

Efficacy and Patient Perception of Grenz Ray Therapy in the Treatment of Dermatoses Refractory to Other Medical Therapy

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Background: Grenz ray therapy (GRT) has been used to treat dermatoses refractory to other therapy. Patient's assessments to GRT alone have not been previously reported.

Objective: (1) To report the patterns of use of GRT at our center over a 10-year period and evaluate the efficacy of GRT in treating recalcitrant skin conditions, (2) to evaluate patient perceptions about GRT, and (3) to evaluate whether patients felt this form of treatment was worthwhile.

Method: Cross-sectional survey by mailed questionnaire to patients treated with GRT from 1990 to 2001.

Results: Of 351 patients treated with GRT from 1990 to 2001, 98 (28%) returned the questionnaire; 64% reported decreased severity or clearing of disease ($p = .003$), and 63% reported decreased or no discomfort ($p = .006$) 3 months following treatment. Overall, 54% said GRT was worthwhile, and 53% would choose it again; 40% reported mild side effects. Number of treatments ($p = .2$) or total dose ($p = .25$) were not significantly different among responders to GRT and nonresponders to GRT. In a subgroup of treated patients with a diagnosis of contact dermatitis (94% with hand dermatitis), 64% felt GRT was worthwhile and 77% indicated that they would choose this therapy again if needed.

Conclusions: Many patients treated with GRT for recalcitrant dermatitis reported that this treatment was an effective therapy in decreasing the discomfort and severity of their skin condition. Overall, just more than half of treated patients believed GRT was a worthwhile therapy that they would use again.

GRENZ RAY THERAPY (GRT) is a form of long-wavelength ionizing radiation that was developed in 1923 by Dr. Gustav Bucky, a dermatologist born in Germany and who practiced in the United States. From the 1930s to the 1950s, it was a popular modality for the treatment of a variety of skin diseases. Grenz rays are produced by low voltage passed across a cathode ray tube in the range of 10 to 25 kV; these electrons pass from the cathode through a window of beryllium to the anode, altering the characteristics of the rays, making them "soft" or less penetrating. The theoretical advantage of GRT is its safety; because it is a form of ionizing radiation with a very low penetration, 75% of the rays are absorbed in the first

millimeter of epidermis and 95% are absorbed in the first 3 mm, allowing very little radiation to pass through to the dermis.¹ In support of the safety of GRT, a large study performed by Lindelöf in Sweden showed that out of 14,140 patients followed for 15 years, only 58 patients developed skin cancer at any site. Of the 8 patients who developed skin cancer at the site of GRT, 6 had been exposed to other known carcinogens at that same site.²

Despite documented safety and previous acceptance, GRT in the United States has largely been supplanted by other therapies. In 1975, 44% of dermatologists in the United States and Canada were using GRT.³ By 1986, the use of GRT and ionizing radiation in dermatology training centers had decreased to 23%.⁴ As of 2005, only 10% of dermatology training programs "have and use" superficial x-ray or GRT equipment.⁵ This may be due to the advent of topical steroid therapy, the lack of training for dermatology residents in the use of the equipment, the limited availability of maintained GRT equipment, and the negative public perception of ionizing radiation. In the 2005 survey, nearly 70% of those surveyed discontinued using their GR machines owing to problems in maintain-

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ing the machines. Some other concerns cited were in regard to the licensing of ionizing radiation (IR) equipment (47%) and to skin cancer in those exposed (46%); 46% also felt that better therapies were available. Only 5% believed that GRT was not effective.⁵ GRT is now available in only a few centers in the United States, where it is often used for patients in whom numerous topical or systemic therapies have failed.

Presently there are no studies that examine outcomes in a group of patients who have been treated with GRT after conventional therapy has failed. There have been studies examining the effectiveness of GRT in combination with other therapies such as steroid creams,⁶ and there have been numerous other small studies documenting the use of GRT for a number of skin conditions, including superficial actinic porokeratosis, morphea, psoriasis, and certain hand dermatoses.⁷⁻¹⁰ These studies, however, have not included an examination of the efficacy of GRT for refractory disease, nor have they addressed patient satisfaction with the therapy. In the United States, GRT is often prescribed as a last resort. In our tertiary practice, physician referral for GRT in the setting of refractory skin disease was notably variable; some physicians were very convinced of the efficacy and usefulness of this treatment whereas others were more skeptical of the outcome of treatment with GRT. Because of this notable difference of opinion among our own practitioners, we wanted to know (1) how treated patients perceived the benefit of GRT and (2) which, if any, patient or treatment characteristics correlated with the best response to this therapy.

Objectives

The purpose of this study was to describe the patterns of use and patient perceptions of GRT at Dartmouth Hitchcock Medical Center (DHMC) from 1990 to 2001. We sought to (1) evaluate the efficacy of GRT for recalcitrant skin conditions, (2) evaluate patient perceptions about GRT, and (3) evaluate if GRT should be considered more frequently as a treatment option.

Methods

Patient Selection

All patients treated with GRT in the DHMC Section of Dermatology between 1990 and 2001 were identified in the GRT logbook. Institutional review board (IRB) approval was obtained, and 351 eligible patients were sent a

questionnaire regarding oral, topical, and light therapies used prior to GRT; the severity of symptoms before and after GRT; side effects experienced; and the patient's opinion regarding GRT, specifically whether they viewed the treatment as worthwhile and would again choose GRT if needed for a similar condition. A cover letter including a photograph of the Grenz ray machine was sent with the questionnaire, and each letter specified the particular patient's diagnosis and the date when he or she was first treated. A chart review was performed to extract patient and therapy data including the patients age and gender, the location of dermatitis, the treatment dosage, the duration of the condition, and the dermatologic diagnosis for which the GRT was prescribed. Response to therapy was entirely self-reported by the patient and was not taken from chart review.

Statistical Analysis

All analyses were based upon the patients responding to the survey. Chi-square tests and Fisher exact tests were used to compare proportions, and logistic regression was used to estimate odds ratios. *S-Plus* 6.0 software (Insightful Corporation, Seattle, WA) was used. Subgroups by diagnosis and treatment location were examined. The subgroup of patients with allergic contact dermatitis was examined separately from the remaining patients with dermatitis of other etiologies. Statistical significance was defined as $p < .05$. Response was defined as a decrease in severity or discomfort after GRT.

Results

Patient Demographics and Disease Type and Duration

From 1990 to 2001, 351 patients were treated with GRT. Ninety-eight patients (28%) returned the questionnaire. Patients responding to the survey were significantly younger ($p < .0001$), were younger at first exposure to GRT ($p = .002$), had a longer treatment interval (days between treatments) ($p = .02$), and were more likely to be female ($p = .02$) (Table 1). Statistical analysis did not reveal any other significant difference between those who responded to the survey and those who did not return the questionnaire. The major diagnoses represented were psoriasis and dermatitis. Other diagnoses represented are displayed in Table 2. Of the responders to the survey, 18% had disease for less than 1 year and 82% had disease for

Table 1. Patient Demographics

	Percentage (n = 98)
Sex	
Male	31
Female	69
Age (yr)	
< 25	0
25–50	39
> 50	61

1 year or longer. Response to GRT was not related to the duration of skin disease. Nonresponders to the survey did not have any significant differences in age, gender, diagnosis, treatment site, or number of treatments.

Patient Perception of Response

For respondents, the average total dose of GRT was 1,280 cGy and the average number of GRT treatments was four. Of all responders, 64% reported decreased severity of disease or clearing of disease ($p = .003$) and 63% reported decreased or no discomfort ($p = .006$) 3 months following GRT. Overall, 54% felt that GRT was worthwhile ($p = .36$) and 53% indicated that they would choose it again if their skin condition worsened ($p = .48$). Subgroup analysis was performed to further characterize GRT efficacy and patient opinions. A summary of the data and the subgroups analyzed is presented in Table 3. As shown in Table 4, 40% of patients reported mild side effects.

Psoriasis and GRT

In the psoriasis subgroup (65% of survey responders), the only improvement approaching significance was decreased discomfort following GRT ($p = .08$). There was no significant decrease in perceived severity of psoriasis, and 48% of psoriasis patients felt that GRT was worthwhile whereas 52% were unsure or disagreed ($p = .36$); 45%

Table 2. Diagnoses

Diagnosis	Percentage (n = 98)
Psoriasis	65
Allergic contact dermatitis	17
Atopic dermatitis	9
Other dermatitis	3
Other (pruritus ani/Hailey-Hailey disease)	6

indicated that they would use GRT again whereas 55% were unsure or disagreed ($p = .48$).

Eczematous Dermatitis and GRT

Of patients responding to the survey, 29% had eczematous dermatitis. Of responders with dermatitis, 71% felt that GRT significantly decreased the severity ($p = .008$) and discomfort ($p = .008$) of their skin condition. The majority (63%) felt that GRT was worthwhile although this was not a significant difference ($p = .14$); 69% of patients with dermatitis indicated that they would use GRT again ($p = .02$). A subgroup of patients with a referral diagnosis of allergic contact dermatitis was examined separately. Seventy-two percent reported having decreased severity and discomfort following treatment ($p = .049$); 77% of these patients indicated that they would use GRT again ($p = .013$), and the majority (64%) felt that the treatment was worthwhile ($p = .14$). These rates of satisfaction and response are the highest rates of all subgroups evaluated.

Of patients with dermatitis, 65% had involvement and treatment of their hands. A separate subgroup analysis of these patients with all types of hand dermatitis showed they had significantly decreased severity ($p = .008$) and discomfort ($p = .003$), and the majority (56%) felt that treatment was worthwhile and indicated that they would use it again (58%).

Patients with Prior Ultraviolet or Oral Therapy

Prior to their having GRT, 31% of respondents had only topical therapy, 26% had ultraviolet (UV) treatments (psoralen plus ultraviolet A [UVA] or ultraviolet B [UVB]) and 24% had oral therapies such as cyclosporine, methotrexate, prednisone, or acitretin. The patients who had prior UV or oral therapy for their skin disease were evaluated separately to determine their opinions of GRT. It was assumed that these therapies were markers of more severe or disabling skin disease as compared to the disease of those using only topical therapy. Response to GRT was not related to prior therapy with UVB or oral medications. There were no significant differences between the topical therapy group and the systemic therapy group in regard to whether patients felt that GRT was worthwhile ($p = .30$) and whether they would use GRT again ($p = .18$).

Conclusions

Our questionnaire results show that in this small population, GRT was effective in decreasing the discom-

Table 3. Patient-Reported Efficacy and Perception of Grenz Ray Therapy

	<i>Decreased Severity or Resolution (%)</i>	<i>Decreased or No Discomfort (%)</i>	<i>Consider Worthwhile (%)</i>	<i>Would Try Again (%)</i>
Overall (<i>n</i> = 98)	64*	63*	54	53
Psoriasis (63)	62	60	48	45
Dermatitis (29)	72*	72*	63	69*
Allergic contact dermatitis (17)	71*	71*	64	77*
Hand involvement (64)	66*	67*	56	58

**p* < .05.

fort and severity associated with recalcitrant dermatoses as perceived by the patient. In addition, many of these patients felt that they would consider using GRT again if necessary. Just over half of the patients felt that GRT was worthwhile. Given that these patients had refractory skin disease, we conclude that GRT is a useful addition to the therapeutic armamentarium. These results support the continued use of GRT in patients who do not respond to other therapies. Patients with dermatitis (especially dermatitis of the hands,) did well with GRT, compared to those with psoriasis.

Study limitations include recall bias, nonresponse bias, and the lack of a comparison group. Much of the data in this study comes directly from patient medical records, which eliminates recall bias for variables such as disease diagnosis, anatomic location of treatment, and treatment parameters. To maximize patient recall and to ensure consistency in responses, each cover letter included both a photograph of the grenz ray machine and an individualized diagnosis with the date of first treatment. It is important to note that dermatologic diseases treated with GRT at our center tend to be memorable because such GRT typically has been a treatment of last resort of unmanageable disease and is delivered in a very specific fashion with a unique machine.

The low survey response of 28% may skew the results. In this situation, those who are particularly happy or unhappy with this GRT may be the ones who actually responded. The overall satisfaction rate of 54% that we

found may actually be lower since those who had treatment but did not respond to it may be less likely to want to spend any more time with an ineffective modality.

GRT is a well-tolerated treatment modality, shown to decrease both severity and discomfort in all patient groups with dermatoses ranging from mild to severe. Response to GRT was not related to duration of skin disease or prior therapy with UVB or oral medications (cyclosporine, methotrexate, oral retinoids, or prednisone). Patients with allergic hand dermatitis seemed to do especially well with GRT. The majority of patients treated felt that GRT was worthwhile and would choose it again if necessary.

To our knowledge, there are no previous studies describing the patterns of use of GRT in patients with refractory skin conditions; published information regarding GRT efficacy, side effects, and patient satisfaction is sparse. Consequently, this study is important to practicing dermatologists near centers that offer GRT or to those interested in providing GRT to patients in their area. The results of our study also allow practitioners to better inform patients about expectations of GRT in terms of treatment response and symptom relief.

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Table 4. Side Effects Following Grenz Ray Therapy

<i>Side Effect</i>	<i>Percentage of Patients</i>
Reported none (<i>n</i> = 59)	60
Reported side effect (<i>n</i> = 39)	40
Increased itch (<i>n</i> = 9)	9
Skin darkening (<i>n</i> = 10)	10
Skin tightness (<i>n</i> = 11)	11
Increased skin scaling (<i>n</i> = 14)	14
Increased skin dryness (<i>n</i> = 15)	15

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