-collagenase capabilities.[13] Acne vulgaris, herpes simplex as well as zoster, skin rejuvenation, as well as psoriasis are just some of the skin conditions that these LEDs can help with. [14]

Concerning PBM's proliferative impact, the therapy's safety in individuals with cancer needs more study. The use of PBMT has not been associated with any negative effects in a systematic study of cancer patients.[15,16.17] The cancer cells may be damaged (indirectly), according to some research, using PBMT.[18] Clinical trials of PBM and RD need to include a follow-up period to determine the efficacy of PBMT on the tumor.

A narrative review on the PBMT for the treatment and prevention of ARD has been published by **Robijns et al., 2019**. The authors found that PBM greatly mitigates ARD, particularly the more serious types of ARD, according to 9 clinical trials in breast as well as HNC patients[19].

This study was conducted to investigate the application of photon therapy during radiation therapy in head and neck cases and evaluate the radiation dermatitis resulting from the radiation therapy.

Because previous studies on the effects of photon therapy lacked sufficient quantitative data, this one was designed to fill that gap on radiation dermatitis in patients with HN tumors by using of two assessment methods RTOG and dermascope.

SUBJECTS, MATERIALS AND METHODS

Only 60 participants out of 70 HNC patients receiving radiation met all the study's inclusion and exclusion criteria. **(Fig. 1)** shows the study's flowchart.

Eligibility criteria: Patients were males and females cases and were diagnosed as HNC with age ranging from 30-60 years. They received radiotherapy (IMRT)**,** all patients were free from any skin diseases, an informed consent was signed from all patients. The study was carried-out in an Oncology centre in a university hospital in Egypt.

Patients with communication disorders or refused to be enrolled in the study or with tumor recurrence or with known skin diseases were excluded from the study.

The study was conducted from July 2020 till April 2021. Ethical committee approval number (**P.T.REC/012/003011**) (clinical trial.gov registry: **NCT05855265**).

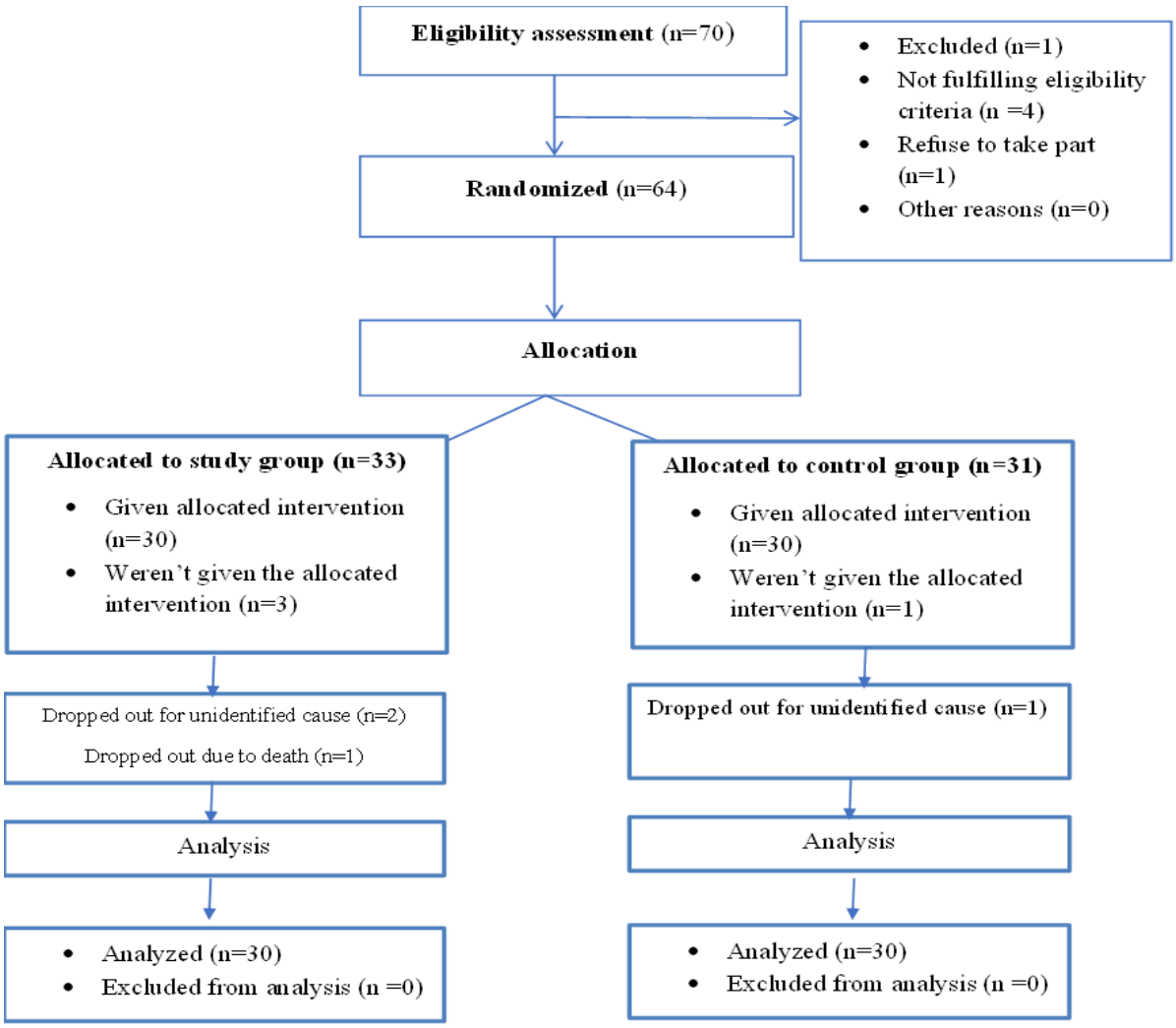

Fig. (1) Patient's flowchart.

The study was randomized controlled study. Prior to the study, sealed envelopes were created and labelled (A) and (B.) Prior to the beginning of the pretest, a researcher who would not be included in the assessment or treatment of the patients randomly assigned the participants to one of two groups. After accepting to take part in the study, patients were randomized into two groups: the investigational as well as the study groups.

During radiotherapy, individuals in the control group (CG) received their standard nursing care, which included health education, skin self-care, as well as a skin protective agent, as well as their medical treatment. Sterile gauze was utilized to dry the area after using cotton balls soaked in normal saline (0.9% solution) to carefully wash the lesion and clear necrotic tissue.

The subjects in the study group (SG) received photon therapy during radiotherapy treatment. During radiotherapy, patients also received basic nursing care, which included wound cleaning with 0.9 percent normal saline cotton and the removal of necrotic tissue if existent. Before the beginning of treatment, a sensitivity test was conducted for each patient which was recommended to determine if patients have light sensitivity issue by testing a small, less sensitive area of skin like forearm. Photon therapy was applied from the beginning of the treatment till the end of the treatment with radiation therapy (three sessions a week, for 6 weeks with an overall of 18 sessions)**.** During the photon therapy sessions, the irradiated area was treated. The treatment wavelength parameter was 630 nm LED phototherapy.[20] Treatment time per session was 20 min, patients choose comfortable position even was sitting or lying supine, then the mask was worn comfortably on the face, use the color button on control box to select red light for the mask and make sure that the patients never look directly into LEDs, and select a power level. At first treatment started with energy level (1) and then increased till reached level (5).

All the participants followed identical management steps according to the national and international protocols. The severity of radiation dermatitis (RD) is evaluated clinically through the principles of the

Radiation Therapy Oncology Group/European Organization for Research and Treatment of Cancer (RTOG/EORTC) criteria**.** Criteria for RTOG scores are as follows: There is no change in grade 0; at grade one there is slight atrophy, altered pigmentation, and some hair loss. grade two: Patch atrophy; there is moderate telangiectasia; overall hair loss. grade three: Extensive atrophy; severe telangiectasia, and grade level 4: ulcer, hemorrhage, and necrosis. [21] The assessment of acute dermatitis by RTOG scale was conducted by the physician once per week during treatment period and documented on patient's file.

While dermoscopy is most commonly used to examine pigmented skin lesions, it can also help observers in evaluating lesions with little to no pigment. Skin surface microscopy, epiluminescence microscopy, incident light microscopy, as well as dermatoscopy are all interchangeable terms. [22] The authors proposed a score based on dermoscopic characteristics of radiation dermatitis to evaluate the degree of the disorder. A score of erythema was 0 showed no erythema, 1 showed faint erythema, 2 showed moderate erythema, as well as 3 showed severe erosion. Scaling was graded from 0 to 2, where 0 = no scaling, 1=moderate scaling, and 2 = severe scaling. Similarly, pigmentation was graded from 0 to 2, where 0 = no pigmentation, 1= moderate pigmentation, and 2 = severe pigmentation. The severity of the condition was determined by summing the grades for erythema, scaling, as well as pigmentation, with 7 being the worst potential score and 0 indicating the absence of any of these symptoms. Dermoscopy scores from a specified area are used to evaluate treatment efficacy, 2 weeks following the first radiation therapy session, four weeks following the first radiation therapy session and after finishing radiation therapy sessions, was compared with the baseline dermoscopic score of the same area.

STATISTICAL ANALYSIS

The statistical analysis was carried-out by utilizing statistical SPSS Package program version 25 for Windows (SPSS, Inc., Chicago, IL). Patients' general clinical features are expressed numerically as means and standard deviations. Numbers and percentages are used to represent categorical data such as gender, RTOG score, as well as dermoscopy (erythema, scaling, pigmentation, and total score). Independent t-test utilized to compare between study group as well as control group for patients' clinical general characteristics variables. Chi-square test utilized to compare within each group, also to compare between both groups for gender, RTOG scale, and dermoscopy. All statistical analyses were significant with P-value ≤ 0.05**.** [23]

RESULTS

In the present study, an overall of 60 patients (35 males and 25 females) participated and were assigned randomly into the control and the investigational (30 patients for each group). No significant differences (P>0.05) in mean values of age (P=0.511), dose (P=0.082), number of fractions (P=0.498), treatment time (P=0.335), and gender (P=0.793) among study group as well as control group **(Table 1).**

Table 1: Patient clinical general characteristics among groups

Variable	Groups		Statistic test-value	*P*-value
	Study group (n=30)	Control group (n=30)		
Age (Years)	48.43 ±11.58	50.27 ±9.82	0.661	0.511
Dose (Gy)	63.97 ±5.62	61.40 ±5.61	1.769	0.082
Number of fractions	31.13 ±3.99	30.53 ±2.68	0.682	0.498
Treatment time (w)	5.37 ±0.61	5.23 ±0.43	0.973	0.335
Gender (males: females)	17 (56.70%) :13 (43.30%)	18 (60.00%) :12 (40.00%)	0.069	0.793

Quantitative data (age, dose, number of fractions, and treatment time) are expressed as mean ±standard deviation (SD) and compared by independent t-test; Qualitative data (gender) are expressed as number (percentage) and compared by Chi-square test; P-value: probability value; P-value>0.05: non-significant

Upon comparing the development of acute radiation dermatitis clinically between the two groups (group effect), according to the RTOG criteria, our findings indicated that there was no significant difference (P>0.05) at assessment-week (1) (P=0.058) between both groups. Interestingly, there were significant differences (P<0.05) in the acute radiation dermatitis according to the RTOG criteria between both groups at assessment-week 2 (P=0.0001), assessment-week 3 (P=0.0001), assessment-week 4 (P=0.0001), assessment-week 5 (P=0.0001), and assessment-week 6 (P=0.0001). As shown in **(Table 2).**

Upon comparing the development of acute radiation dermatitis clinically between each group during the RTOG criteria, radiation dermatitis resulted from radiation therapy but delayed progression of it. Furthermore, the control group showed higher grades of toxicity according to the RTOG criteria (χ^2=205.368; P=0.0001) that developed faster than the study group (χ^2=151.006; P=0.0001) which showed a lower grade for prolonged time. As shown in (Table 2).

Table 2. Distribution of assessments for RTOG scale grades in both groups

Assessments		Groups										Group effect	
		Study group (n=30)					Control group (n=30)						
		Grade (0)	Grade (1)	Grade (2)	Grade (3)	Grade (4)	Grade (0)	Grade (1)	Grade (2)	Grade (3)	Grade (4)	χ^2-value	P-value
Assessment-week (1)		27 (90%)	2 (7%)	1 (3%)	0 (0%)	0 (0%)	12 (40%)	17 (57%)	1 (3%)	0 (0%)	0 (0%)	5.571	0.058
Assessment-week (2)		26 (87%)	1 (3%)	2 (7%)	0 (0%)	1 (3%)	0 (0%)	13 (43%)	16 (53%)	1 (3%)	0 (0%)	49.175	0.0001*
Assessment-week (3)		15 (50%)	12 (40%)	0 (0%)	1 (3%)	2 (7%)	0 (0%)	4 (13%)	19 (64%)	4 (13%)	3 (10%)	40.000	0.0001*
Assessment-week (4)		9 (30%)	18 (60%)	1 (3%)	2 (7%)	0 (0%)	0 (0%)	0 (0%)	13 (43%)	12 (40%)	5 17(%)	49.429	0.0001*
Assessment-week (5)		7 (23%)	11 (37%)	12 (40%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (20%)	19 (63%)	5 (17%)	44.000	0.0001*
Assessment-week (6)		1 (3%)	2 (7%)	24 (80%)	2 (7%)	1 (3%)	0 (0%)	0 (0%)	1 (3%)	26 (87%)	3 (10%)	45.731	0.0001*
Time effect	χ^2-value	151.006					205.368						
	P-value	0.0001*					0.0001*						

Data are expressed as number (percentage); RTOG scale: Grade 0 (no change), Grade 1 (slight atrophy; pigmentation change; some hair loss), Grade 2 (patch atrophy; moderate telangiectasia; total hair loss), Grade 3 (marked atrophy; gross telangiectasia), and Grade 4 (ulcer, bleeding, and necrosis).
χ^2-value: Chi-square value; P-value: probability value; S: significant; * Significant (P<0.05)

Upon comparing the development of acute radiation dermatitis using dermascope, according to the erythema scale, within each group during the radiation therapy (time effect), our findings revealed that there were significant differences (P<0.05) in erythema grades assessments within study group (P=0.0001) as well as control group (P=0.0001) that presented that photon therapy did not prevent the radiation dermatitis resulted from radiation therapy but delayed progression of it. Furthermore, the control group showed higher grades of erythema (χ^2=151.149; P=0.0001) that develop faster than study group (χ^2=87.312; P=0.0001) which showed a lower grade for prolonged time. As shown in **(Table 3).**

Upon comparing the development of the acute dermatitis using dermascope, between the two groups (group effect), according to the erythema scale, our findings indicated that there were no significant difference (P>0.05) at assessment (1) of erythema grades (P=0.076) between both groups. Interestingly, there were significant differences (P<0.05) in the acute radiation dermatitis according to erythema scale between both groups at assessment 2 (P=0.0001), assessment 3 (P=0.0001), and assessment 4 (P=0.0001). As shown in **(Table 3).**

Table 3. Distribution of assessments for erythema grades in both groups

Assessments		Groups								Group effect	
		Study group (n=30)				Control group (n=30)					
		Grade (0)	Grade (1)	Grade (2)	Grade (3)	Grade (0)	Grade (1)	Grade (2)	Grade (3)	χ^2-value	P-value
Assessment (1)		27 (90%)	0 (0%)	0 (0%)	3 (10%)	30 (100%)	0 (0%)	0 (0%)	0 (0%)	3.158	0.076
Assessment (2)		14 (47%)	16 (53%)	0 (0%)	0 (0%)	0 (0%)	17 (57%)	10 (33%)	3 (10%)	27.030	0.0001*
Assessment (3)		0 (0%)	29 (97%)	1 (3%)	0 (0%)	0 (0%)	0 (0%)	25 (83%)	5 (17%)	56.154	0.0001*
Assessment (4)		0 (0%)	28 (94%)	1 (3%)	1 (3%)	0 (0%)	11 (37%)	16 (53%)	3 (10%)	21.646	0.0001*
Time effect	χ^2-value	87.312				151.149					
	P-value	0.0001*				0.0001*					

Data are expressed as number (percentage); Erythema grades: Grade 0 (no erythema), Grade 1 (faint erythema), Grade 2 (moderate erythema), and Grade 3 (erosion); χ^2-value: Chi-square value; P-value: probability value; S: significant; * Significant (P<0.05)

Upon comparing the development of acute radiation dermatitis using dermascope, according to the scaling and the pigmentation scale, within each group during the radiation therapy (time effect), our findings revealed that there were significant differences (P<0.05) in the scaling and the pigmentation grades assessments within study group (P=0.0001 and P=0.0001, respectively) as well as

control group (P=0.0001 and P=0.0001, respectively) that presented that photon therapy did not prevent the radiation dermatitis resulted from radiation therapy but delayed progression of it. Furthermore, the control group showed higher grades of scaling and the pigmentation grades (χ^2=112.377 and χ^2=144.440, respectively) that develop faster than study group (χ^2=33.385 and χ^2=57.173, respectively) which showed a lower grade for prolonged time. As shown in **(Table 4).**

Upon comparing the development of the acute dermatitis using dermascope, between the two groups (group effect), according to the scaling and pigmentation scales, our findings revealed that there was no significant difference (P>0.05) at assessment-week (1) of scaling and pigmentation grades (P=0.076 and P=0.355, respectively) between both groups. At assessment 2, there was significant difference (P<0.05) in scaling grades (P=0.0001), while no significant difference (P>0.05) in pigmentation grades (P=0.117) between both groups. Curiously, there were significant differences (P<0.05) in the acute radiation dermatitis according to scaling and pigmentation grades between both groups at assessment 3 (P=0.0001 and P=0.0001, respectively) and assessment 4 (P=0.0001 and P=0.0001, respectively). As shown in **(Table 4).**

Table 4. Distribution of assessments for scaling and pigmentation grades in both groups

Item	Assessments	Groups						Group effect	
		Study group (n=30)			Control group (n=30)				
		Grade 0	Grade 1	Grade 2	Grade 0	Grade 1	Grade 2	χ^2-value	P-value
Scaling grades	Assessment (1)	27 (90%)	3 (10%)	0 (0%)	30 (100%)	0 (0%)	0 (0%)	3.158	0.076
	Assessment (2)	27 (90%)	2 (7%)	1 (3%)	12 (40%)	16 (53%)	2 (7%)	16.991	0.0001*
	Assessment (3)	22 (73%)	8 (27%)	0 (0%)	0 (0%)	19 (63%)	11 (37%)	37.481	0.0001*
	Assessment (4)	10 (33%)	18 (60%)	2 (7%)	0 (0%)	8 (27%)	22 (73%)	30.513	0.0001*
	Time effect χ^2-value		33.385			112.377			
	Time effect P-value		0.0001*			0.0001*			
Pigmentation	Assessment (1)	28 (94%)	1 (3%)	1 (3%)	30 (100%)	0 (0%)	0 (0%)	2.069	0.355
	Assessment (2)	26 (87%)	4 (13%)	0 (0%)	21 (70%)	9 (30%)	0 (0%)	2.455	0.117
	Assessment (3)	15 (50%)	15 (50%)	0 (0%)	0 (0%)	21 (70%)	9 (30%)	25.000	0.0001*
	Assessment (4)	4 (13%)	21 (70%)	5 (17%)	0 (0%)	2 (7%)	28 (93%)	35.726	0.0001*
	Time effect χ^2-value		57.173			144.440			
	Time effect P-value		0.0001*			0.0001*			

Data are expressed as number (percentage); Scaling grades: Grade 0 (no scaling), Grade 1 (moderate scaling), and Grade 2 (severe scaling); Pigmentation grades: Grade 0 (no pigmentation), Grade 1 (moderate pigmentation), and Grade 2 (severe pigmentation); χ^2-value: Chi-square value; P-value: probability value; S: significant; * Significant (P<0.05)

Upon comparing the development of acute radiation dermatitis using dermascope, according to the total score, within each group during the radiation therapy (time effect), our findings indicated that there were significant differences (P<0.05) in total score assessments within study group (P=0.0001) as well as control group (P=0.0001) that presented that photon therapy did not prevent the radiation dermatitis resulted from radiation therapy but delayed progression of it. Furthermore, the control group showed higher total score (χ^2=230.631; P=0.0001) that develop faster than study group (χ^2=109.121; P=0.0001) which showed a lower grade for prolonged time. As shown in **(Table 5).**

Upon comparing the development of the acute dermatitis using dermascope, between the two groups (group effect), according to the total score, our findings indicated that there was no significant difference (P>0.05) at assessment (1) of total score (P=0.369) among both groups. grippingly, there were significant differences (P<0.05) in the acute radiation dermatitis according to the total score between both groups at assessment 2 (P=0.0001), assessment 3 (P=0.0001), and assessment 4 (P=0.0001). As revealed in **(Table 5).**

Table 5. Distribution of assessments for total score in both groups

Assessments	Groups																Group effect	
	Study group (n=30)								Control group (n=30)									
	Score (0)	Score (1)	Score (2)	Score (3)	Score (4)	Score (5)	Score (6)	Score (7)	Score (0)	Score (1)	Score (2)	Score (3)	Score (4)	Score (5)	Score (6)	Score (7)	χ^2-value	P-value
Baseline (1)	26(88%)	1(3%)	0(0%)	1(3%)	0(0%)	1(3%)	1(3%)	0(0%)	30(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	4.286	0.369
Assessment (2)	14(47%)	12(40%)	1(3%)	2(7%)	1(3%)	0(0%)	0(0%)	0(0%)	0(0%)	11(37%)	3(10%)	10(33%)	2(7%)	4(13%)	0(0%)	0(0%)	24.710	0.0001*
Assessment (3)	0(0%)	12(40%)	12(40%)	6(20%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	15(50%)	8(27%)	4(13%)	3(10%)	60.000	0.0001*
Assessment (4)	0(0%)	2(7%)	10(33%)	12(40%)	3(10%)	2(7%)	1(3%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	3(10%)	15(50%)	9(30%)	3(10%)	43.341	0.0001*
Time effect χ^2-value	109.121								230.631									
Time effect P-value	0.0001*								0.0001*									

Data are expressed as number (percentage) ; The total score grades: Grade 0 (no erythema, no scaling, and no pigmentation) to grade 7 (the most severe); χ^2-value: Chi-square value P-value: probability value; S: significant; * Significant (P<0.05)

DISCUSSION

Radiotherapy (RT) has an important role in the treatment of head and neck cancers (HNCs). [24] But, around 95 % of patients having RT develop radiation dermatitis (RD) as an undesirable side effect of the treatment.[25]. When RT interrupt the natural processes of skin regeneration as well as cell division, it produces radiation dermatitis.[26]. Erythema, hyperpigmentation, dry desquamation, moist desquamation, as well as ulceration are all symptoms of the acute form of RD, which commonly appears 30–90 days after exposure to radiation.[27] Patients with radiation dermatitis report a decrease in their quality of life. In particular, embarrassment, mental depression, as well as physical discomfort all contribute to the diminished quality of life brought on by skin problems.[28].

The efficacy of various topical methods for preventing RD is compared in a meta-analysis study **(Kao et al., 2023)**[29]. The study analyzed data from 45 randomized trials. No more effective treatment for preventing RD of grades 3 or above was found in this study in comparison with the current standard of care. The effectiveness of the following topical preventative measures is comparable: Aloe vera gel, Biafine cream, Hydrocortisone cream, Lipiderm, HPR Plus, standard of care (SOC), Nigella sativa L., Silver sulfadiazine, Recombinant human epidermal growth factor (EGF)-based cream, Silymarin, Mebo Ointment, Mometasone cream, as well as Aloe vera gel.

Photon therapy (LEDs) treatment is one of the most attractive methods nowadays because of its noninvasive nature.[30-33] Reducing water loss across the epidermis, reducing pain, and preventing skin lesions by reducing the effects of ionizing tissue injury are the purpose of treatment of radiation-induced skin alterations.

This study was conducted to identify the effect of photon therapy in reducing the incidence of acute radiation induced dermatitis during radiotherapy in patients with HN tumors.

Sixty Egyptian head and neck cancers patients who were eligible to receive radiation therapy, were randomly assigned into two equal groups from both sexes into **study group (GA),** in which patients were receiving photon therapy during radiotherapy treatment in addition to medical treatment, and **control group (GB)** who received their routine medical treatment during radiation therapy. Assessment of the following variables was conducted for each patient: RTOG SCALE (Radiation Therapy Oncology Group scale) and dermoscopy.

Interestingly, the results of the current study revealed that there was a significant impact of photon therapy reducing radiation dermatitis in patients with HN cancer who received radiation therapy. Photon therapy has been shown to have helpful clinical effects as it motivates cellular function. Wound healing acceleration, improve ischemic injury recovery, as well as attenuate degeneration in the injured optic nerve reported when the light in the red to the near infrared range (630–1000 nm) has been used. Photon irradiation effect at the cellular level can generate considerable biological effects including cellular proliferation and the release of growth factors from cells. [33] Increasing fibroblast function and wound-healing functions of LED are two sides of the same coin[34]. LEDs speed up wound healing by its anti-inflammatory performance.[35] Photon therapy also helped our study group patients to continue all radiation therapy sessions without +

The current study's findings were consistent with those of **Camargo et al.,** 2023[36], who found that histological examination of treated rats demonstrated an improvement compared to the control group, and that the combination of 630 wavelengths induced an increase in vascular density as well as dermal appendage density, which indicated an increase in cell division along with migration from the epidermis's basal layer.

Further, **Camargo et al.,** 2022 [37] reported that macro as well as microscopic analysis on rats proposed good benefits with exposure to light, particularly with the association among wavelengths 630 along with 850 nm, leading to a less severe case of radiation-induced dermatitis. Photobiomodulation improved cell division as well as migration in the basal layer of the epidermis, showed its regenerative capacity in the impacts of radiotherapy, and accelerated up the process of epithelialization of the injury, as seen in the histological analysis for the aforementioned research.

Furthermore, our findings were consistent with **Zhang et al., 2018** [38] **.** Healing times for radiation dermatitis among patients with HN cancer were shown to be greatly reduced when red-light phototherapy (wavelength 630nm) was used in combination with conventional wound care. In addition to dealing with inflammation and ulcer healing and reducing wound pain, it can also facilitating patients' progress through radiotherapy, and help enhance their quality of life.

Also, **Robijns et al., 2021** [39] which is the first randomized, placebo-controlled trial (RCT) with HNC patients who received radiotherapy (RT). Patients were randomized to receive PBM or placebo treatments from the 1st day of RT 2 times per week with institutional skincare. **Robijns et al.,** 2021 reported that PBMT (Photobiomodulation therapy) is an efficient technique to avoid the development of severe ARD.

Additionally, the current results were in agree with **DeLand et al., 2007** [40] results, which reported that

LED photomodulation (GentlewavesTM, Light BioScience, LLC, Virginia Beach, VA) treatments directly following IMRT decreased the incidence of NCI (National Cancer Institute) grades 1, 2, as well as 3 skin reactions in patients having breast cancer who received RT. It's possible that the decreased severity of RT-induced skin alterations in the RT+LED group is due to the LEDs' effects of stimulating fibroblast function in addition to reduced inflammation.

However, a study by **Fife et al.** 2010[41] compared PBMT to sham therapy, which involved following a similar protocol on a control group but utilizing a laser that had been deactivated, demonstrated that LED (GentleWaves Select 590-nm high-energy LED array) did not show a lower incidence or grade of radiation dermatitis, using (NCI), when RT was conducted in combination with LED. That may be due to small sample size, Patient characteristics may had varied in the patient populations of that study, using different parameter (wavelength-590nm) for just 35 seconds before and 35 seconds after each radiation session.

In addition, **Robijns et al. 2022**[42], conducted a randomized, multicentric clinical trial (LABRA trial, NCT03924011) involving 71 breast cancer patients, dividing them equally between a control group (n = 32) as well as a PBM group (n = 39). The PBM group received conventional institutional skincare in addition to PBM (2/week) utilizing the class IV MLS® M6 laser (ASA Srl) for the duration of their radiotherapy (RT) with treatment session involves 2 LDs with various wavelengths (808–905 nm) with max. time 15min, patients in the control group were given the standard skincare in combination with placebo treatment two sessions per week), indicated that PBM appears not capable of decrease the incidence of severe ARD in patients with breast cancer experiencing hypofractionated whole-breast irradiation (HF-WBI) but they were suggested additional studies in a greater sample size.

LIMITATION:

The safety of the treatment method could not be determined because there was no long-term assessment of the patients after treatment. Furthermore, this trial needs to be confirmed in more prospective larger multi-centric randomized trials.

CONCLUSION

It was found that photon therapy significantly reduced the incidence of radiation dermatitis in patients getting radiation treatment for head and neck cancer, this means that photon therapy delays the presence of radiation dermatitis results from radiation therapy.

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