

# Narrow-Band UVB: A Practical Approach

Joan Shelk  
Pamela Morgan

*Narrow-band UVB therapy offers a new and exciting treatment option and area of study in phototherapy. The narrow-band skin type protocol offers a safe and effective treatment plan for those who do not routinely use, or wish to use, minimal erythema dosing to establish starting doses for narrow-band UVB therapy.*

**B**road-band ultraviolet B (UVB) has been an accepted form of phototherapy for decades. Ultraviolet A (UVA) therapy, as utilized in a psoralen plus UVA (PUVA) program, has been an integral part of most comprehensive phototherapy offerings since the mid 1970s. Both therapies have been very successful but are not without limitations. Narrow-band therapy offers a new and exciting treatment option and area of study. This type of UVB therapy has been used for years in Europe and Australia but only for the last few years in the United States. As the use and knowledge base of this therapy expands in the United States, we can expect to see changes in the application of this new phototherapy modality.

Moving from left to right on the light spectrum, ultraviolet energy is greatest next to X-rays and becomes gradually weaker as it approaches visible light. The wavelengths in the range from 290 to 320 nanometers are classified as UVB and those in the range from 320 to 400 nanometers are classified as UVA. All ultraviolet light is capable of producing erythema; however, UVB rays are the most energetic and, therefore, produce the most erythema (sunburn). UVA rays are the least energetic and are noted for their tanning effect (melanogenesis) rather than burning.

Standard fluorescent UVB lamps emit a wide selection of ultraviolet rays that are a combination of both therapeutic and non-therapeutic wavelengths as well as a considerable amount of UVA (see Figures 1 & 2).

With the advent of the narrow-band UVB lamps, only a narrow selection of UVB energy, the wavelengths in the range of 311 to 313 nm are emitted, hence the term "narrow band." Skin derives its most therapeutic effects from these three wavelengths. Wavelengths in the lower nanometer range of 290 to 310, which have been eliminated in narrow-band lamps, are associated with non-therapeutic responses such as burning, premature aging, and skin cancer. This means that the most erythemogenic (erythema producing) wavelengths of 290 to 310 nm are not a factor for narrow-band therapy. For this reason, larger treatment doses are permitted, in fact necessary, in narrow-band therapy as compared to broad-band UVB. Starting doses are considerably higher, as are treatment increases and ultimate clearing levels.

To better understand the difference in the dosing of various types of ultraviolet light, note that a skin type III individual may expect minimal erythema from:

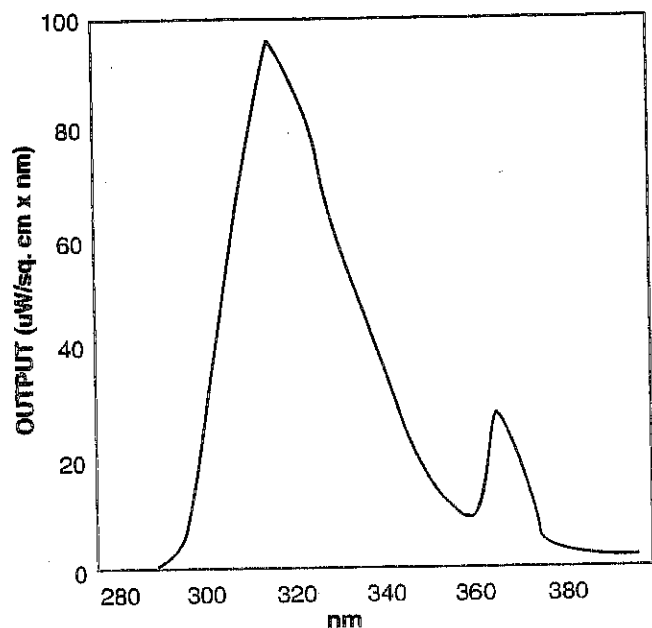
- 30 millijoules of UVB.
- 200-300 millijoules of narrow band (NB).
- 3 joules of UVA.
- 20 to 30 minutes of sunlight at noon in the summer in New York City.

Narrow-band UVB lamps (also known as "TL-01") are manufactured in Europe by Phillips and are fitted with pin adapters to make them compatible with U.S. manufactured equipment. These adapters make them slightly longer than standard

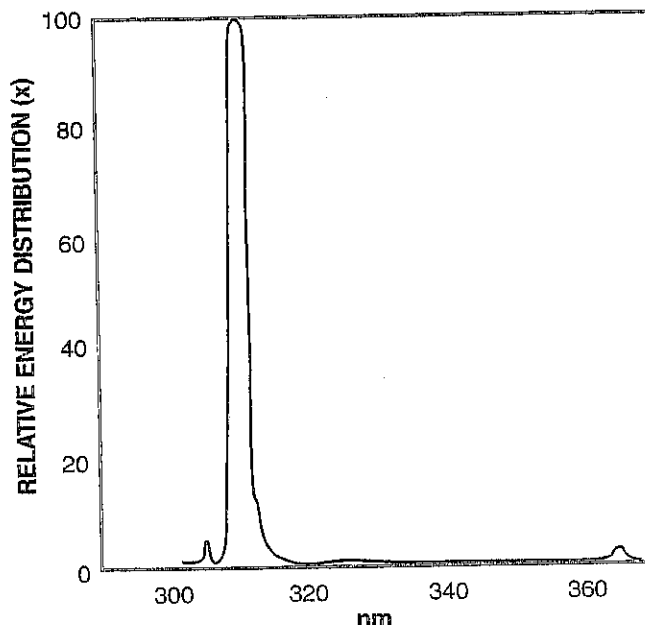
Joan Shelk, RN, is Clinical Administrator, Leone Dermatology Center, Arlington Heights, IL.

Pamela Morgan, RN, is former Clinic Administrator of the Psoriasis Treatment Center, Seattle, WA, and is currently the Nurse Phototherapist, Virginia Mason Medical Center, Seattle, WA.

**Figure 1.**  
Spectral Energy Distribution of Sylvania Ultraviolet  
F75/85W/UV6 Lamps



**Figure 2.**  
Relative Spectral Energy Distribution of  
Phillips TL-01 Lamps



**Table 1.**  
Example of Narrow-Band Output  
Determination

<p>Actual meter reading — 4.5 mw/cm<sup>2</sup>          Multiply by 0.74 to achieve a:          Usable reading — 3.3 mw/cm<sup>2</sup></p>
---

**Note:** Failure to make this mathematical adjustment will result in a significant under treatment.

fluorescent lamps. This slight variation in the length makes it difficult to fit these lamps into most current phototherapy systems. In response to the demand for this therapy, many U.S. phototherapy equipment manufacturers now offer dedicated narrow-band equipment.

#### Narrow-Band Lamp Output Determination

Equipment designed specifically for narrow-band therapy that is fitted with internal dosimeters or those with hand-held meters specifically for use with narrow band, will automatically determine the power output. Per a study at Rockefeller Hospital

(NYC), narrow-band systems that are to be metered with hand-held meters designed to determine broad-band output should have the reading adjusted by multiplying the actual reading by 0.74 to obtain a usable reading (see Table 1) (Coven et al., 1997).

#### Pros and Cons of Narrow Band

##### Pro:

- No topical or oral medications, tests, or special glasses are required.
- Faster response than broad-band UVB and similar to PUVA.
- Many practitioners have noted a significant reduction in scaling after the first 3 to 6 treatments and initial improvement may be noted after 6 to 9 treatments.
- Number of treatments needed for clearing is generally less than broad-band UVB.
- Offers an additional phototherapeutic option positioned between broad-band UVB and PUVA.
- Treatment is safe for children, pregnant women, and lactating mothers.
- Clearing of disease has been

very successful.

- Patient reaction has been overwhelmingly positive.

##### Con:

- Erythema is:
  - Less predictable than with broad-band UVB.
  - May be more intense and persistent.
  - Often lesional only.
- Dosing is somewhat less predictable than broad-band UVB.
- MED testing is often required due to lack of available skin type dosing protocols.
- Equipment and replacement lamps are expensive.

Due to the reduced power of narrow band compared to broad band, more lamps are needed to provide timely treatment. Standard broad-band systems have 8 to 16 lamps, whereas narrow-band systems need 24 to 48 lamps.

Narrow-band lamps appear to have a shorter life expectancy than broad band and, therefore, require more frequent replacement (narrow-band lamps cost approximately \$125 each).

- Current availability of practices

with narrow band is limited.

- There is no current CPT code specific for narrow band. For this reason it must be billed under the broad-band code which limits reimbursement. A request for a separate CPT code is pending.

### Narrow-Band Patient Selection

- Patients who exhibit a resistance to broad-band UVB as well as those who have a determined contraindication for PUVA are excellent candidates for narrow-band UVB therapy.
- Diagnoses responsive to narrow band therapy:
  - Psoriasis
  - Vitiligo
  - CTCL (mycosis fungoides)
  - Atopic dermatitis
- A multitude of other diagnoses are being treated with narrow band. (*Journal articles should be searched for additional details.*)

### Narrow-Band Dosing with an MED Approach

Initially, doses for narrow band were determined by performing an MED (minimal erythema dose) test to establish the smallest dose of narrow-band light to produce a very mild sunburn (erythema). Investigators found that the MED for narrow-band UVB was more than five to ten times higher than the doses needed to produce an MED with broad-band UVB. This can be explained by noting that broad-band UVB lamps emit wavelengths in the range of 290 to 310 nanometers

which are historically 10 times more erythemogenic than 311 to 315 nanometer wavelengths (Karvonen, Kokkonen, & Ruotsalainen, 1989).

Once an MED has been determined, the treatment protocol is usually "percent based." For those using MEDs, the percent protocol, developed by Robert S. Stern, MD, dermatology department, Beth Israel Hospital, Boston, may be helpful (see Table 2).

MED testing can have its own inherent difficulties and results may not be conclusive. An *all* negative MED, where there is no erythema in any of the test sites, or an *all* positive MED, where erythema is evident in every one of the sites, should be con-

sidered invalid. No treatment should be given based on those results. Repeating the MED is recommended but often difficult due to time constraints on behalf of the patient and/or the phototherapy staff. A narrow-band study done in 1997 at the Rockefeller University Hospital in New York City provides relevant MED testing information (Coven et al., 1997).

### Developing a Narrow-Band "Skin Type" Protocol

It is the authors' experience that the majority of phototherapy facilities do not routinely administer MEDs to determine starting doses for either UVB or PUVA. This is

**Table 2.**  
**Protocol - TL-01**  
**(Narrow-Band UVB)**

Determine MED	
Treatment #1 = 60% of MED	
Subsequent Treatments	
Increase 20%	If no reaction.
Increase 10%	If minimal reaction anywhere that has resolved.
Repeat last dose	If slight generalized erythema that has resolved.
Decrease 20%	If moderate erythema (no sunburn - not totally resolved).
NO treatment	See physician if sunburned, having pain.
	When burn fully resolved, treat at 50% of dose that burned and for subsequent treatments, limit increments to 10% or less.
Treat 3 times per week	
Missed treatments	Repeat dose if one or two treatments missed.
Re-evaluate	After 15 treatments.

**Table 3.**  
**Narrow-Band MED Testing Guidelines**  
**(As Used at Leone Dermatology Center)**

Skin Type	Dosing
I (increase by 50 millijoules)	100 150 200 250 300 mjs
II (increase by 75 millijoules)	200 275 350 425 500 mjs
III (increase by 100 millijoules)	200 300 400 500 600 mjs
IV (increase by 100 millijoules)	300 400 500 600 700 mjs
V (increase by 125 millijoules)	300 425 550 675 800 mjs
VI (increase by 150 millijoules)	350 500 650 800 950 mjs

These same testing guidelines are used when deemed necessary for patients who have transferred from another phototherapy center or who are having questionable treatment results that need analysis by use of an MED test.

**Table 4.**  
**Skin Type Narrow-Band Protocol**

Skin Type	Initial Dose	Increases	Estimated Goal Range
I	100 millijoules	15 millijoules	520 millijoules
II	220 millijoules	25 millijoules	880 millijoules
III	260 millijoules	40 millijoules	1,040 millijoules
IV	330 millijoules	45 millijoules	1,320 millijoules
V	350 millijoules	60 millijoules	1,400 millijoules
VI	400 millijoules	65 millijoules	1,600 millijoules

**Notes**  
 Treatment frequency – 3 times weekly  
 Maintenance – every 7 to 10 days when indicated to prevent relapse

Goal ranges determined by a broad selection of patient responses appear to be approximately four times the initial dose or MED (other sources report five times the initial dose).

Extra treatment for resistant extremities may be initiated right from the first treatment or introduced at any time it is indicated.

Dosing is based on skin type (darker skin types can have higher doses)  
 Starting dose 30 to 50 millijoules  
 Increase by 15 to 25 millijoules per treatment

**Caveat**  
 There are many dosing guidelines for phototherapy. The above protocol is intended ONLY as a guideline and was developed specifically for the patients at the Leone Dermatology Center, Arlington Heights, Illinois. National Biological Corporation equipment was utilized in determining this protocol. *It is important to acknowledge that the use of different equipment can dramatically change the dosing required to duplicate the treatment indicated above. The interpretation of power, particularly by equipment with internal dosimeters, may be significantly different.* Therefore, these guidelines MUST be interpreted with flexibility based on the individual patient's response and should never be considered as hard and fast rules.

**Table 5.**  
**Missed Treatments**

Time Missed	% of Last Treatment to Give
1 to 7 days	Increase per standard protocol
8 to 11 days	100% (no conditioning lost)
12 to 14 days	Decrease by two treatment's worth
15 to 20 days	75% of last dose — but not less than base dose (25% of conditioning may be lost)
21 to 27 days	50% of last dose but not less than base dose (50% of conditioning may be lost)
28 or more days	Start over at base dose (100% of conditioning may be lost)

most likely explained by the labor intensity of the test and the need for proper staff training. Giulio Leone, MD, of the Leone Dermatology Center in Arlington Heights, Illinois inaugurated the use of narrow-band therapy in his busy phototherapy practice in December 1997. Prior to routinely offering this new treatment option, he felt it incumbent to develop a simple "skin type" approach to dosing, rather than the time-consuming method of MED testing (see Table 3).

To establish an uncomplicated, user-friendly, safe, and effective narrow-band protocol, three or four patients each of skin type II, III and IV were selected for MED testing. Dr. Leone determined a "skin type" narrow band treatment protocol using the common patterns noted in the MED responses to narrow-band light in each skin type group and the extensive experience gained from treating thousands of patients with phototherapy since 1977. Based on

patient response to that initial protocol, two separate modifications to higher doses were made. The current version has been in place since May 1998. Although a bit arbitrary, this schedule has proven immensely effective and has been widely distributed and used in a broad selection of phototherapy practices (see Table 4).

The protocol may be somewhat conservative for skin types IV-VI. As with all protocols, adjustments should be made according to each patient's response.

### Missed Treatments

Narrow-band conditioning lasts somewhat longer than broad-band conditioning. Therefore, a slightly more aggressive schedule is permitted for missed treatments than with broad-band therapy (see Table 5).

### Narrow Band Maintenance

Initially it was hoped that no maintenance would be necessary; however, experience has shown it is indicated for most patients. Due to fast loss of conditioning, particularly in psoriasis plaques, maintenance cannot be stretched out very far. Recommended maintenance, when needed, is every 7 to 10 days (more than UVB, less than PUVA).

### Summary

Narrow-band phototherapy is still in its infancy in the United States and should be viewed as a "work in progress." Further study is needed to yield more applications as well as findings of ratios between broad band and narrow band, expected clearing ranges, and the development of new protocols or the refinement of existing ones. Until such time, the aforementioned skin type

protocol offers a safe and effective treatment plan for those who do not routinely use, or wish to use, MEDs to establish starting doses for narrow-band UVB phototherapy. □

### References

- Coven, R., Burack, L.H., Gilleaudeau, P., Keogh, M., Ozawa, M., & Krueger, J.G. (1997). Narrowband UV-B produces superior clinical and histopathological resolution of moderate-to-severe psoriasis in patients compared with broadband UV-B. *Archives of Dermatology*, 133.
- Karvonen, J., Kokkonen, E.L., & Ruotsalainen, E. (1989). 311 nm UVB lamps in the treatment of psoriasis with the Ingram regimen. *Acta Derm Venereol (Stockh)*, 69, 85.

### Additional Reading

- Van Weelden, H., Baart De La Faille, H., Young, E., & Van Der Leun, J.C. (1988). A new development in UV-B phototherapy of psoriasis. *British Journal of Dermatology*, 119, 11-19.