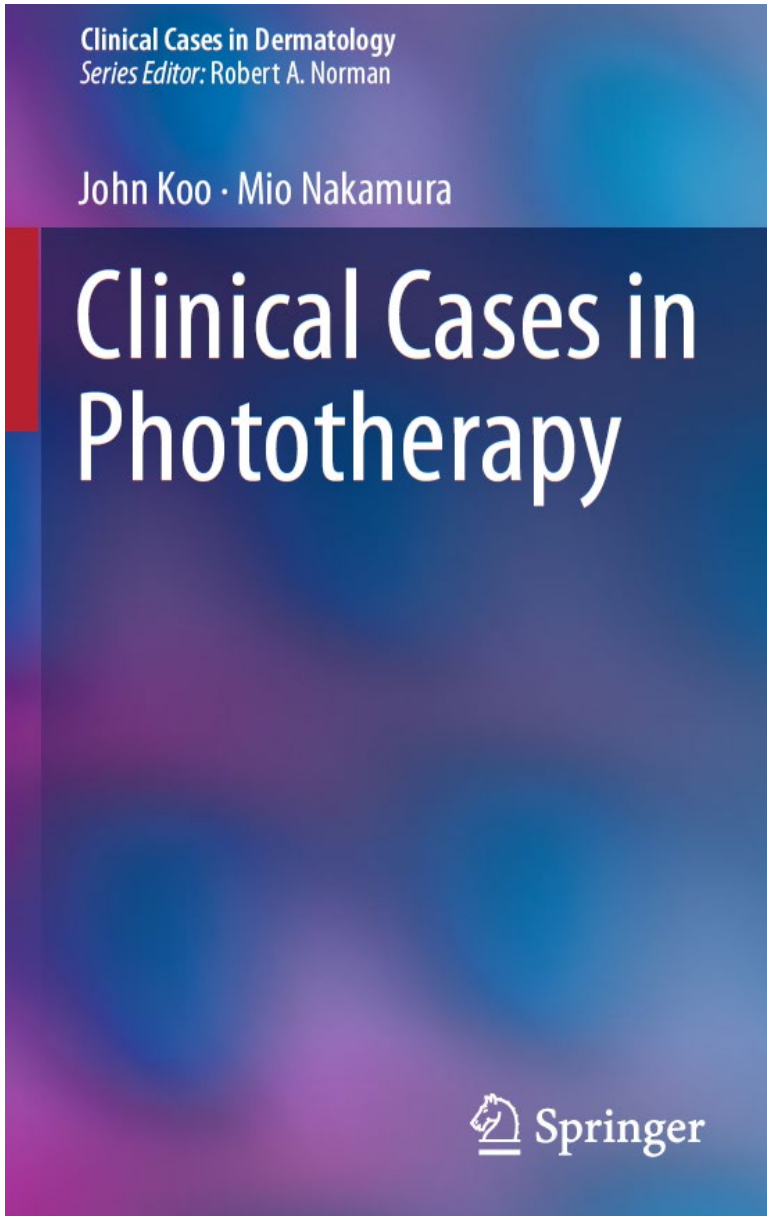
Phototherapy: Principle and Practice

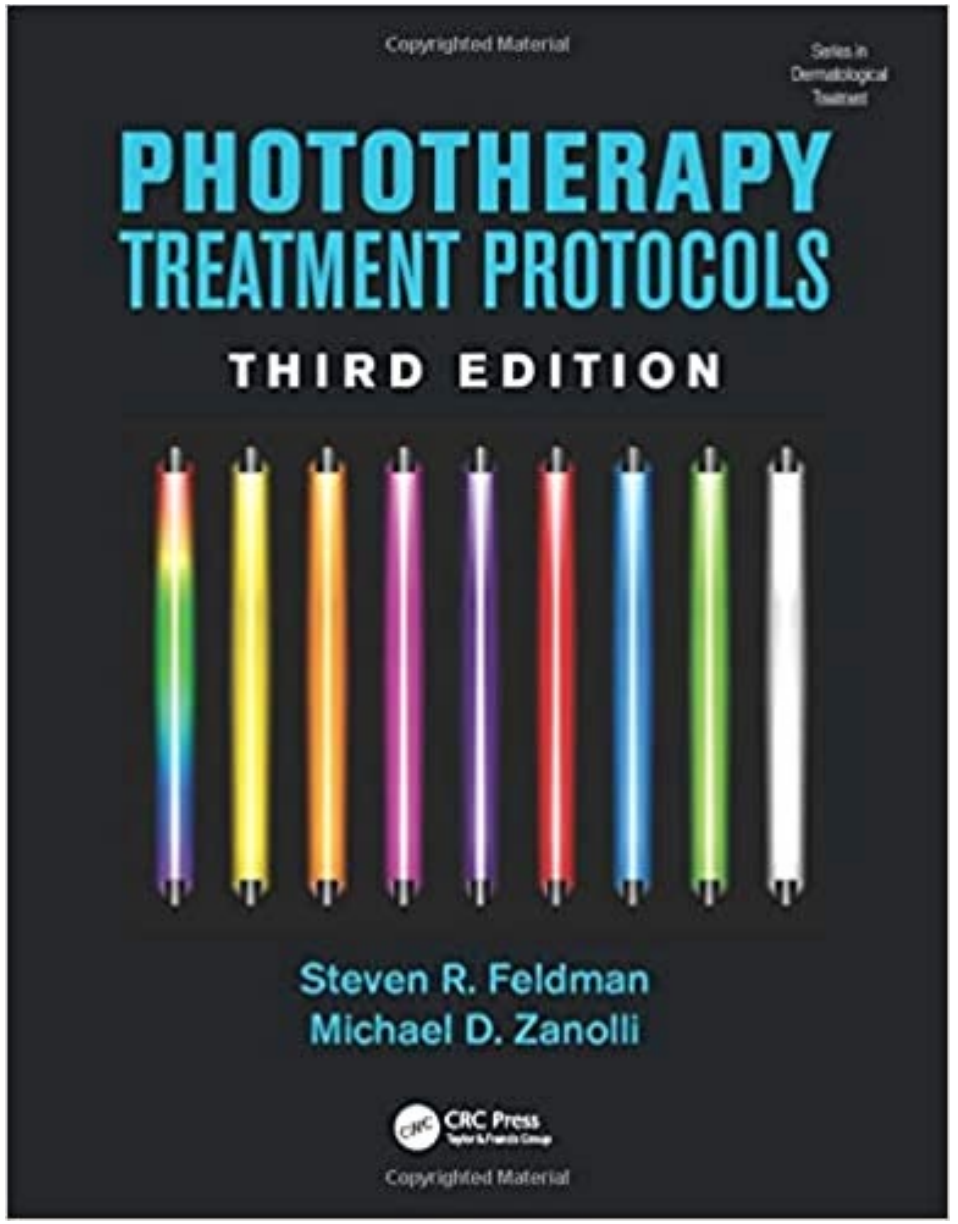
Dr Matheen Mohamed

Acknowledgement: A/Prof Peter Foley for some slides, comments and suggestions


UV 182
1
2


PHILIPS
NARROWBAND
TL 100W/01 - FS72
ULTRAVIOLET-B
MADE IN GERMANY
DANGER:
ULTRAVIOLET RADIATION.
FOLLOW INSTRUCTIONS.
USE ONLY IN FIXTURE
EQUIPPED WITH A TIMER.


Clinical Cases in Dermatology
Series Editor: Robert A. Norman
John Koo · Mio Nakamura
Clinical Cases in Phototherapy
Springer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PHOTOTHERAPY: MAJOR INDICATIONS

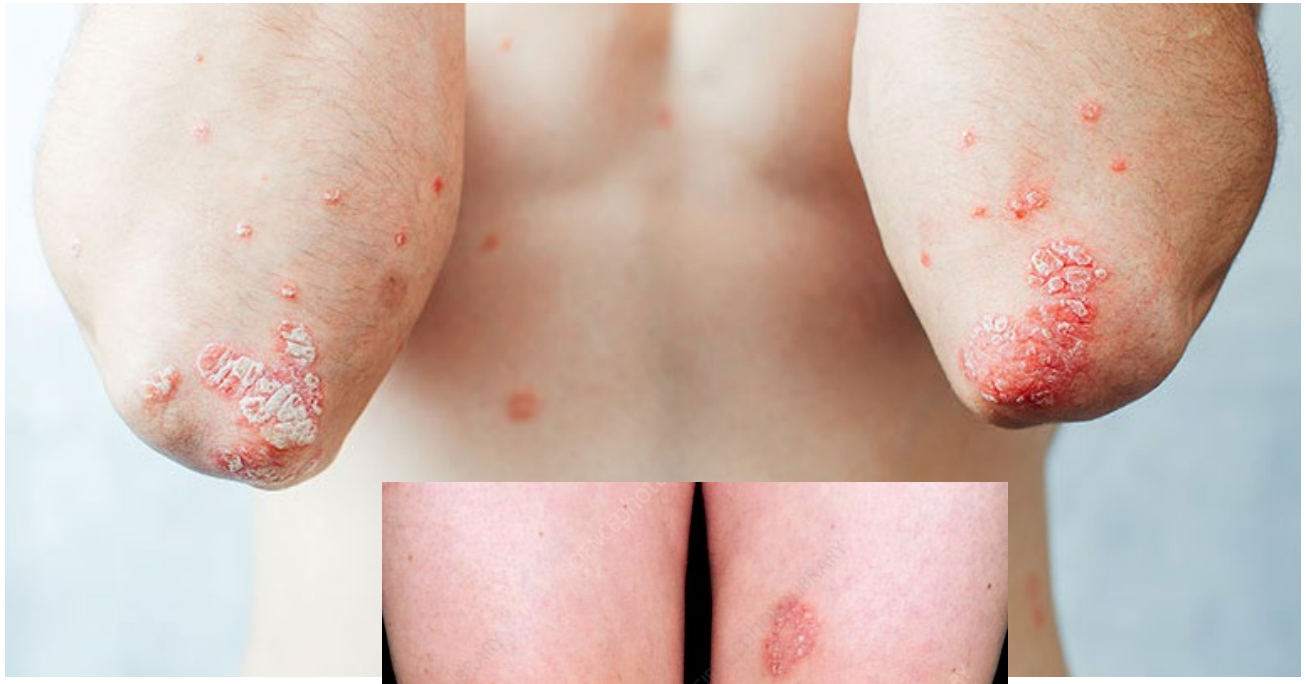
- PSORIASIS
- ECZEMA
- VITILIGO
- PRURITUS
- CTCL

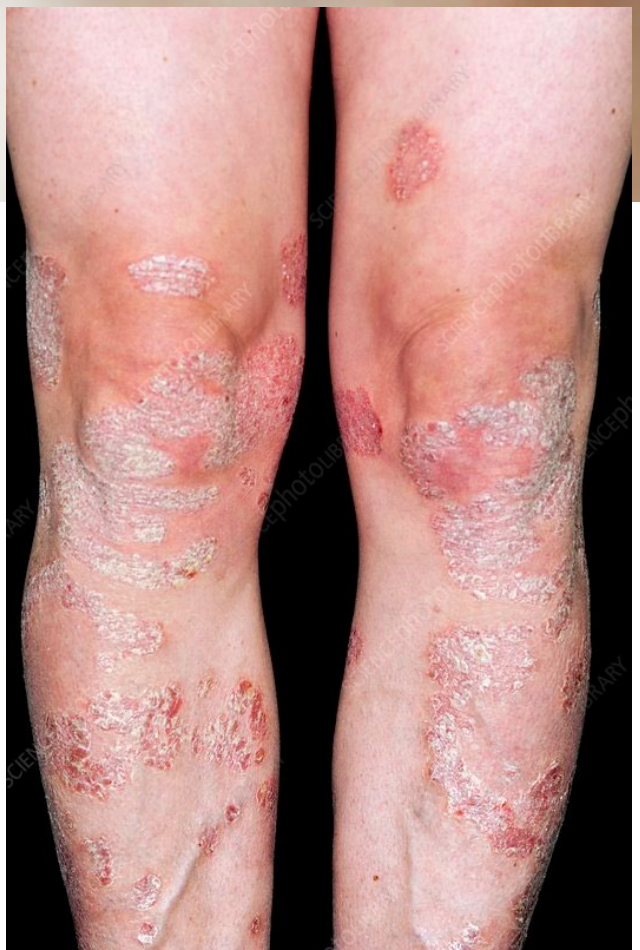
PHOTOTHERAPY

- INDICATIONS (less common)
  - Pityriasis rosea
  - Pityriasis lichenoides
  - GVHD
  - Granuloma annulare
  - Morphoea
  - Lichen planus
  - Mastocytosis
  - Eosinophilic folliculitis
  - Polymorphous light eruption

Clinical scenario 1

- A 19 year old apprentice plumber with Chronic Plaque Psoriasis presents for review of UVB phototherapy which has commenced 2 months ago
- Type 2 skin
- Had been prescribed Enstilar foam & NBUVB in Feb 2020
- Has attended for 7 treatments over the last 2 months





Date of review 16/4: UV chart

Rx no.	Date	Dose J/Cm2	Comments
1	17/2	0.1	
2	20/2	0.2	
3	24/2	0.3	
4	26/2	0.4	
5	11/3	0.3*	Why was dose reduced?
6	16/3	0.4	
7	6/4	0.2*	Why was dose reduced?

Questions

1. Why has he not improved?
2. When would you normally expect to see some improvement with UVB?

When to expect improvement following initiation of UVB

- For Psoriasis minimum of 9-12 treatments to see noticeable improvement. Need at least 4-7 doses above 0.6-0.7 J/cm2

- (PBS requires 18 treatments over 6 weeks as minimum trial of UVB before assessing for Biologics)

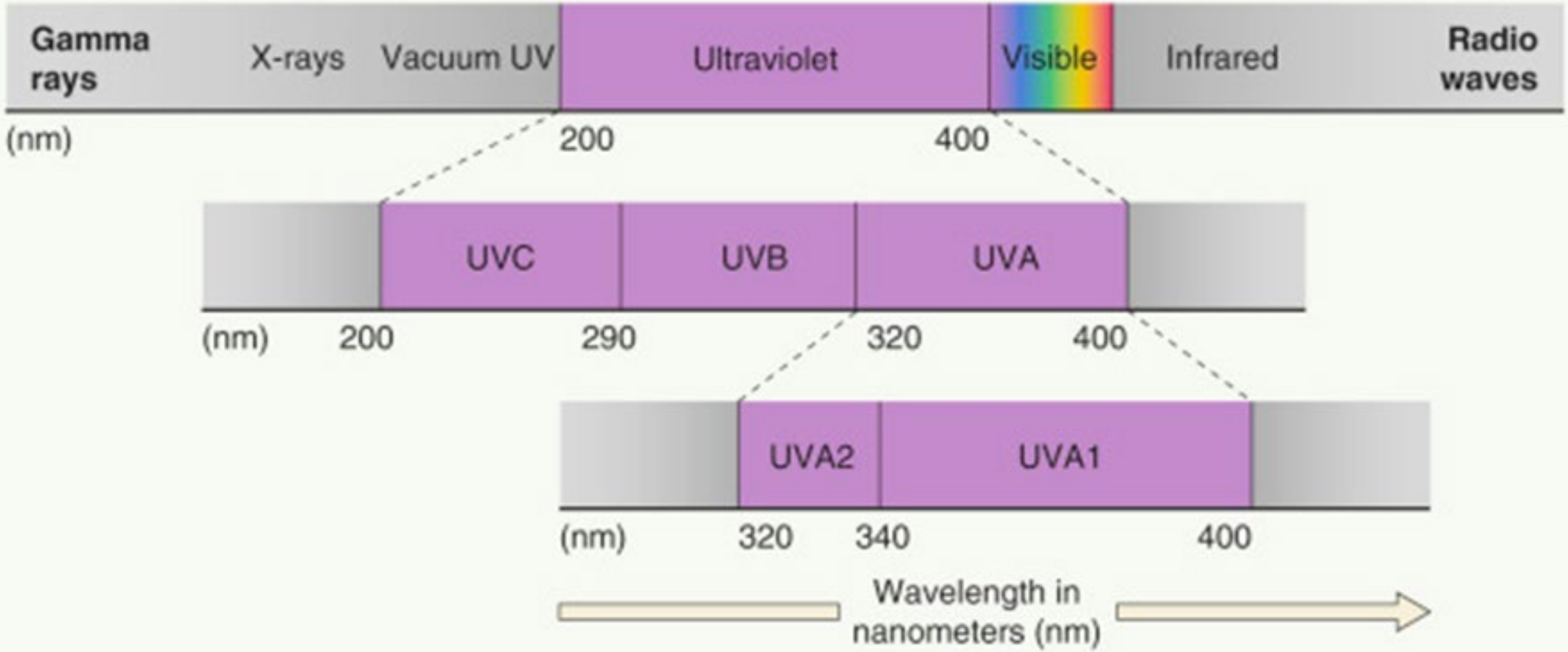
- For itchy conditions generally need a minimum of about 7-10 doses to assess effectiveness.

Questions

1. He asks if he could work without his shirt off for part of the day as he has little time to attend for UVB treatments.

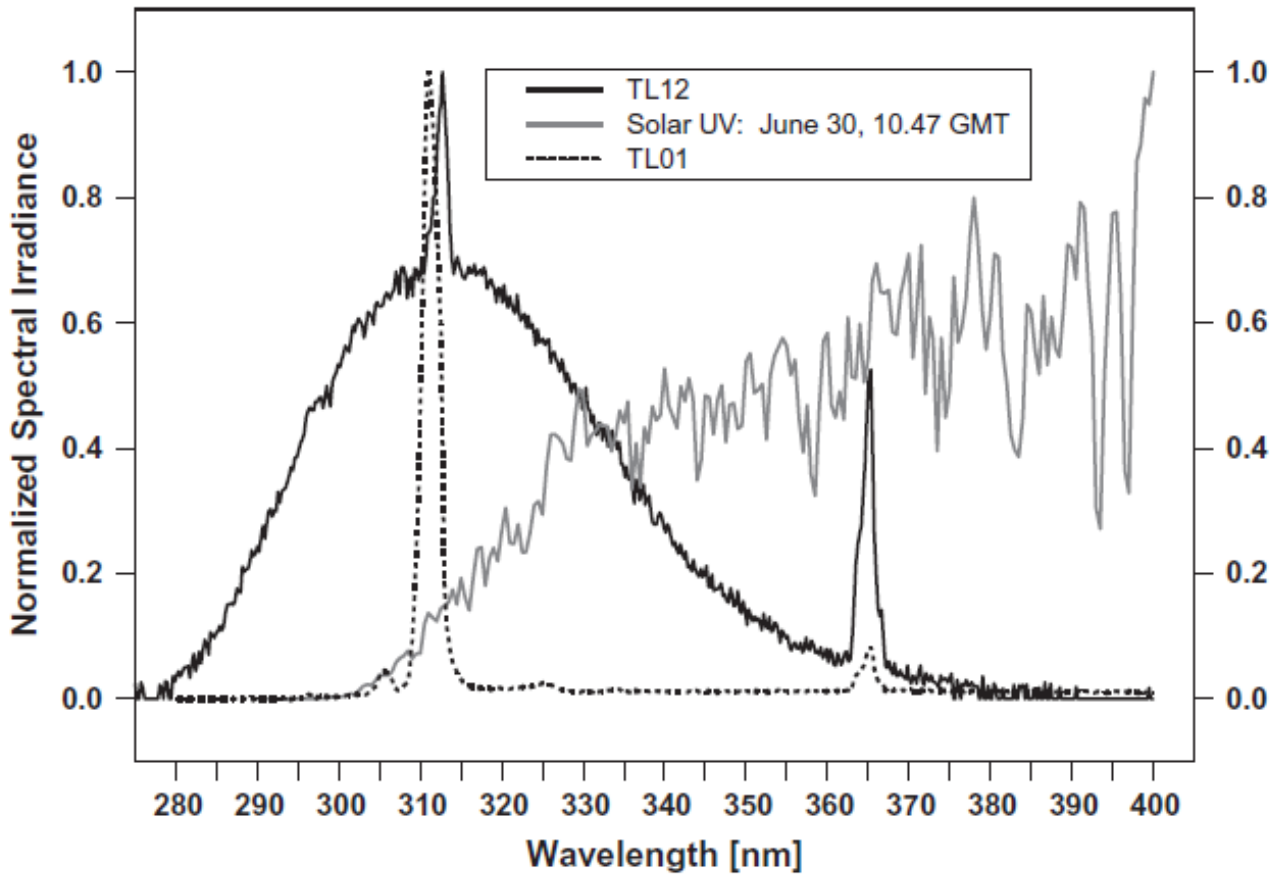
2. What are the Risks versus the benefits of such an approach

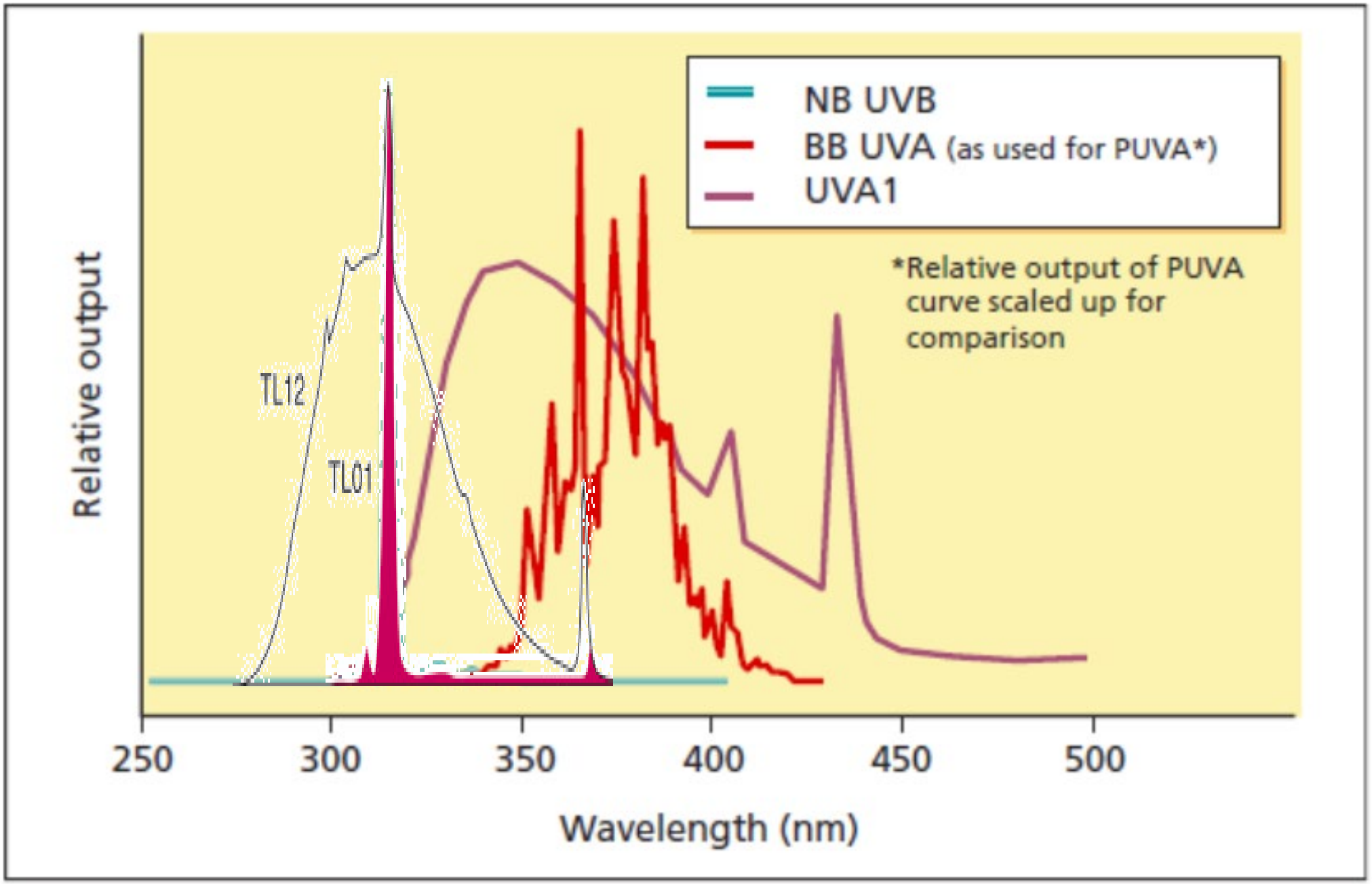
ELECTROMAGNETIC SPECTRUM WITH EXPANDED UV REGION



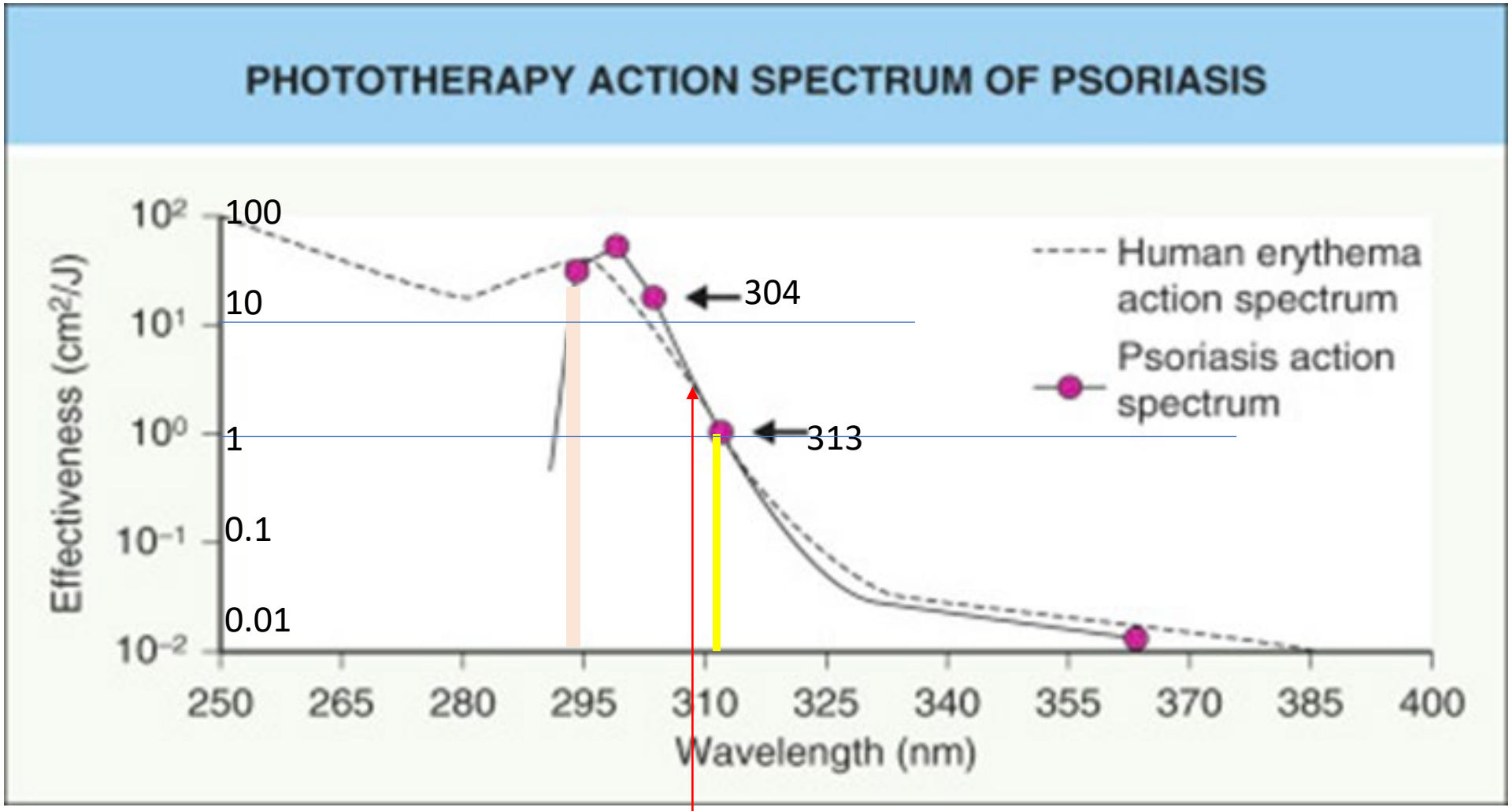
How does NB-UVB spectral irradiance compare with the Solar spectrum

J.W. Krzyścin et al. / Journal of Photochemistry and Photobiology B: Biology 115 (2012) 35–41




NB UVB
BB UVA (as used for PUVA*)
UVA1
*Relative output of PUVA curve scaled up for comparison
TL12
TL01
Relative output
250
300
350
400
450
500
Wavelength (nm)

The **black arrows** point to the wavelengths that were optimally effective (304, 313 nm)



Excimer laser = 308nm

Answer

- While “heliotherapy” has been used for treatment of various skin conditions including psoriasis, it is hard to implement it in practice due to the following factors:
  - Unsuitable for vary fair skin types (Type1) (This patient has type 2 skin)
  - Variability of UV index: Time of day, Cloud cover, Season & Location make is hard to design a protocol for safe and effective use
  - Generally needs some form of dosimetry which is hard to obtain in practice: Hard to quantify cumulative dose
  - Occupational health and safety protocols do not permit such exposure
  - Sunburn risk and Koebnerisation of psoriasis are risks
  - In the long run could increase risk of skin cancer

How will you manage the patient going forward?

- Attend regularly for UVB 3/week for at least 2 weeks
  - This allows dose to be built up to 0.6-0.7 J/cm2
- Then can drop down to 2/week for the next 6 weeks then review

At Review

- If improved++, then can drop to once a week
- If slow to improve then continue 2/week.
  - Consider adding Acitretin
  - Ensure compliance with topicals

After another 8 weeks….

- Psoriasis has improved on upper body greatly but his legs are still lagging behind.
  1. Why?
  2. How can this slowness of response on the legs be improved?

Answer

1. The output of the tubes in maximal in the middle with drop off at top and bottom….face and legs get less output
2. Ask patient to stand on a small stool in the phototherapy unit to increase the light irradiance to the legs.

After a further 4 weeks he is much better all over (i.e. 12 weeks after starting consistent Rx)

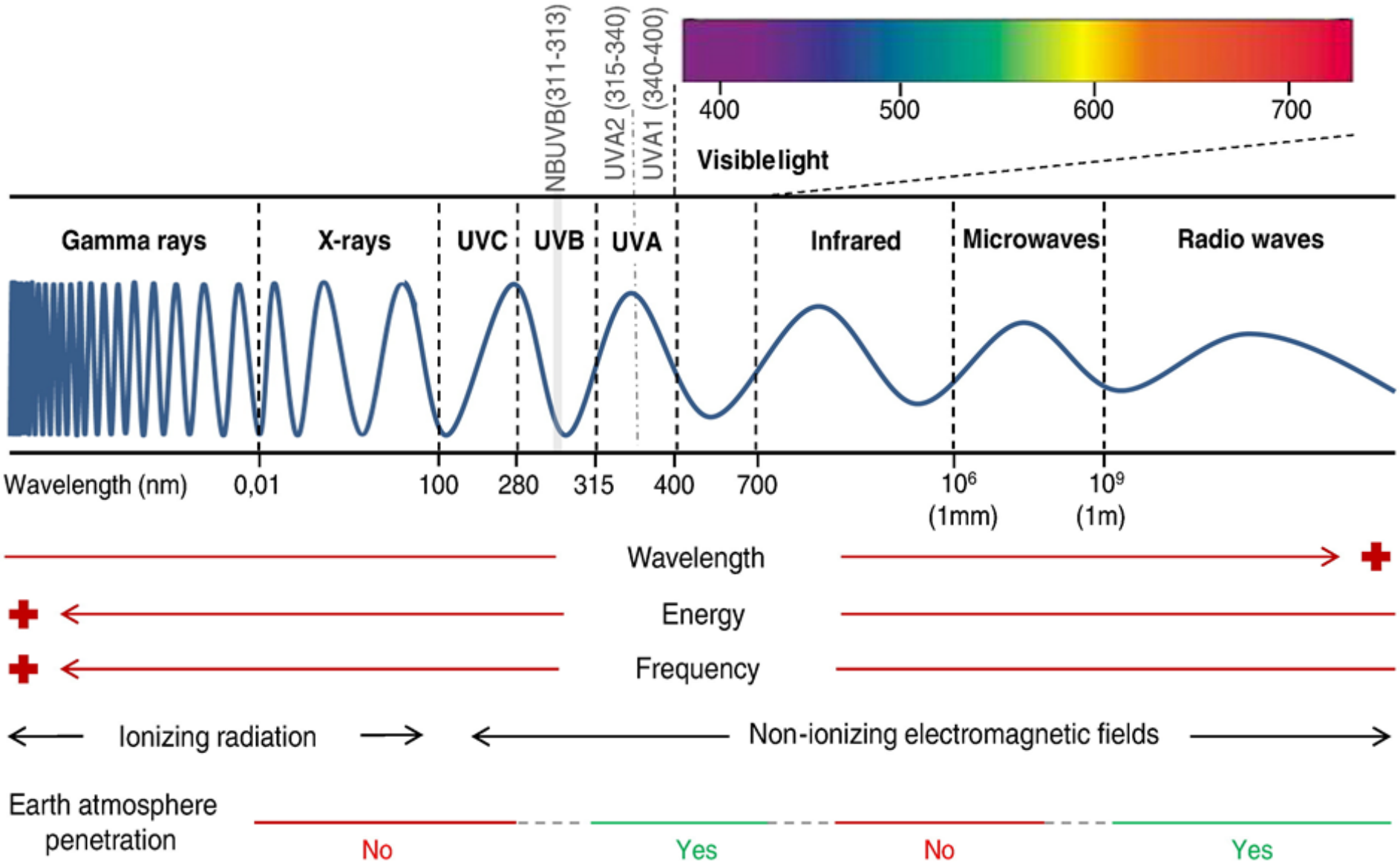
- He asks:
  - When can he stop Treatment?
    - Stop “cold turkey” or Maintain
    - At what frequency and dose to maintain?
  - How long will the improvement last after stopping?

Answer

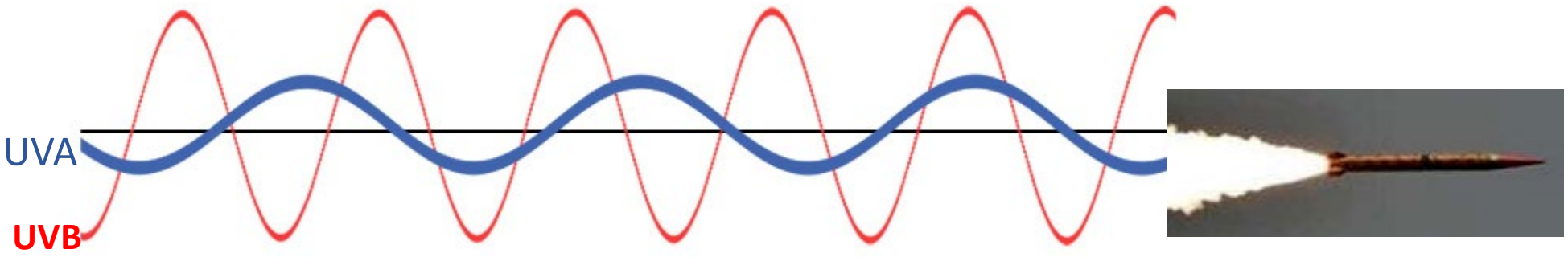
- If there is a past h/o UV Rx, ask about what happened last time after stopping: did it relapse quickly or take months to relapse?
- Likely to follow a similar pattern. Can discuss benefit vs drawbacks
- Maintain if wants to avoid early relapse (esp if past h/o early relapse)
  - Keep dose at max dose achieved at a frequency of once weekly for 2-3 months then consider stopping
- If he has a prolonged remission after previous UVB episode can consider stopping “cold turkey”

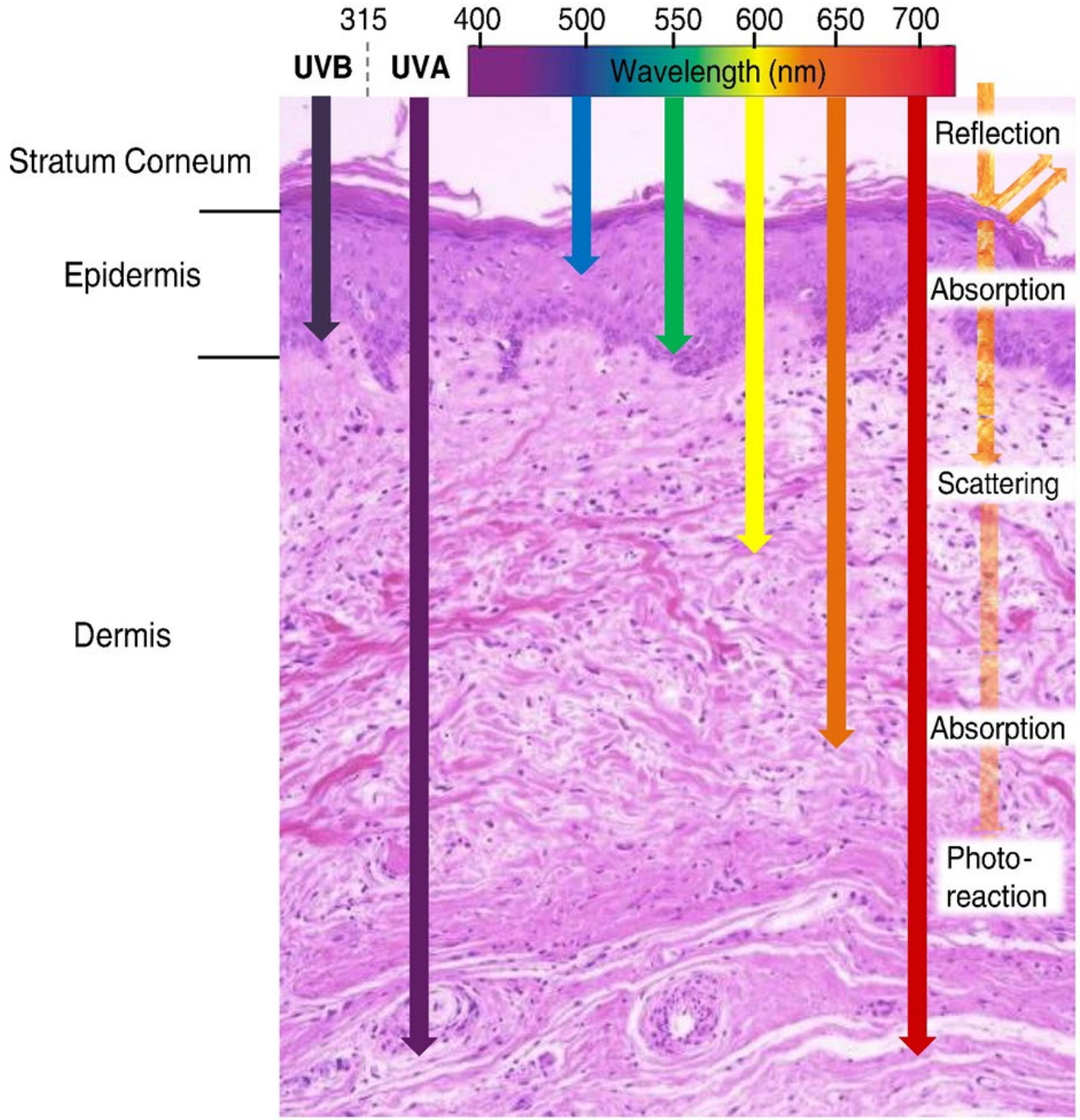
UV spectrum	Comments
NBUVB 311-313nm	Commonest and safest
BBUVB 290-320nm (280-320)	Historical
PUVA	Rarely used, More effective and more Carcinogenic Needs an oral / topical psoralen
High dose UVA1 340-400	At Specialised Centres eg Skin Health Institute, long duration of each Rx

For deep dermal conditions eg Generalised Morphoea which is better NB-UVB or PUVA?


NBUVB(311-313)
UVA2 (315-340)
UVA1 (340-400)
400
500
600
700
Visible light
Gamma rays
X-rays
UVC
UVB
UVA
Infrared
Microwaves
Radio waves
Wavelength (nm)
0,01
100
280
315
400
700
10⁶
(1mm)
10⁹
(1m)
Wavelength
Energy
Frequency
Ionizing radiation
Non-ionizing electromagnetic fields
Earth atmosphere penetration
No
Yes
No
Yes

Energy is directly proportional to Frequency: UVB high energy
Penetration is directly proportional to Wave Length: UVA high penetration



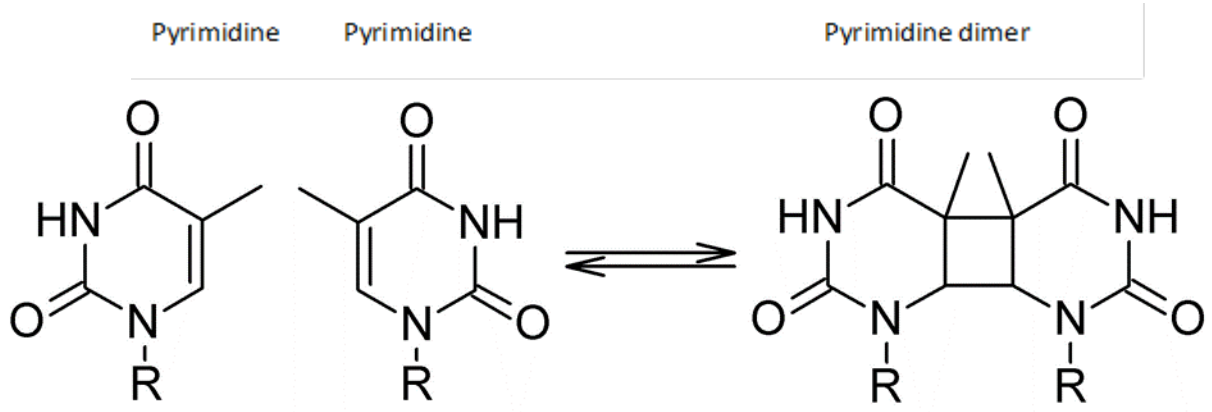

315
400
500
550
600
650
700
UVB
UVA
Wavelength (nm)
Stratum Corneum
Epidermis
Dermis
Reflection
Absorption
Scattering
Absorption
Photo-
reaction

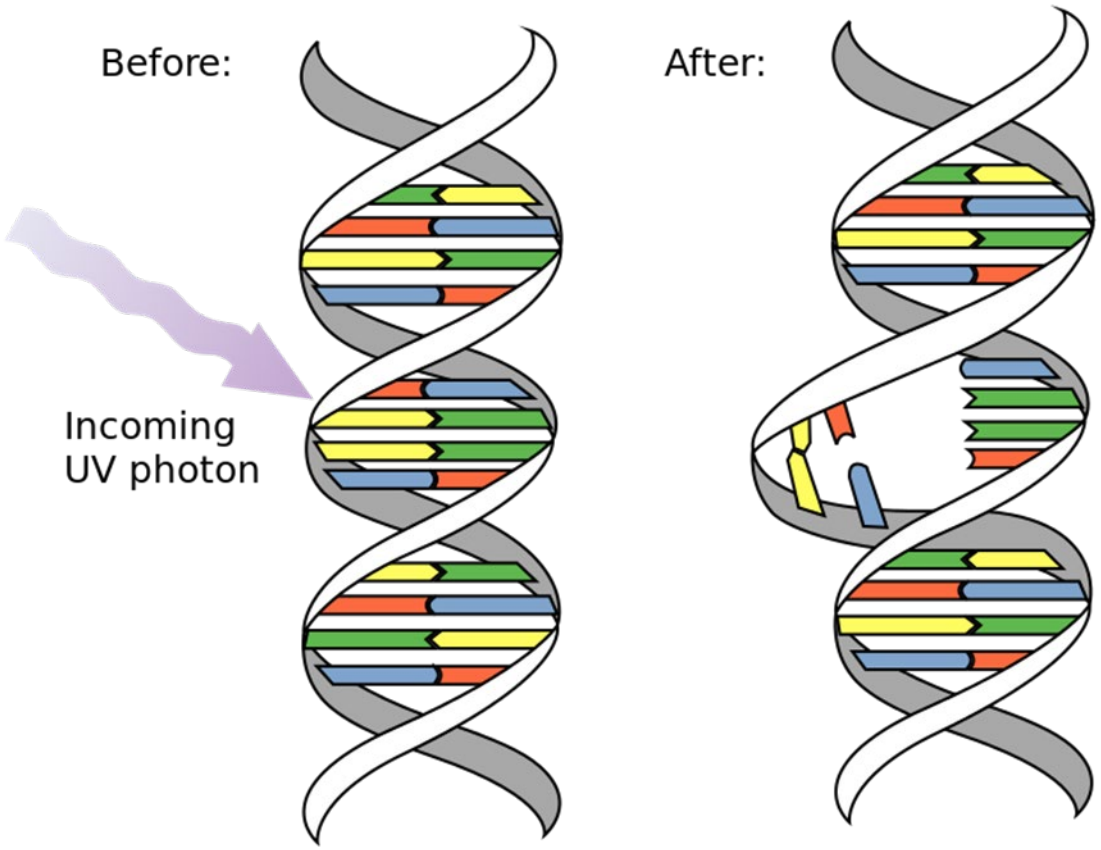
How does UV work?

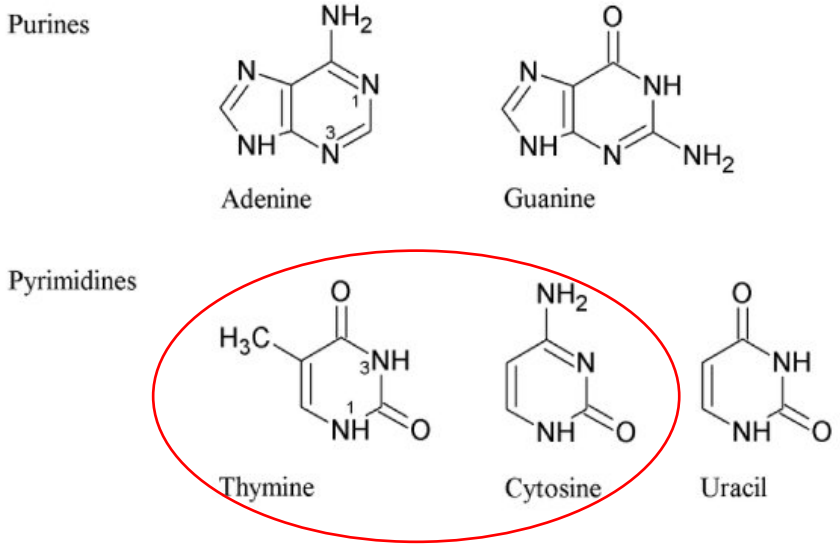
Effect	Comment
UVR induces mostly local immunosuppressive effects in the skin.	Some systemic immunosuppressive effects via reduced pro inflammatory cytokines from epidermal cells
UVR induces mostly temporary short-term effects	Therefore the need for repeat treatments 3 times a week
UVB penetrates epidermis and upper dermis only	Used to treat epidermal conditions: Psoriasis, Eczema, Vitiligo, PLE, upper dermal conditions eg Patch stage MF
UVA (UVA1) penetrates well into the dermis	Can treat dermal conditions (Sclerodermoid disorders eg Morphoea via induction of matrix metalloproteinases) as well as Plaque stage MF (direct apoptosis of MF cells) and Mastocytosis (depletion of mast cells)

Mechanism of Immunosuppression by UVB

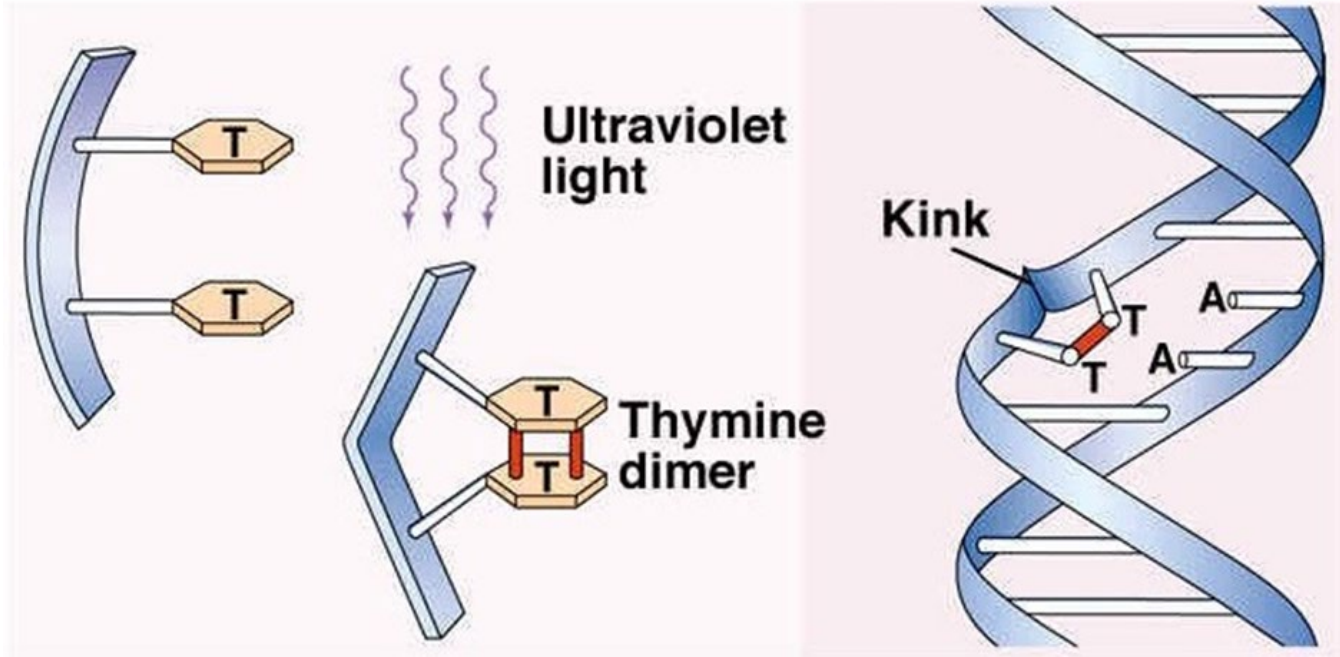
- DNA damage →inhibits cell replication by reducing DNA synthesis
  - Direct DNA damage via Cyclobutane Pyrimidine dimer formation
  - Indirect DNA Damage via Oxygen generation





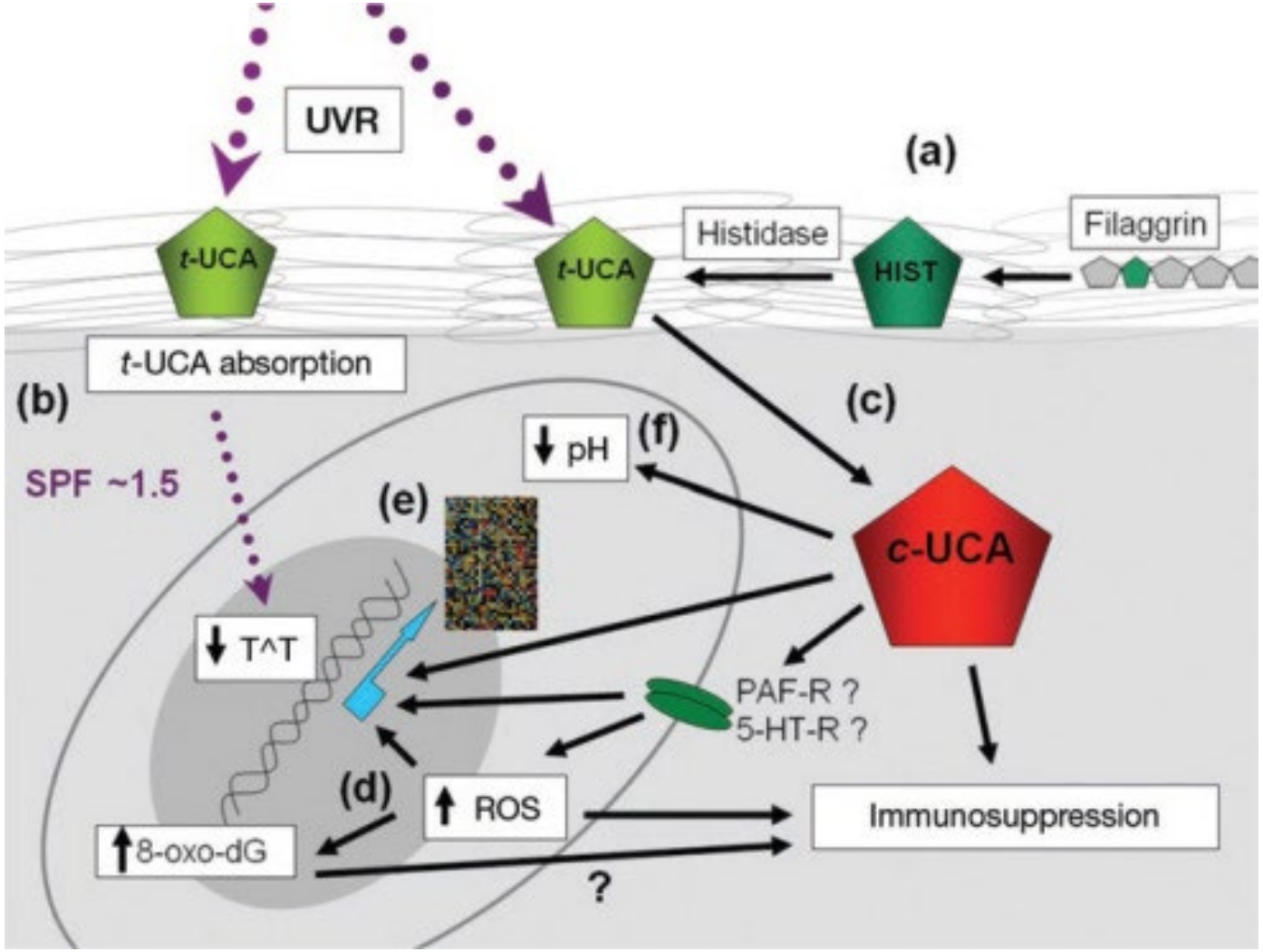


Pyrimidine Dimer



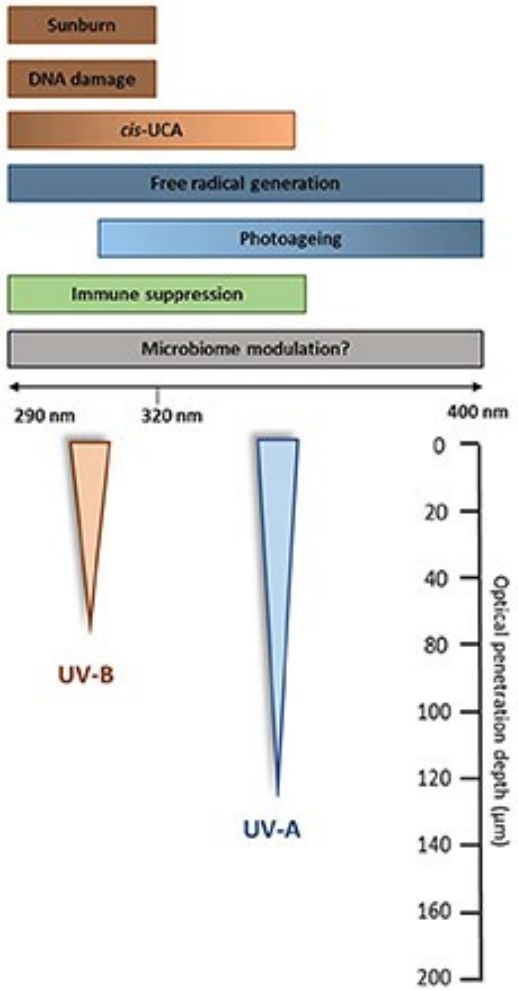
Mechanism of Immunosuppression by UVB

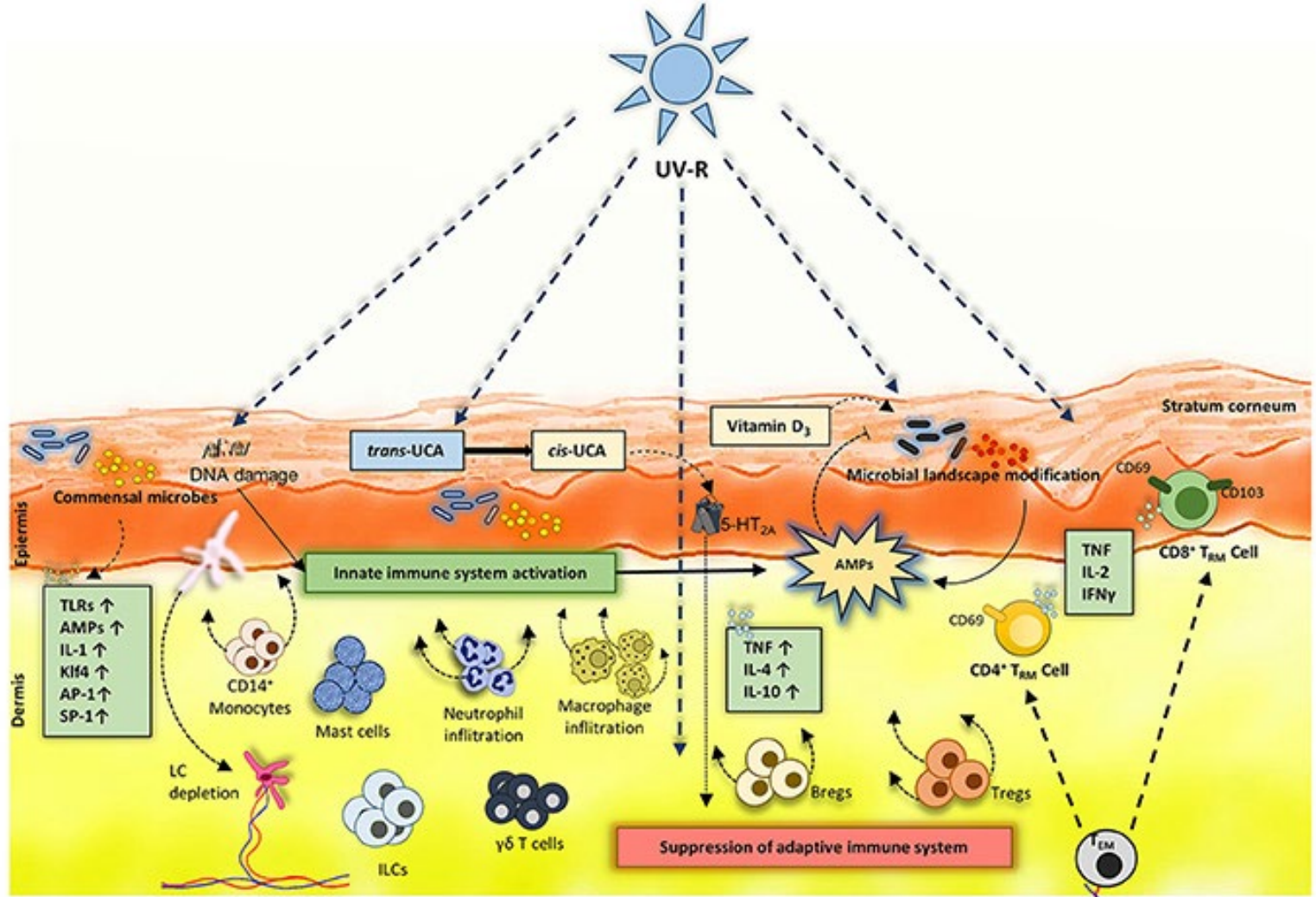
- UVB converts trans urocanic acid to cis urocanic acid
- Cis urocanic acid induces immunosuppression

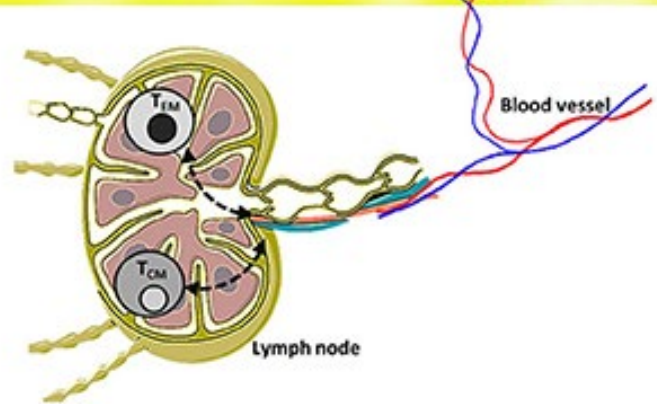


Mechanism of Immunosuppression by UVB

- UVR reduces Langerhans cells in dermis → reduce antigen presentation
  - Langerhans cells undergo apoptosis or leave the skin and migrate to the local lymph node
- UVR leads to generation IL-10 (anti-inflammatory cytokine) that increases Treg cells in the skin which are immunosuppressive.
- UVR increases Monocytes and Macrophages and reduces NK cells in the skin.
- Increases Innate Immunity and reduces Adaptive Immune responses in the skin

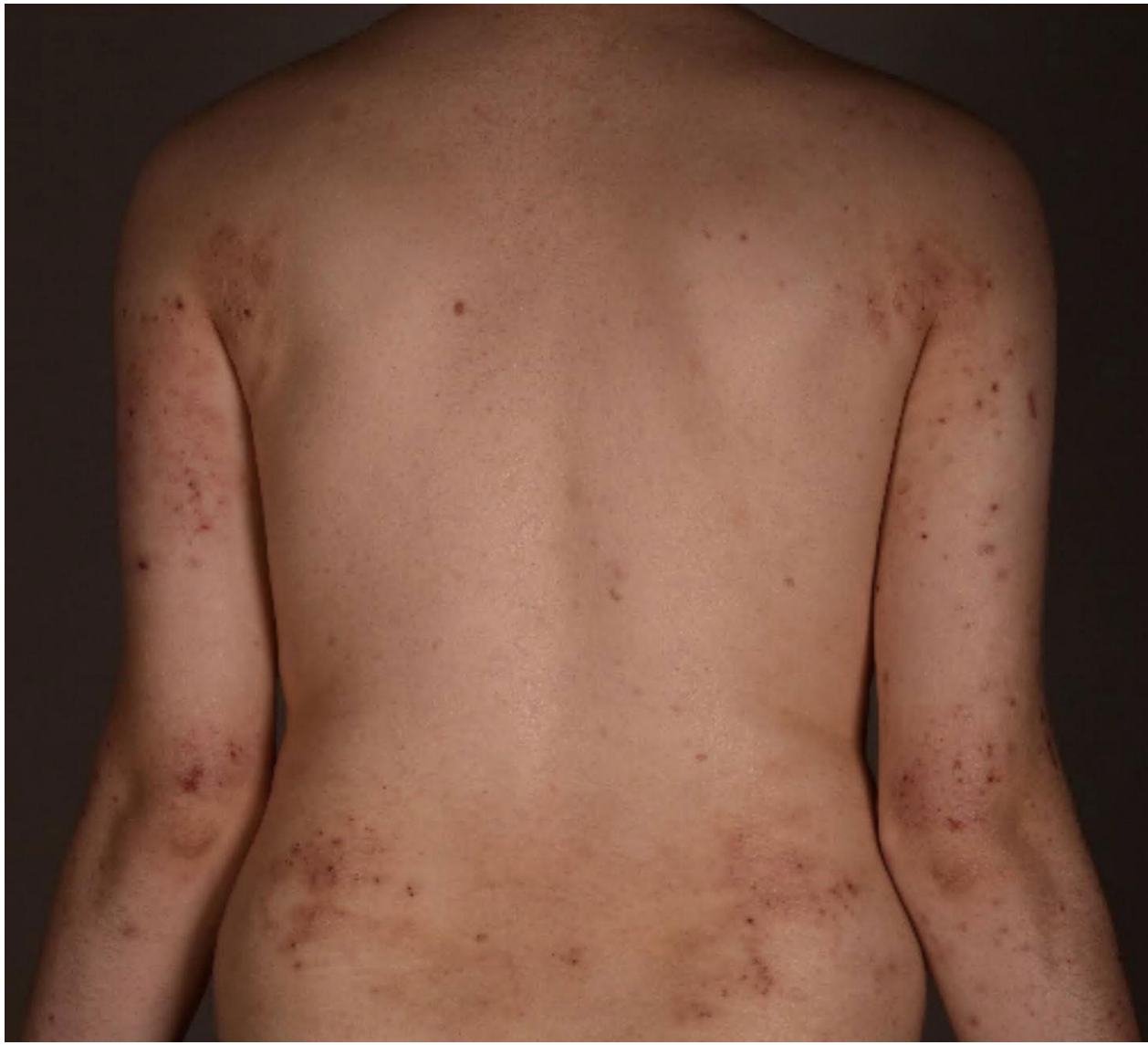

Sunburn
DNA damage
cis-UCA
Free radical generation
Photoageing
Immune suppression
Microbiome modulation?
290 nm
320 nm
400 nm
UV-B
UV-A
0
20
40
80
100
120
140
160
200
Optical penetration depth (μm)


UV-R
Stratum corneum
Epidermis
Dermis
DNA damage
trans-UCA
cis-UCA
Vitamin D3
Microbial landscape modification
Commensal microbes
5-HT2A
CD69
CD103
CD8+ TRM Cell
Innate immune system activation
AMPs
TNF
IL-2
IFNγ
TLRs ↑
AMPs ↑
IL-1 ↑
Klf4 ↑
AP-1↑
SP-1↑
CD14+ Monocytes
Mast cells
Neutrophil infiltration
Macrophage infiltration
TNF ↑
IL-4 ↑
IL-10 ↑
CD4+ TRM Cell
LC depletion
ILCs
γδ T cells
Bregs
Tregs
Suppression of adaptive immune system
TEM


TEM
TCM
Blood vessel
Lymph node

Clinical scenario 2

- 26 year old nurse with Atopic Dermatitis, Photo-type 3
- Poorly controlled on topical therapy with Diprosone Ointment + QV Gentle wash and Cetaphil cream
- Not keen on any long term oral agents



Questions

- How will you commence her on NB-UVB?
  - Any thing to watch out for when starting UVB?
- What about Folic Acid supplementation?

Answer

- Explain how UVB works, Protocol, Risks versus benefits, check Contraindications / Drug history
- Obtain Consent
- Start at 0.15 J/cm2
- Increase by 0.1 J/cm2 every treatment up to a max of 1.5-1.7 J/cm2
- Continue topicals
- Consider Prednisolone 37.5mg to 0 over 3 weeks to offset Eczema Flare with UVB commencement
- Review at 6-8 weeks

Folic Acid Supplementation

- The risk of Neural tube defects with NB-UVB is theoretical with no evidence of actual cases at this stage

- UVA degraded Folic acid > UVB

Folate deficiency after NB-UVB

- Folate degradation occurs in a dose dependent manner with NB-UVB
  - Individual Doses of >2 J/cm2 and Cumulative doses of >40 J/cm2 have been shown to cause a reduction in serum folate by 20-30% (19-27%).
  - Lower doses did not affect folate levels: 18 doses of NBUVB for Psoriasis in UK population did not affect serum folate levels
  - Vitiligo Rx in an Egyptian population with 36 doses of NBUVB showed a reduction in serum folate

Table I. Comparison of two narrowband ultraviolet B folic acid degradation studies

Condition	Patients (study vs control)	Exposure (no. of treatments)	Folate levels baseline (ng/mL)	Folate levels after exposure (ng/L)
Vitiligo*	20 S/20 C	36	8.1 ± 2.6	5.9 ± 1.5
Psoriasis†	35 S	18	6.3 ± 3.6	6.4 ± 3.3

C, Control; *S*, study.

*Shaheen et al.[2]

†Rose et al.[1]

Folate deficiency after NB-UVB

- Crucially even in the Egyptian Vitiligo study (with likely much higher cumulative dose (average cumulative dose 75 J/cm2) than UK psoriasis study (no cumulative dose reported) the folate level did not drop below 3.7 ng/mL (which is considered lower limit of normal range)

My Thoughts

- Risk is not likely to be significant in a standard course of photo therapy for type 1-2 skin lasting 30-35 Rx
- (I calculated a cumulative dose of about 35 J/cm2 for Type 2 skin for a standard psoriasis protocol lasting about 30 treatments)
- In photo-type 3 (and > phototypes) for phototherapy courses with >30 treatments the cumulative dose could be > 40 J/cm2….eg when treating vitiligo.

The exam answer

- Ask about contraception
- Risk of NT defects is in first trimester. (organogenesis complete at 12 w)
- If unprotected and at risk of pregnancy then
  - Supplement with folate 1mg/day
  - Folate available in Australia as 0.5mg tabs (500mcg) or 5 mg tabs
  - In high risk pregnancies (maternal age >30 yrs., Indigenous, past h/o Neural tube defects, DM, obesity, alcohol/smoking, poor nutrition, etc) check Vit B12 (and correct if needed) and give 5 mg folate/day
- If pregnancy does accidentally occur in unsupplemented NB-UVB patient reassure that risk is <u>likely very low</u> & start folate 1mg to 5 mg (Check Vit B12 as well). Liaise with their Obs and get imaging done.

How to administer UVB

A Good OSCA question!!

Phototherapy documents should record

- Diagnosis
- Skin photo-type
- Region to be Rx: full body / hand and foot /both
- Any areas to be shielded and method used
  - Date last seen by doctor and date of next review
  - Joules / Time / number of treatments
  - Cumulative Joules
  - Response to therapy: erythema, exacerbations
  - Adverse events

Phototherapy – Before starting Checklist

- Medication List (even occasional meds)
- Check for Contraindications
- Explain
  - Treatment regime
  - Side effects: acute and long term
  - Benefits
- Consent
- Consider photographs
- Consider objective scoring of disease – PASI / EASI etc

Administering UVB

Identify the Patient by name and DOB. Caution Patients with same name!

Check Condition, Type of UV prescribed and region to be treated (full body versus hands (palms/dorsa) or feet (usually only soles) or both hands and feet). Choose the correct machine based on the above

Patient is asked if there were any issues with previous Rx and check to see if they have attended the last treatment < or = 3days prior.

If all OK go ahead with Rx: remind patient to wear (the same type of) underwear each time and UV protective glasses

In some conditions which spares the face and in those with pre-existing sun damage, the face may be covered with a pillow case or similar covering (to be worn each time!!).

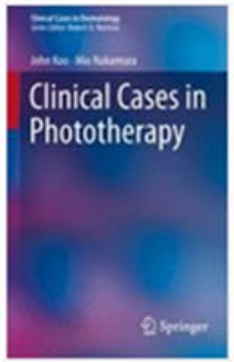
The Patient is told that the door to the UV cabinet is never locked and they can interrupt the treatment anytime by opening the door.

The patient stands in the middle of the machine with legs slightly parted & arms held slightly aloft and in front of the body (hands up position).

During the 2nd week

Patient reports being moderately pink and itchy over her trunk after 4th treatment at 0.45 J/cm2……. Pinkness has lasted < 36 hours

1. Why did this occur? *(Remember she has Type 3 skin)*
2. What do you do?



Clinical Cases in Phototherapy pp 65-67 | Cite as

Recognizing and Managing Initiation Burn

Authors | Authors and affiliations

John Koo, Mio Nakamura

Abstract

Initiation burn is a phenomenon in which the patient unexpectedly experiences burn very early in the course of phototherapy at very low dosimetry. In other words, the patient appears to be photosensitive without any underlying cause. In the case of initiation burn, it is important not to jump to the conclusion that the patient is not a candidate for phototherapy or has "failed" phototherapy. Instead, it is recommended to deliberately continue phototherapy with the highest amount of light the patient can tolerate, even if this is a very low dose. This allows the skin to desensitize, harden, or get used to the light, and oftentimes the patient can eventually tolerate doses of light per the usual protocol.

Reason for Pinkness after 4th Treatment

- Increment was a bit much for them (exceeded MED): hence mild burn

  Initiation Burn (IB)

- Factors
  - Provocation of eczema (Initiation burns are more common in atopic patient c/w psoriasis patients
  - Mild PLE? (female patient have a higher risk)
  - Drug photosensitivity (mostly often with UVA/PUVA): check medication history
    - In this patient: Tetracyclines, Retinoids, NSAIDS, Fluoroquinolones
    - In an older patient: Amiodarone, Thiazides, Phenothiazines (Chlorpromazine), Griseofulvin, Voriconazole, Vemurafinib
  - Other Photosensitive disorder

Discussion

Even though the phenomenon called "initiation burn" may not be well documented in the medical literature, it is not uncommon. Initiation burn is a phenomenon in which the patient unexpectedly experiences burn very early in the course of phototherapy at very low dosimetry. In other words, the patient appears to be photosensitive without any underlying cause [1]. This phenomenon may be more commonly experienced by patients with atopic dermatitis and other forms of eczema compared to patients with psoriasis. Although the exact cause and underlying pathophysiologic mechanism of this phenomenon are not well understood, it may be due to the hypersensitive nature of the skin to UV light in a certain subset atopic dermatitis patients [2] or due to heat-induced flare [3]. In patients with psoriasis, the prevalence of photosensitivity is estimated to be 5.5% [4] and is associated with skin type I, a heredity of photosensitivity, advanced age, and psoriasis affecting the hands [5].

When initiation burn occurs, it is important not to jump to the conclusion that the patient is not a candidate for phototherapy or has "failed" phototherapy. Instead, it is recommended to deliberately continue phototherapy with the highest amount of light the patient can tolerate, even if this is a very low dose. This allows the skin to desensitize, harden, or get used to the light [1]. After the patient tolerates several treatment sessions at low dosimetry, a very small incremental increase can be attempted. If the patient tolerates the slightly higher dose, further increase in dosimetry can be tried again in small increments. The practitioner should be very careful and aware of any erythema on the skin or any reports by the

Initiation Burns

- IB is the Phenomenon on Burning at unexpectedly low doses for phototype
- Not Uncommon in Clinical Practice
- More common in Atopic Dermatitis than Psoriasis
- Mechanism is unclear
  - Heat induced provocation of eczema
  - “hypersensitivity” to UV in a subset of AD patients (?/// to PLE)
- In Psoriasis Patients occurs in 5.5%, Risk factors include:
  - Type 1 skin
  - FH of Photo sensitivity
  - Palmo plantar Psoriasis

Rx in this patient

- Action →Assess patient:
  - examine for burn (sharp cut off, macular erythema),
  - eczema flare & PLE (could have urticarial or papular rash which can be hard to separate)
- Reduce dose to previously tolerated dose
- Repeat this dose on 3 occasions
- Then slowly increase by 0.03J/cm2
- Slower Increments: increase only after every second dose

TABLE 7.1 Suggested dosing protocol for a patient with initiation burn

	Initial dose (mJ/cm^2)	**Subsequent dose increments (mJ/cm^2)[a]**
NB-UVB	30	10–30
BB-UVB	5	5–10
PUVA	0.25	0.5

[a]Maintain tolerable initial dose for approximately 2 to 5 treatments before attempting subsequent dose increments to allow time for photohardening. Subsequent dose should only be increased if there is no erythema and symptoms of burning after the previous treatment session

What are the short term and long term side effects of Phototherapy?

Acute	Long term
Sun burn like reactions: Erythema, Pruritus, Peeling, Koebnerisation. In severe cases pain swelling and blistering can occur.	Possible increased risk of skin cancer with UVB, but not yet established. There may be an increased risk of genital skin cancer in UVB treated patients: Cover genitalia!
	Proven risk with PUVA: increased risk of SCCs and melanoma.
Induction of PLE	Photoaging
Exacerbation of photo sensitive conditions (LE)	Peculiar to PUVA: PUVA has additional side effects including **PUVA lentigines, PUVA keratoses**, ophthalmological effects such as generation of cataract.
Panic reactions / claustrophobia	
Tanning	
Corneal burn if eyes are not protected	
Provocation of HSV (more often with BB-UVB)	
PUVA has additional side effects such as nausea, PUVA itch (can sometimes last months) PUVA pain.	

= PUVA related

How many doses of NB-UVB can one have in a life time?

In theory there is no limit!

EXAM answer: Just need to monitor carefully after 150-250 doses for the future development of skin cancer depending on skin type (Type 1 – Type 3 or 4)

For PBS Biologics: can choose to stop after 200 doses

PUVA >200 doses increases the risk of SCC > BCC ……& probably Melanoma

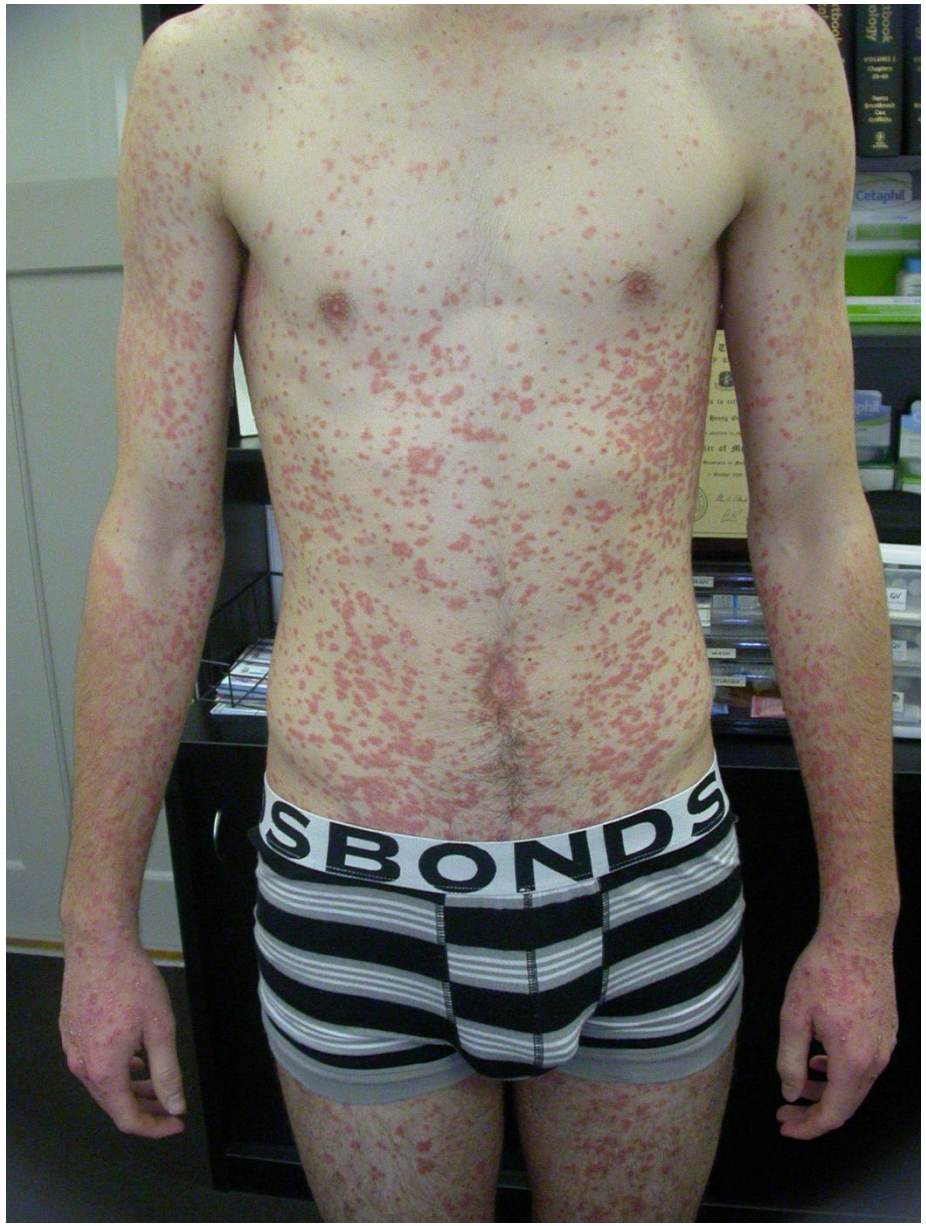
British Guidelines state no upper limit but after 450-500 Rx monitor for increased risk of NMSC (and ? Melanoma)

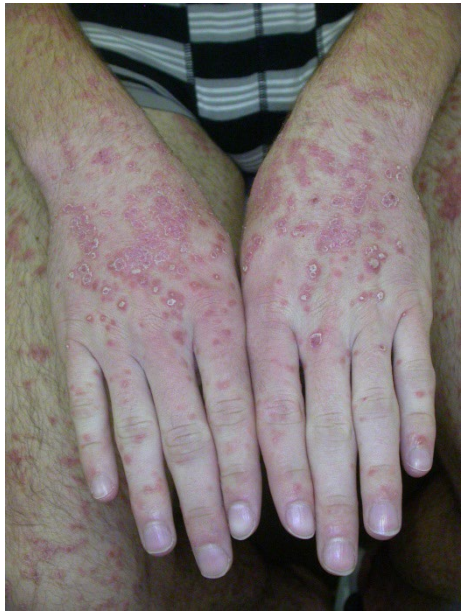
Clinical scenario 3: 20 year old Med student

- >4 week history of widespread worsening rash
- Had a severe sore throat → 6 weeks ago…….saw his LMO
- LMO treated with: Oral Cephalexin 500mg tds
- A week into A'biotic course he got a rash: initially thought to be due to allergy to Cephalexin…….stopped it immediately.
- However rash worse despite being off the antibiotics for >4 weeks

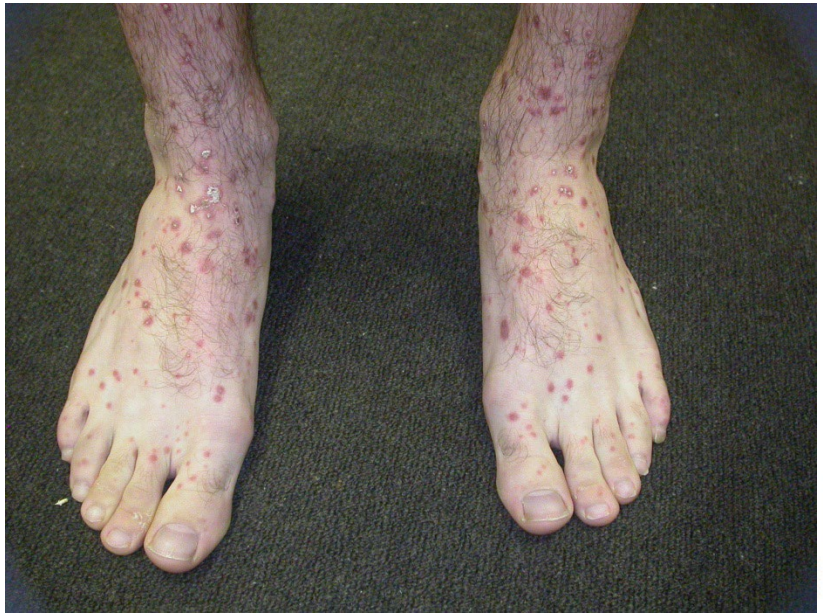
- Currently on Isotretinoin for acne which is much better, started 6 months ago. PH of anxiety and panic attacks.

Post-streptococcal guttate psoriasis





DIAGNOSIS ?



How do you determine skin phototype?

Skin type	Typical Features	Tanning ability
I	Pale white skin, blue/hazel eyes, blond/red hair	Always burns, does not tan
II	Fair skin	Burns easily, tans poorly
III	Darker White skin	Tans after initial burn
IV	Light Brown skin	Burns minimally, tans easily
V	Moderate Brown skin	Rarely burns, tans darkly easily
VI	Dark Brown or Black skin	Never burns, always tans darkly

How would you treat this patient with NBUVB?

- What about Isotretinoin: Would you stop it?
- Any other issues to manage proactively?

Answers

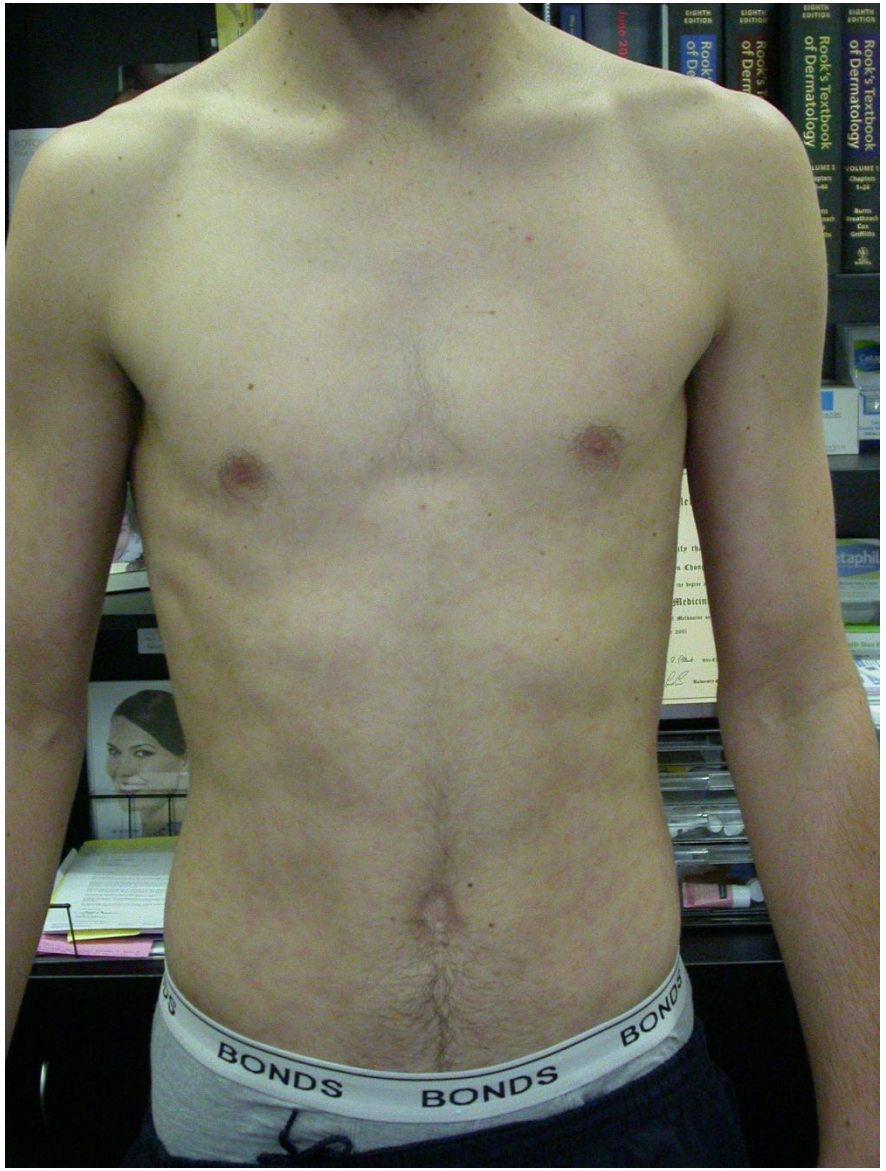
- Isotretinoin should be fine to continue. (like Re-UVB)*

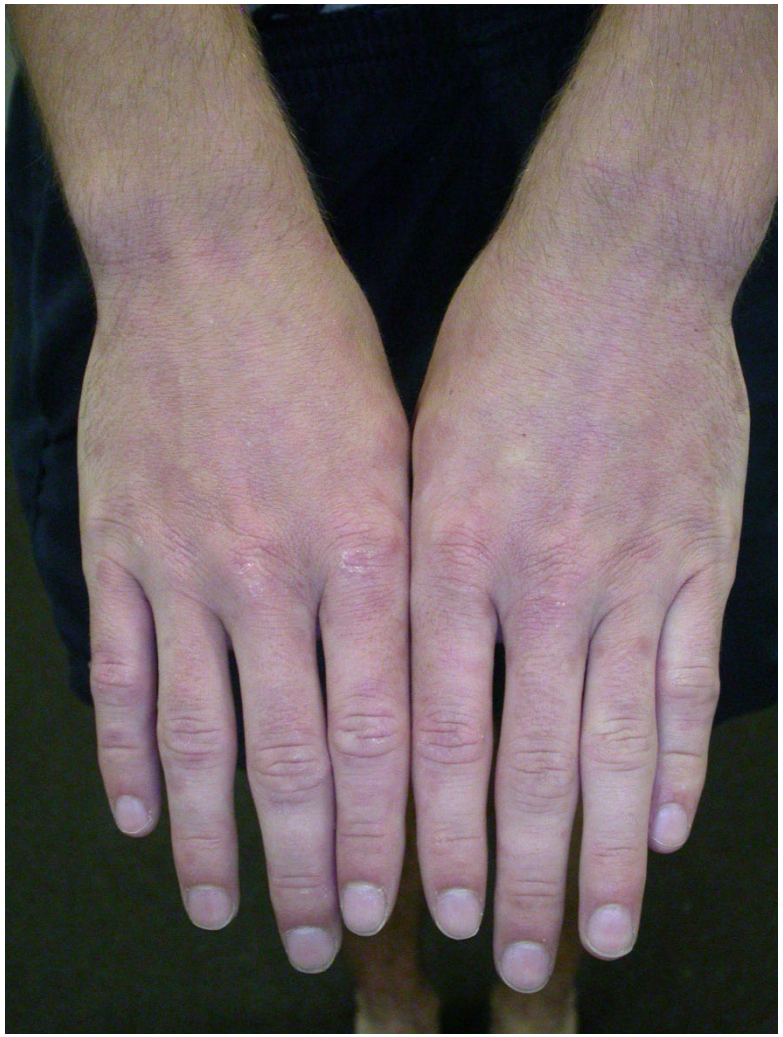
**However there are some precautions to consider, discussed later.*

(If he is SPT 2 then Rx as per SPT 1 protocol)

- Panic attack: check if he is claustrophobic…

Post-streptococcal guttate psoriasis: Resolution
4 weeks post NBUVB phototherapy





Imagine that after 3 weeks of Rx Patient takes a 10 day holiday

- When he is away, he falls and badly grazes his Right arm.
- He has a large dressing on his arm when he returns.

- Are any special precautions are needed to continue treatment?

Answer

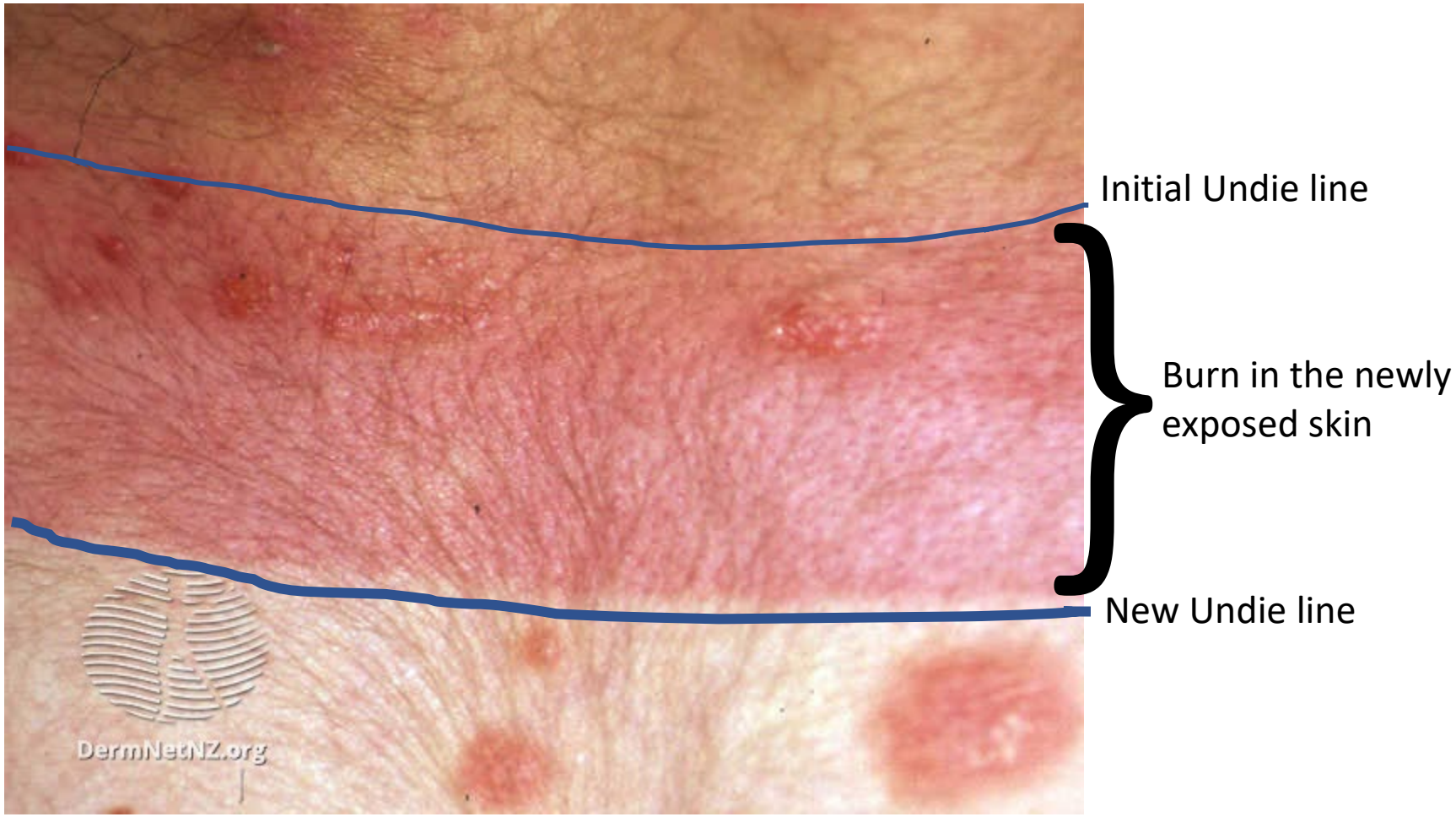
- Due to the gap he will need a ~25-30% dose reduction.

- The area under the dressing will not receive any UV. If the dressings are needed for several days…..then he may burn when he has a UV Rx without dressings, in the newly exposed area.
  - Option 1: skip UV until skin heals and dressings no longer needed. Then resume at a much lower dose (depending on the hiatus in Rx) The new skin could be sensitive to UV as likely to be paler.
  - Option 2: Continue UV, but keep dressings on even after skin has healed.
- What is the disadvantage of Option 2?

Option2

- If the graze (trauma) causes Koebnerised Psoriasis later, we cannot expose to UV in the future as this area has lost its tolerance to UV.

Importance of wearing the same style of underwear for UV



What are the absolute and relative contraindications of phototherapy?

If a patient is taking Photosensitising medication/s, is NB-UVB phototherapy contraindicated?

Box 21.2 Contraindications to UVB and PUVA

Absolute contraindications

- Dysplastic naevus syndrome
- Systemic lupus erythematosus
- Dermatomyositis
- Genetic skin cancer syndromes (xeroderma pigmentosum, Gorlin syndrome)
- Bloom syndrome, Cockayne syndrome
- Patients unwilling or unable to comply with safety procedures
- Patients who are medically unfit and unable to stand, e.g. severe cardiovascular or respiratory disease

Relative contraindications

- Age <16 years
- Previous or current non-melanoma skin cancer
- Previous melanoma
- Previous exposure to arsenic or ionizing radiation
- Current pre-malignant skin lesions
- Concomitant immunosuppressive therapy
- Photo-induced epilepsy
- Pregnancy[a]
- Bullous pemphigoid/pemphigus
- Cataracts[a]
- Significant liver dysfunction[a]

PUVA can induce B Pemphigoid in Psoriasis

[a]Contraindication to oral PUVA only.

Absolute	Relative
Genetic increase skin cancer risk XP, Gorlins, DNS photosensitive Blooms, Cockayne, Porphyrias (PCT, EPP, VP), albinism	Young Old +/- frail (medically unwell → Infirmity) Unable to comply Too far to travel
Connective tissue disorders SLE, DM	Increase risk of malignancy: PH of NMSC, Melanoma, Aks++ Immunosuppressive eg Azathioprine, Cyclosporin

TABLE 13.1 Medications known to have photosensitizing potential, adapted from Glatz and Hofbauer [1]

Antimicrobials	**NSAIDS**	**Anti-hypertensives**
Doxycycline	Naproxen	Furosemide
Minocycline	Ketoprofen	Hydrochlorothiazide
Ciprofloxacin		Calcium-channel blockers
Levofloxacin		
Voriconazole		
Antimalarials	**Retinoids**	**Other**
Chloroquine	Acitretin	Psoralens
Hydroxychloroquine	Isotretinoin	Chlorpromazine
Quinidine	Targretin	

NOTE: Drug Photosensitivity is usually induced by UVA

How will you start / administer NBUVB to Patient taking Photosensitising medications?

TABLE 13.2 Recommended assessments and precautions regarding the use of photosensitizing medication during the course of phototherapy

Prior to initiating phototherapy	Patient to disclose active medication list, including any vitamin or herbal supplements and alternative treatments
During course of phototherapy	Patient to promptly report to practitioner any new or changes to existing medications/ supplements
	If on a photosensitizing agent, give maximum time between medication dosing and the next phototherapy session in order to minimize blood levels of the medication

TABLE 13.3 Recommended dose adjustments for patients on photosensitizing medications

Patients on a photosensitizing drug at the start of phototherapy	Treat per protocol of one skin type lower than the patient's actual skin type (i.e. if skin type II, treat per protocol of skin type I).
Patient starts a photosensitizing drug during course of phototherapy	Decrease dose by 50%, then proceed with subsequent dose increases per protocol for patient's actual skin type

Psoriasis

Skin Phototype	Initial dose J/cm2	Increments (within 3 days of last Rx) J/cm2	Maximum dose
1	0.10 to 0.20	0.05 to 0.10	0.9
2	0.20 to 0.25	0.10	1.2
3	0.30	0.10 - 0.15	1.7
4	0.40	0.15 - 0.20	2.5
5	0.4 to 0.50	0.15 - 0.20	3.0
6	0.4 to 0.60	0.20 - 0.25	3.0

Eczema

Skin Phototype	Initial dose J/cm2	Increments (within 3 days of last Rx) J/cm2	Maximum dose
1	0.10	0.05 to 0.10	0.9
2	0.10	0.5 to 0.10	1.2
3	0.15 to 0.20	0.10 - 0.15	1.7
4	0.20	0.10 - 0.20	2.0
5	0.25 to 0.30	0.15 - 0.20	2.3
6	0.30	0.15 - 0.20	3.0

Vitiligo

Skin Phototype	Initial dose J/cm2	Increments (within 3 days of last Rx) J/cm2	Maximum dose
1	0.05	0.05 to 0.10	1.0
2	0.05	0.05 to 0.10	1.2
3	0.10 to 0.20	0.05 to 0.10	1.5
4	0.20 to 0.30	0.05 to 0.10	2.0
5	0.20 to 0.30	0.05 to 0.10	2.3
6	0.20 to 0.30	0.05 to 0.10	3.0

A Prof Peter Foley
Dosing schedule

NB-UVB Starting dose and Increments

Skin type	NBUVB dose J/cm^2	Increments J/cm^2 (psoriasis)
I	0.3	0.1
II		
III	0.5	
IV		
V	0.8	0.15
VI		

In practice: starting dose 0.1-0.2 J/cm^2
increments 0.03-0.1 J/cm^2

NBUVB - MAXIMUM DOSE

Skin type	UVB dose J/cm^2
I	2
II	
III	3
IV	
V	5
VI	

Maximal dose for: atopic dermatitis 1.5 J/cm^2
vitiligo 0.8 J/cm^2

Patient with Psoriasis, Type-III skin, on NBUVB for 4 weeks....last dose was 1.5 J/cm^2 ……..away for 12 days..
What dose will you give on return ?

Missed doses (Based on Zanolli / Feldman, Phototherapy Treatment Protocols, Second Edition)

Number of missed days	Action
4-7 days	Keep dose the same
1-2 weeks	Decrease by 25%#-50%*
2-3 weeks	Decrease by 50%#-75%*
>3 weeks	Start over

Use % range to decide on dose reductions: based on phototype, previous h/o UV burns, diagnosis (eg ECZEMA* needs bigger dose reductions), patient anxiety about risk of burning.
If risk is considered high use the larger % of the range.

= more appropriate for psoriasis

John Koo

TABLE 1.3 Missed treatment protocol for both NB-UVB and BB-UVB

Missed visit	Action (for all skin types)
1–7 days	Increase dose per protocol
8–11 days	Hold dose constant
12–20 days	Decrease by 25%
21–27 days	Decrease by 50%
28 or more days	Restart with initial dose

Patient develops burn on Monday with moderate pinkness lasting 36 hours,…. his last dose was 1.1 J/cm^2 …….comes for UVB on Wednesday …..your nurse ask you to set the next dose….What do you do?

Burning

Burning	Action
Minimal pinkness, settles <24 hours	Keep dose the same (do not increase)
Moderate pinkness	Skip dose till redness settles and reduce next dose by 25 to 50%, consider smaller increments if repeated burning occurs
Severe Burn	Doctor to Review patient immediately

Answer

-Reduce dose to 0.7 J/cm2
-Consider smaller increments
-Re-check top dose

Treatment of severe UV burn

Review patient and ascertain what went wrong: incorrect dose, long gap between treatments without dose reduction, newly exposed area (undies position has changed or face exposed after several UVB treatments after being covered initially), photosensitizing medication.

DDx: PLE reaction or other dermatosis eg LE

NSAIDs

Top steroid (Class 3), Wet Dressings

Consider Prednisolone

Contact medical indemnity

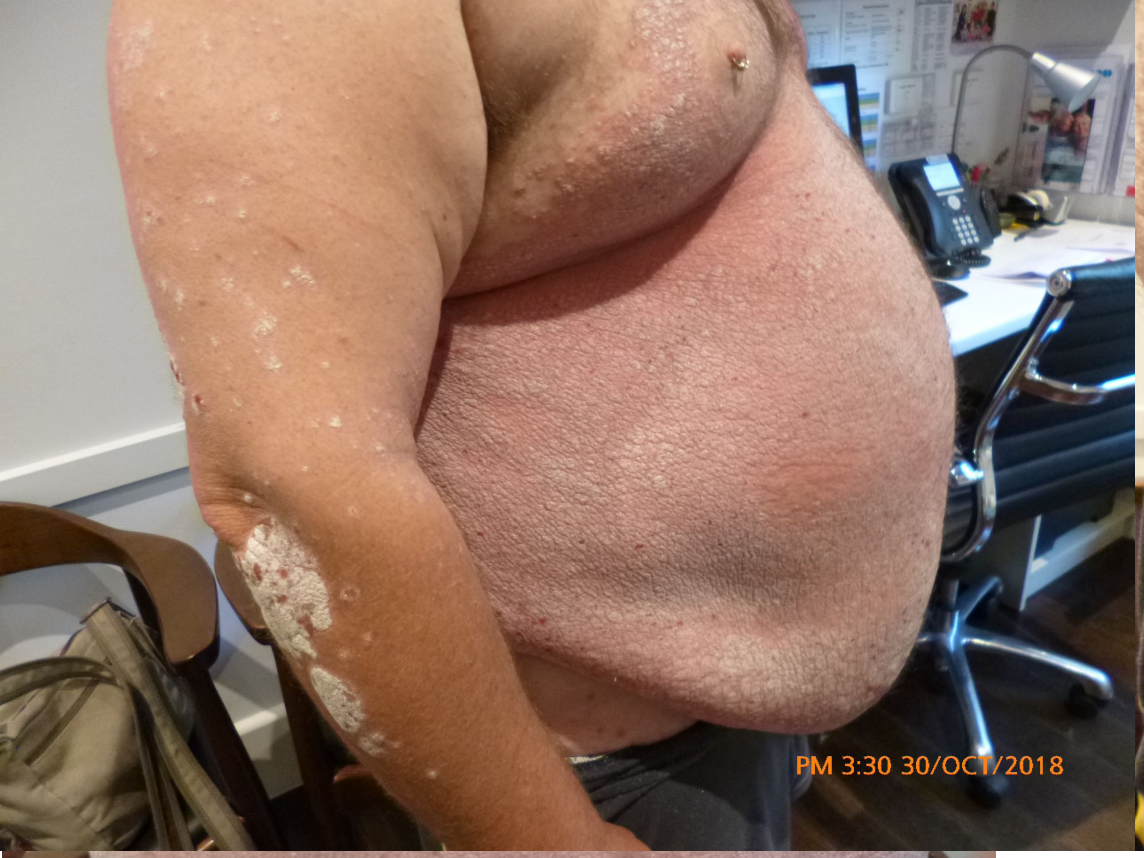
Preemptive Management Strategies for Phototherapy Burns

Table 8.1 Keys to management of phototherapy-induced burn

1. Tell every patient ahead of time that he/she might eventually experience a "sunburn" type reaction as a natural consequence of dosimetry titration. The burn most commonly occurs 4–6 h after a treatment
2. Every patient undergoing phototherapy should be prescribed a topical corticosteroid to use at home in case a phototoxic reaction occurs
3. Topical corticosteroid (superpotent when appropriate) should be applied at the earliest sign or symptom of skin burn noted by the patient
4. Ibuprofen can help decrease the phototoxic reaction and symptoms
5. Restart phototherapy only when both the last of the erythema and symptoms disappear. Resume at a dose that is lower than the highest dose previously tolerated, as there can be residual excitability of the skin after a phototoxic reaction

Clinical scenario 4

- 54 year old man
- Very thick plaque psoriasis
- Obesity, however LFTs almost NAD
- Otherwise well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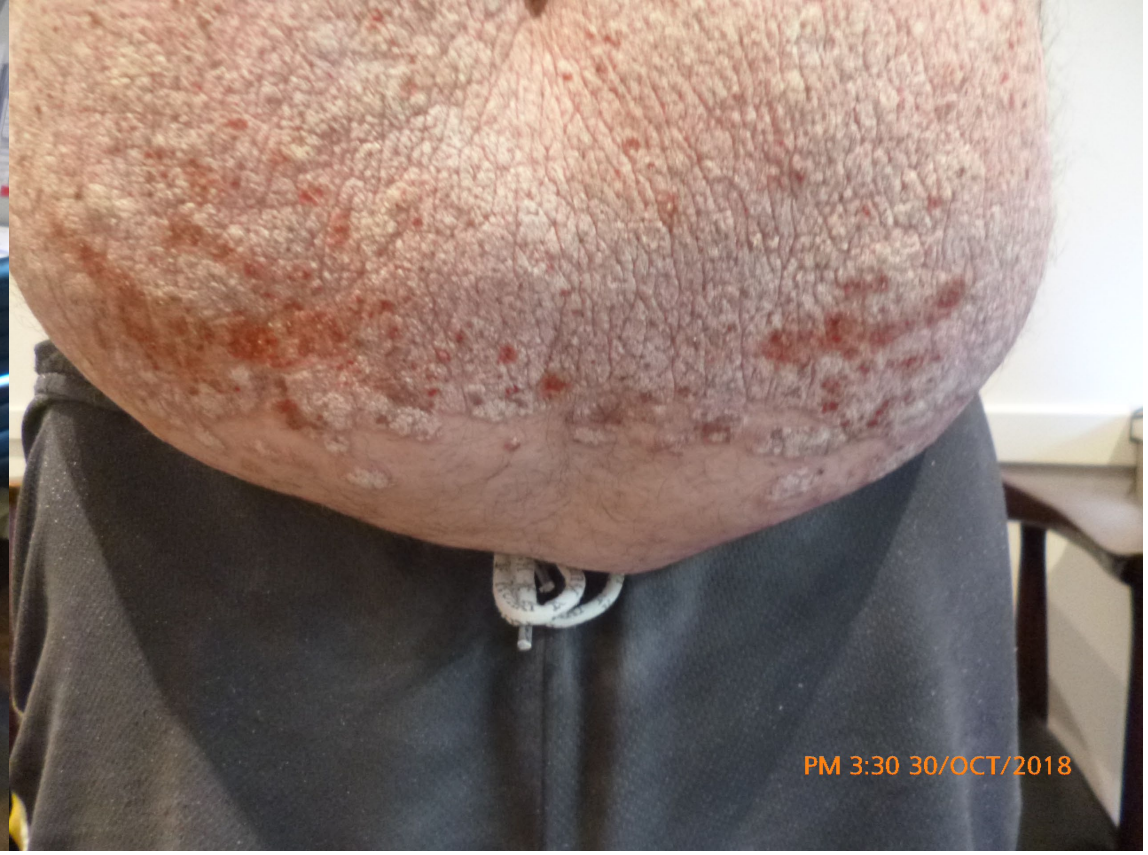
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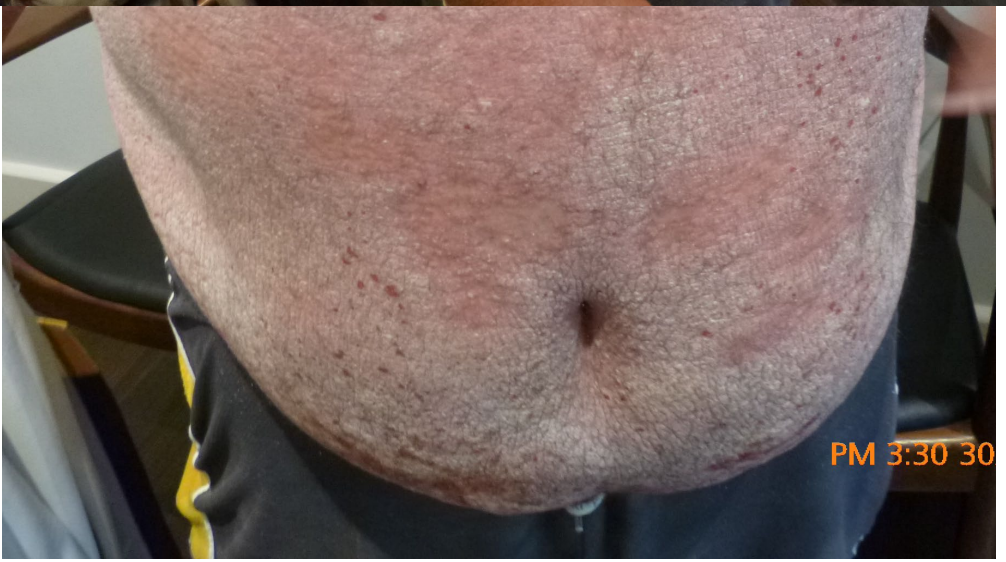
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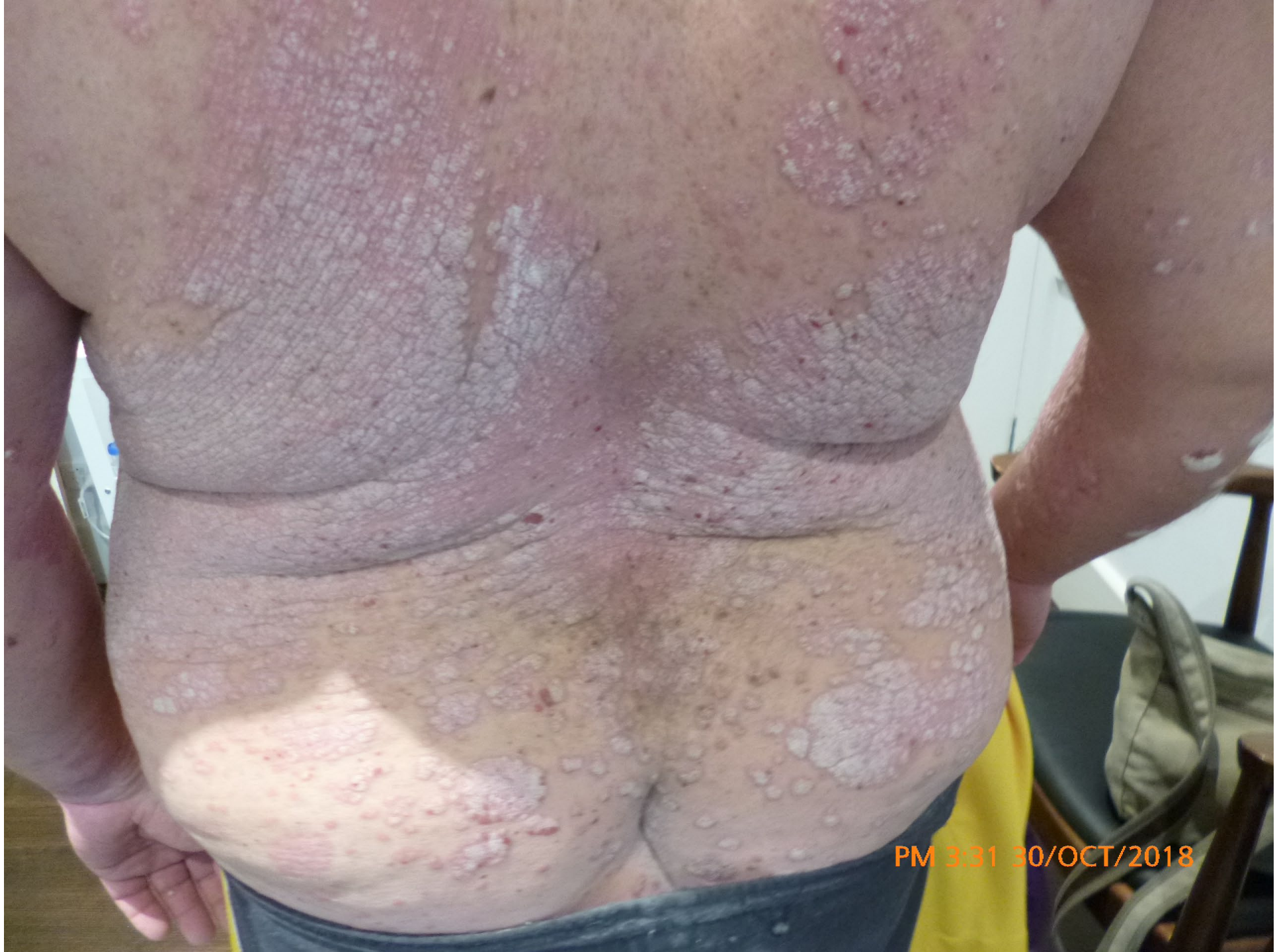
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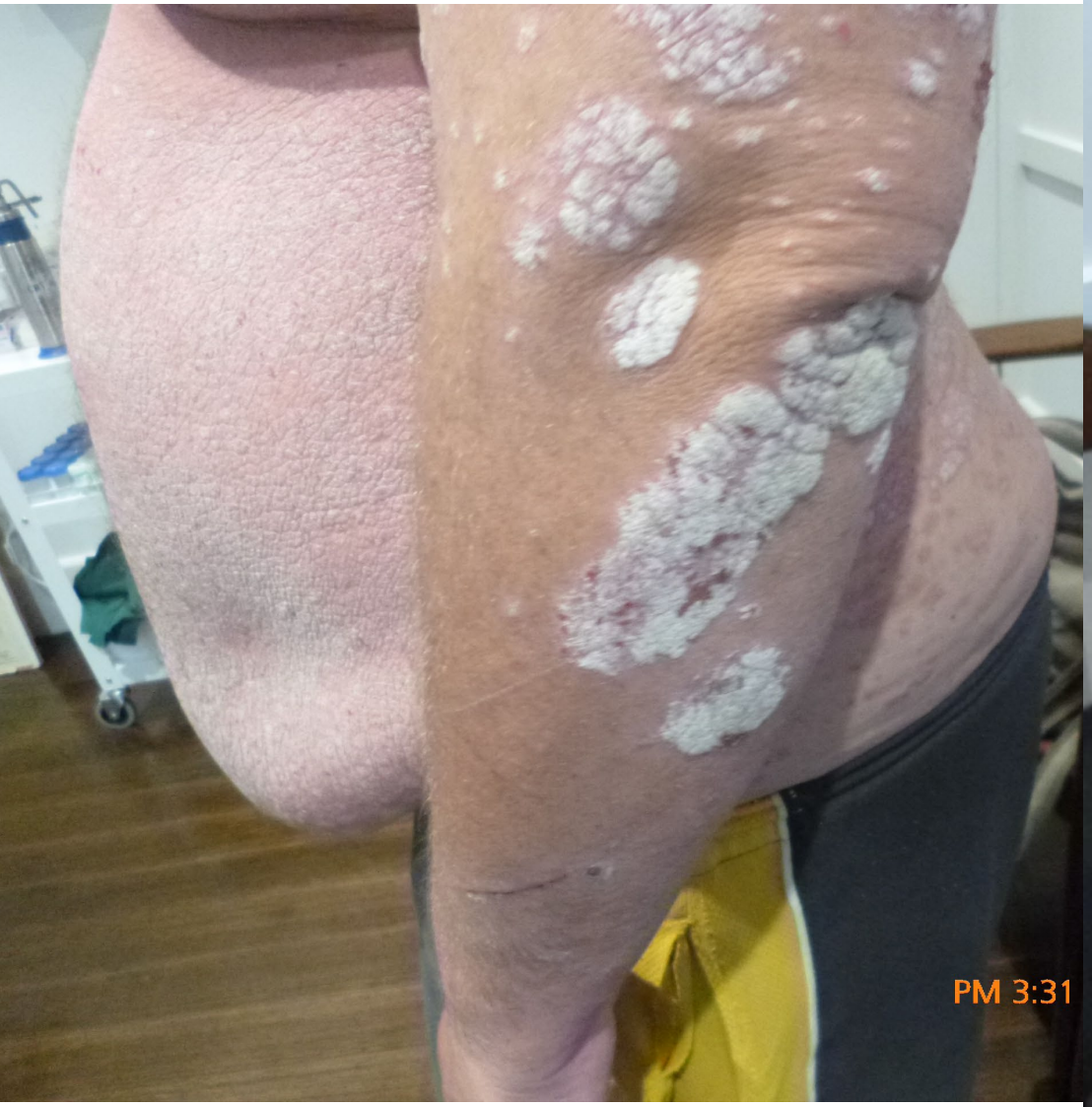
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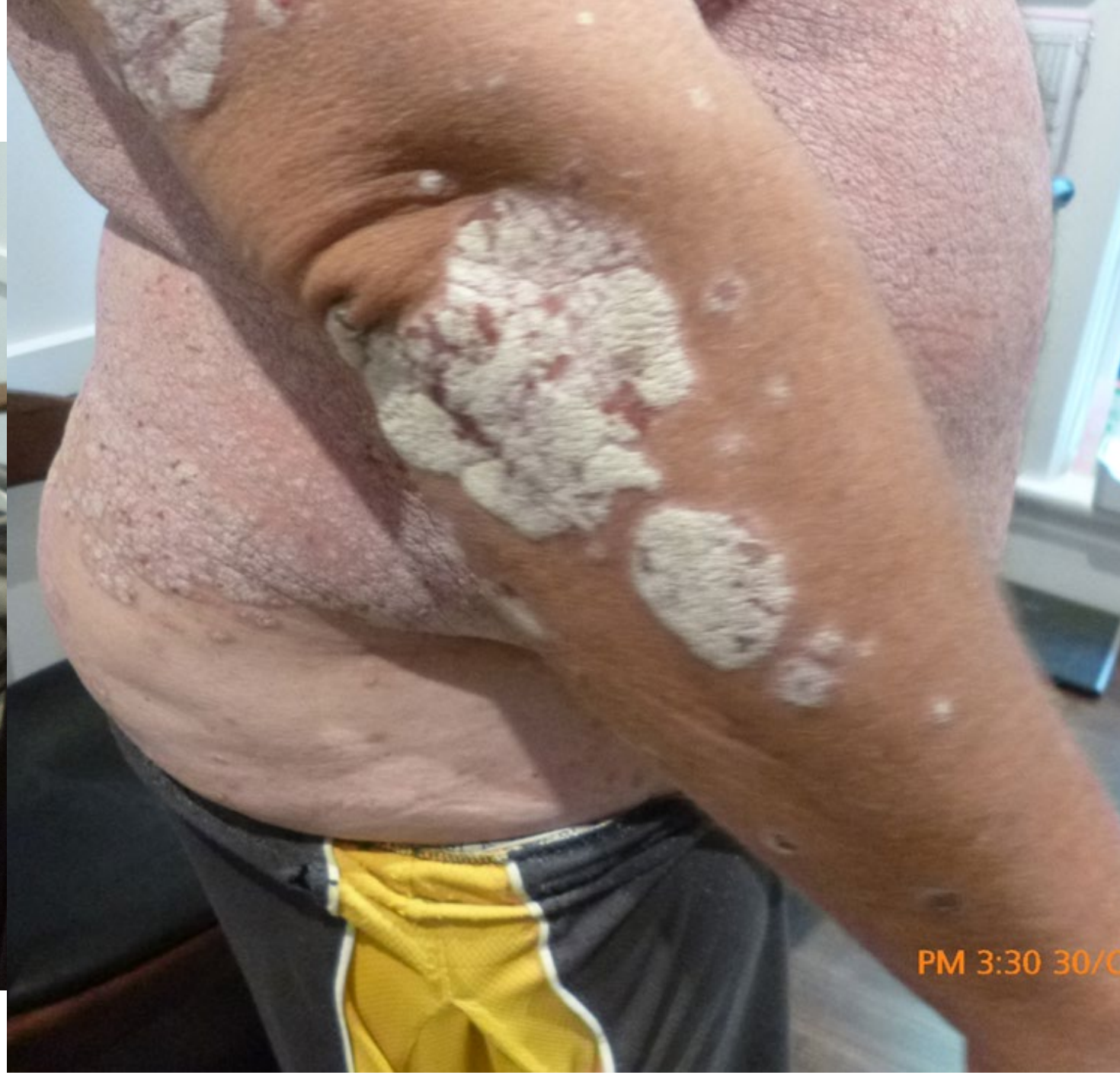
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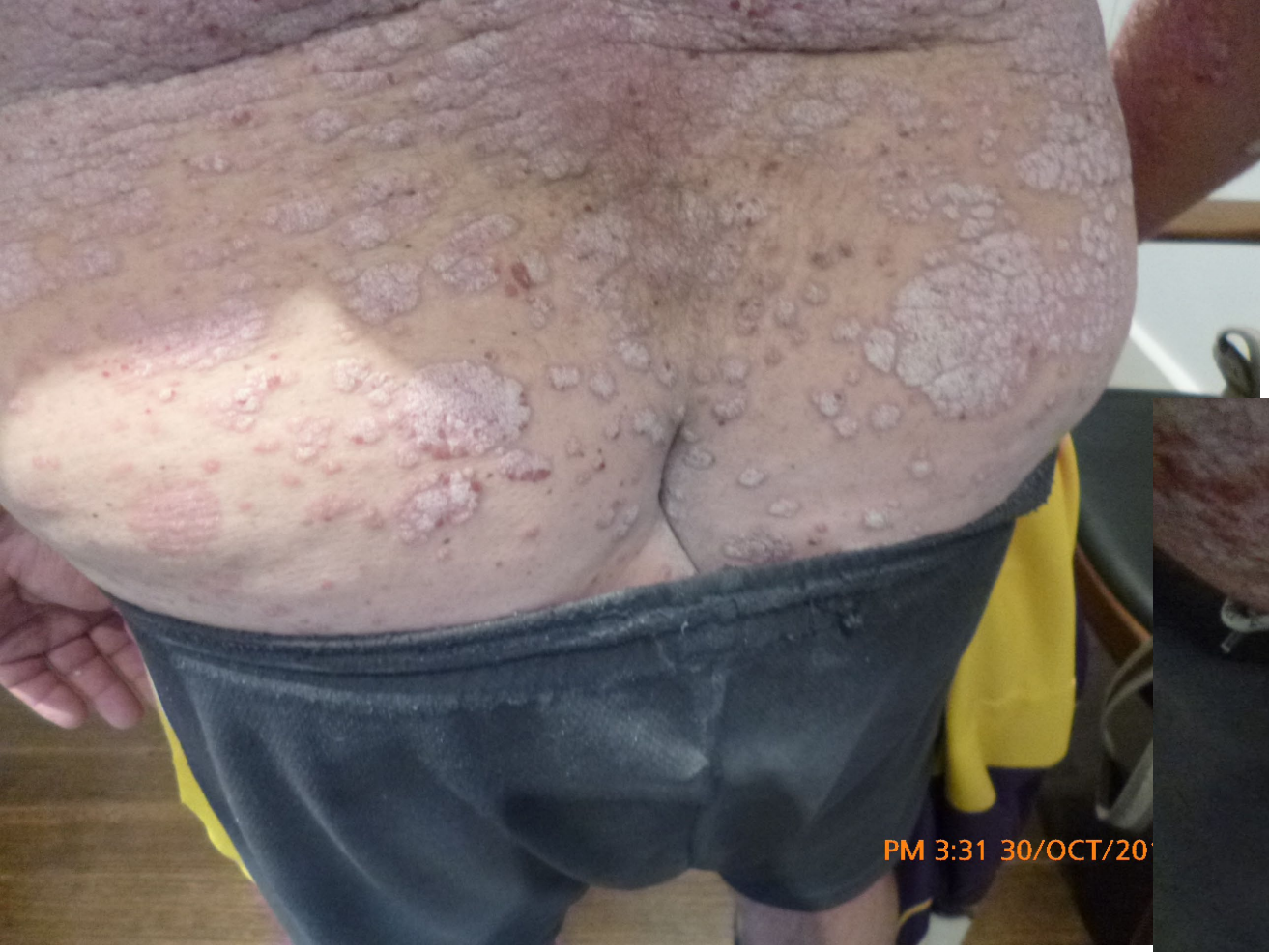
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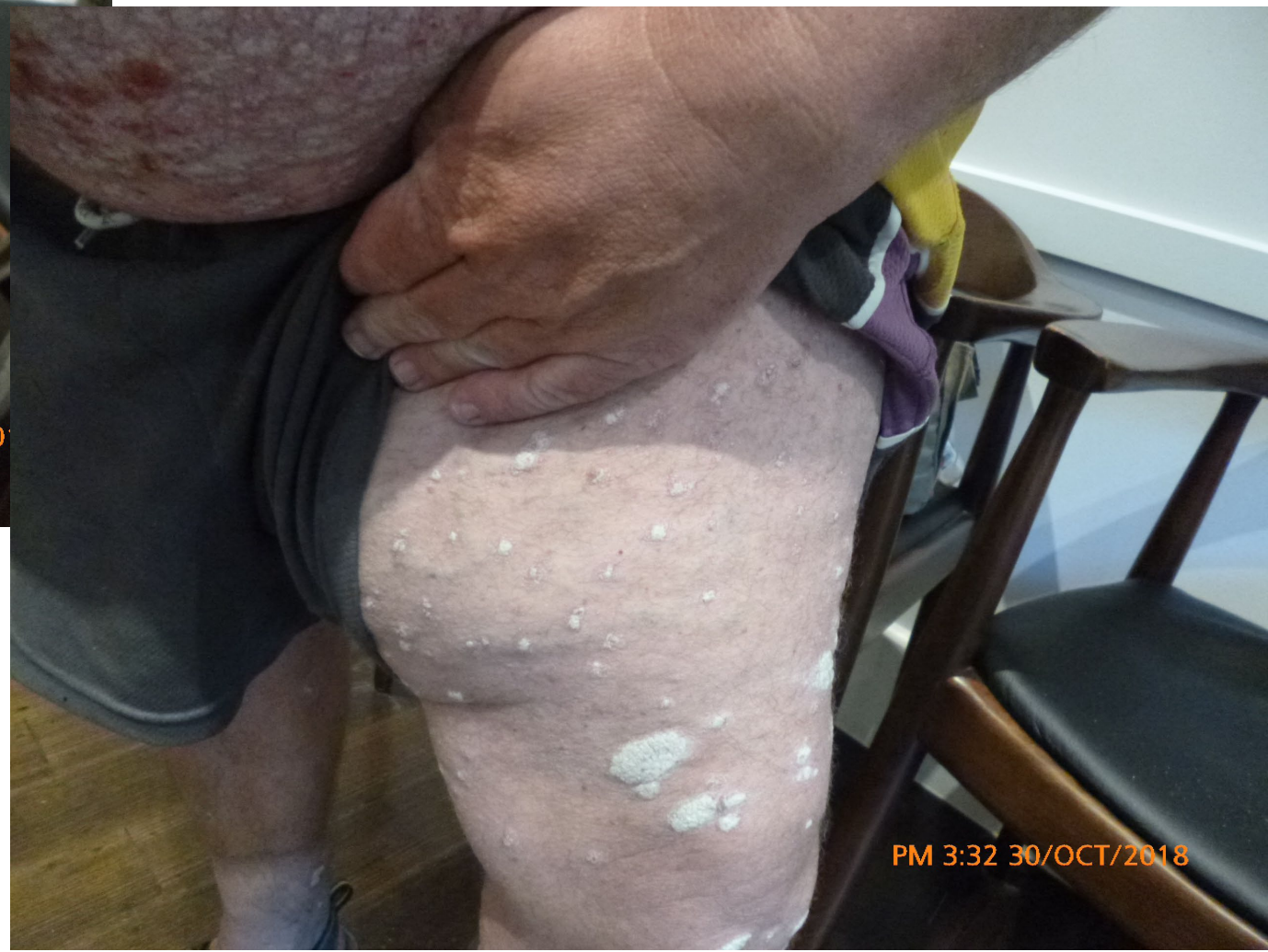
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What Medications can you safely combine with NBUVB to treat skin conditions?

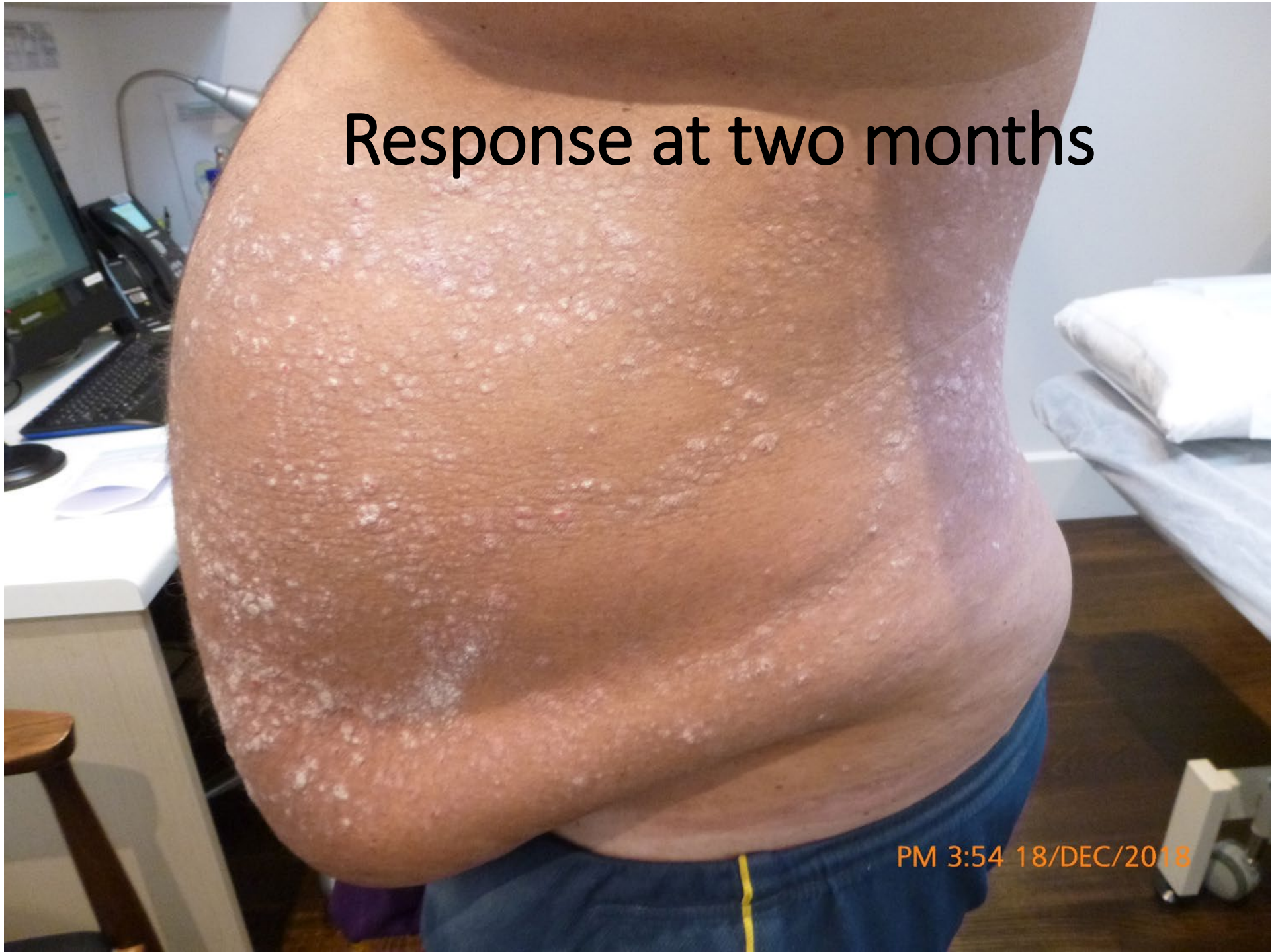
- Retinoid: Re-UVB
  - Acitretin
- Methotrexate
- Mycophenolate
- Biologics
- Prednisolone
- Medications to be avoided: Azathioprine, Cyclosporine

RE-UVB was used to treat this patient

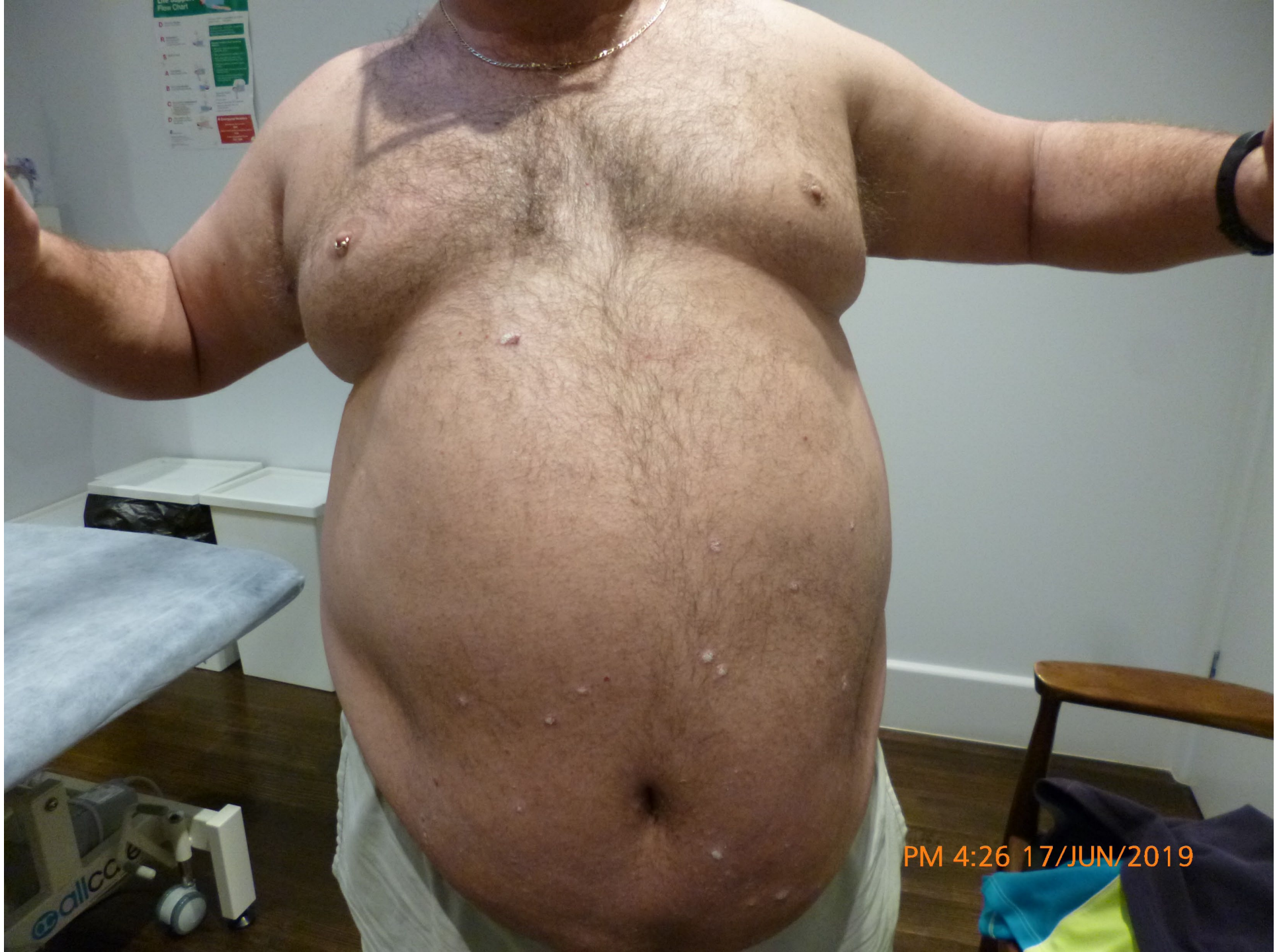
Acitretin 25 mg /day increasing slowly to 40 mg per day

Along with NBUVB

Response at two months



At 8 months post Commencement of RE-UVB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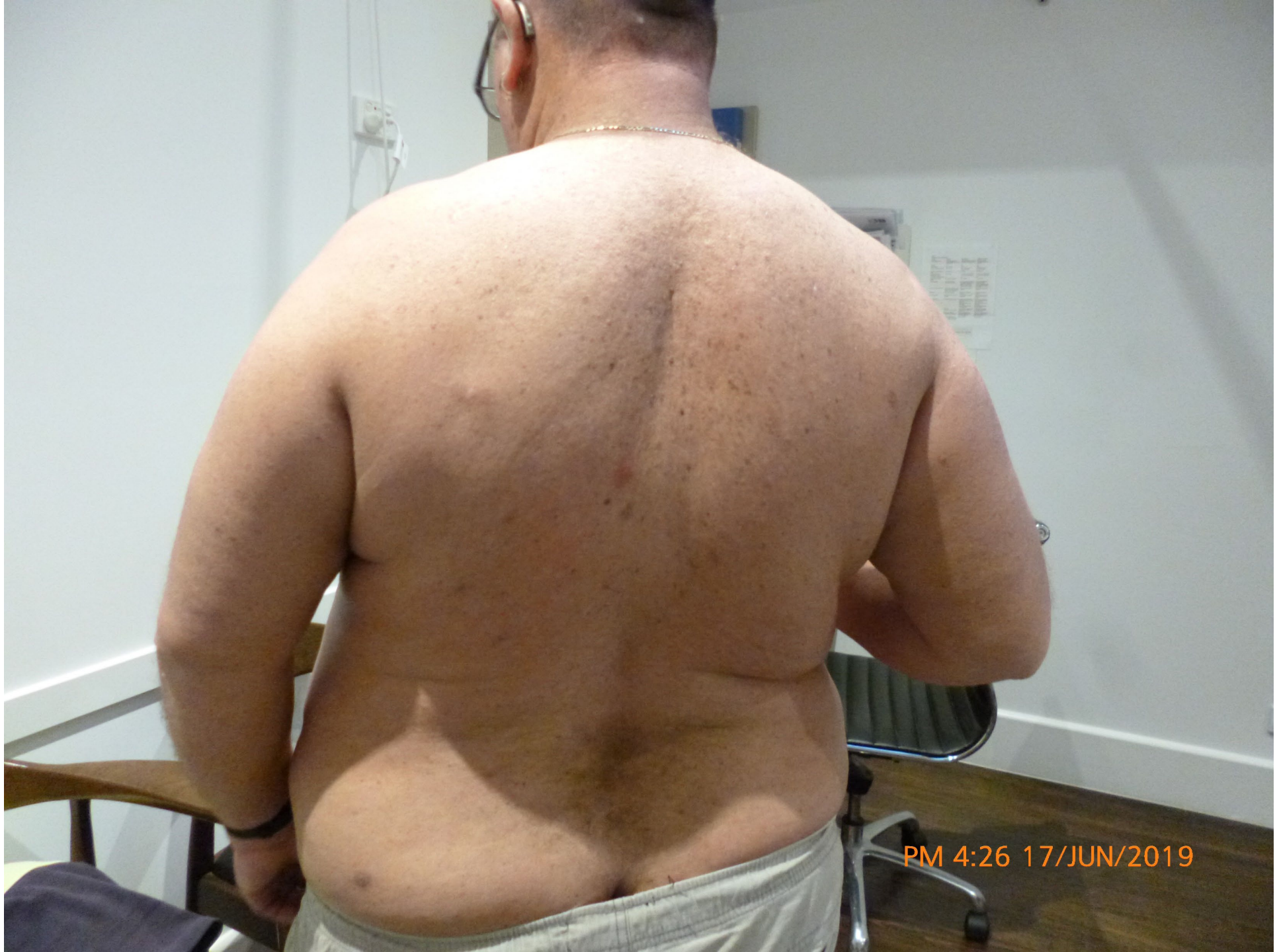
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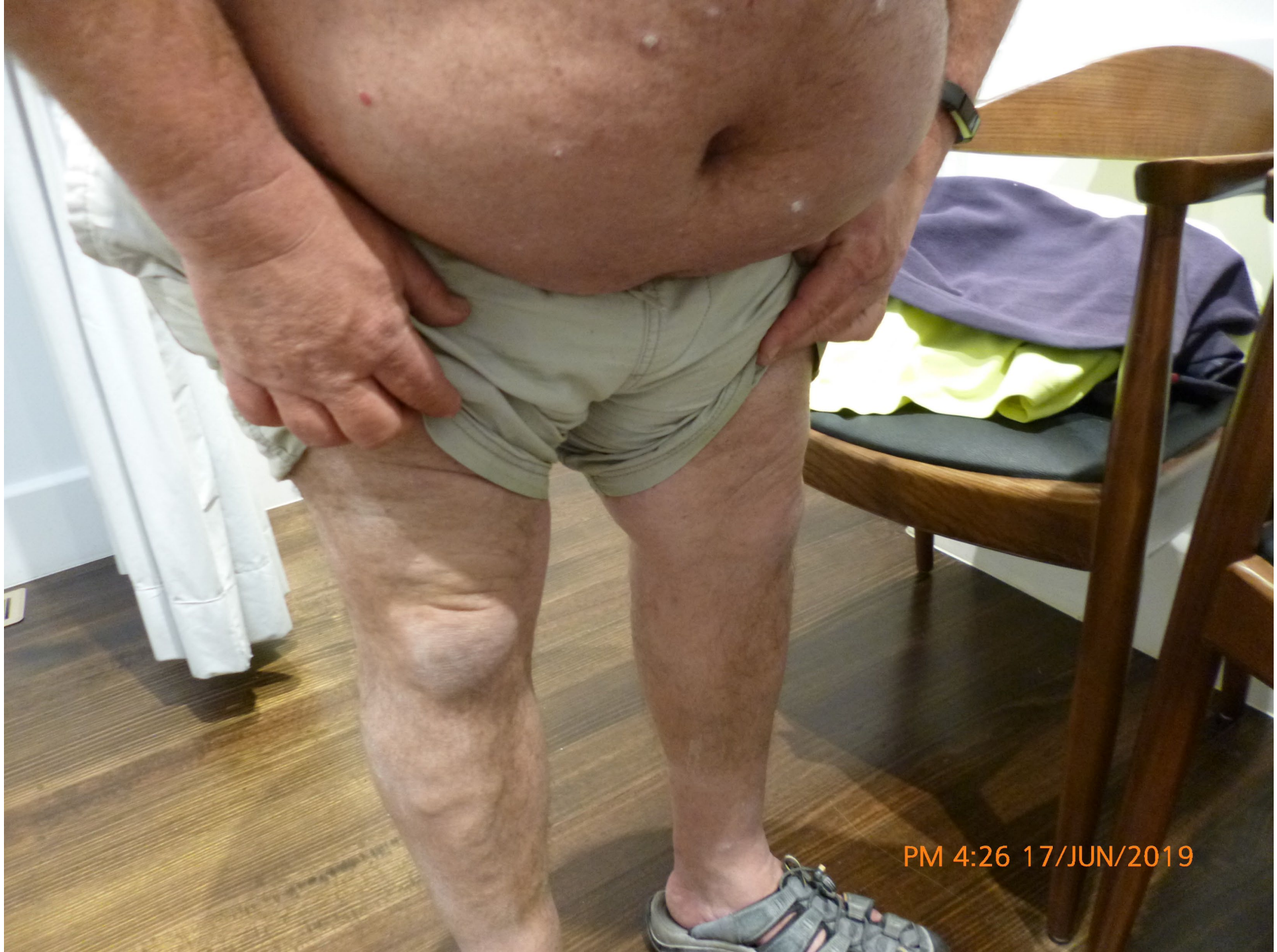
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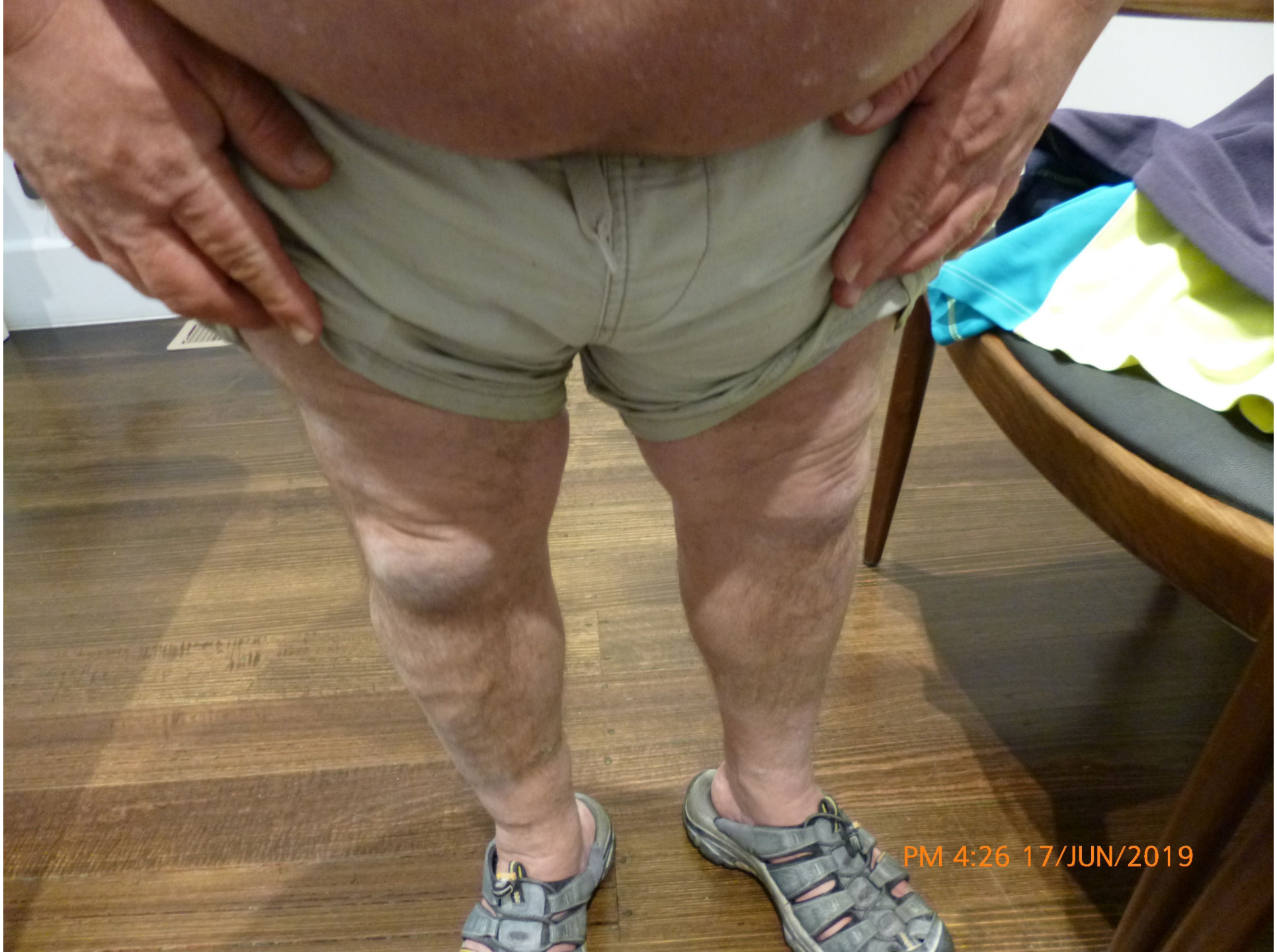
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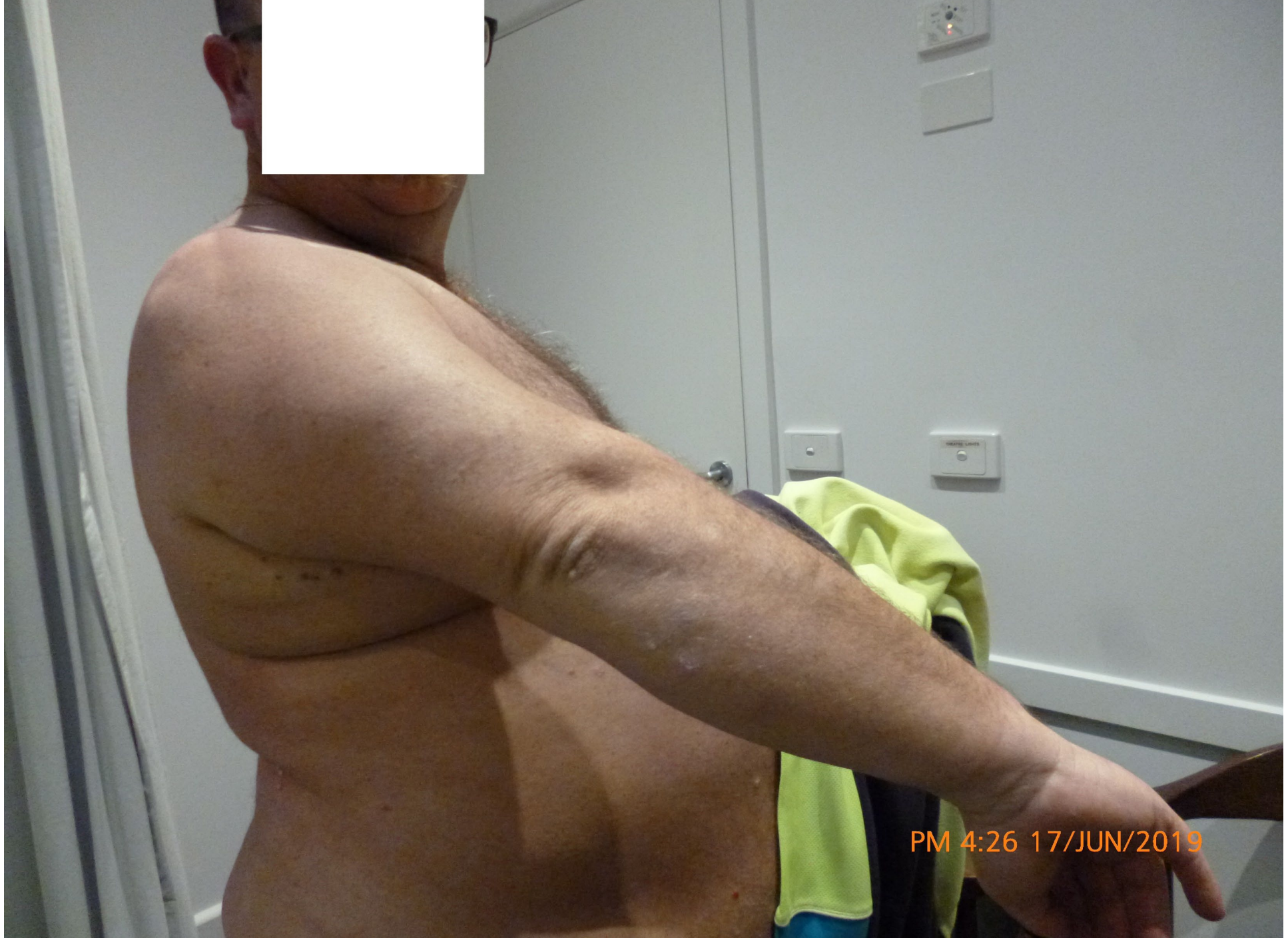
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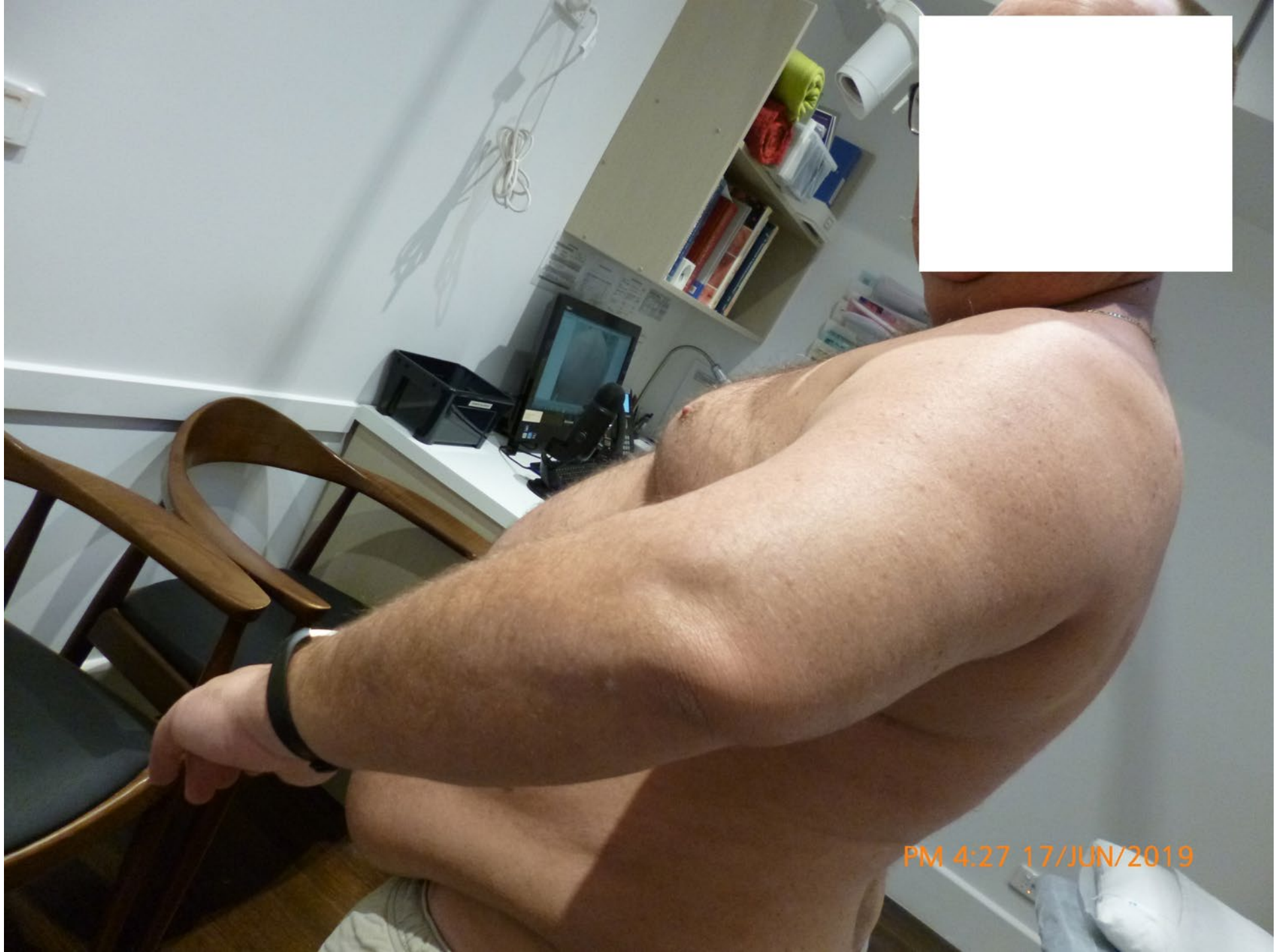
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RE-UVB

- Start slowly with Acitretin dosing
- Increase Acitretin gradually as tolerated up to 0.4mg/kg
- After clearance ….Keep the Acitretin going to prevent relapse
- Monitor LFTs and Lipids
- Good synergistic combination as Retinoids reduce the risk of UVB included carcinogenesis

Devices

UVB machines come in 2 major forms: Full body and Hand and Foot machines

Full body machines have 1.76 to 2.0 metre Philips TL-01 tubes.

The newer machines have 2.0 metre tubes which are said to deliver a more uniform output: homogeneous irradiation from head to toe (Output=120W).

Output loss of both TL-01 tubes (1.76 and 2.0 m)	
Depreciation at 500 Hours	10 %
Depreciation at 1000 Hours	15 %

The older machines use 1.76 metre TL-01 tubes with an output of 100W.

Dr Matheen Mohammed and Colleagues
East Malvern Dermatology
503 Waverley Road
Malvern East VIC 3145

Dear Matheen and Colleagues,

RE: [redacted]

Thank you for seeing [redacted] for continued nbUVB phototherapy for her eczema and prurigo. You are welcome to contact the rooms here to find out her latest dose if you would like to pick up therapy at her most recent dose, if this is practical.

With my best wishes,

Transferring to a different UVB machine in the middle of a UV course

- What factors will you consider in planning a safe transfer of this patient to your machine?

Factors to consider

- Skin Phototype, Condition being Rx
- Last dose: How much, when, how was it tolerated
- What type of machine:
  - Timer controlled
  - single or multiple dosimeter controlled
  - computer and dosimeter controlled.
- Age of machine / Tubes and date of last calibration

These factors are hard to confirm

Older Timer or single Dosimeter controlled unit

New multiple Dosimeter and Computer controlled unit

Most modern full body machines use a dosimeter to measure output and calculate the dose.

Hand and foot machine use timers to calculate dose. As tubes depreciate in output over time, timer-controlled unit tend to under-dose patients more than dosimeter-controlled units over a period of years.

Hence re calibration is needed every year.

PUVA
How to Perform

From A/Prof Peter Foley

SYSTEMIC PUVA

- 8MOP
- 0.6mg/kg
- 2 hours before treatment, with food
- Sunscreen to exposed skin
- Sunglasses (for 12 to 24 hours post Oral Psoralen)
- Remove sunscreen immediately before treatment
- Underwear
- Goggles

SYSTEMIC PUVA

- AFTER TREATMENT
  - Reapply sunscreen
  - Sunglasses
  - Avoid deliberate sun exposure

SYSTEMIC PUVA- STARTING DOSE

Skin type	UVA dose J/cm^2 (psoriasis)	Increments J/cm^2	UVA dose J/cm^2 (eczema/vitiligo)
I	0.5	0-1.0	0.25
II	1.0		0.5-1.0
III	1.5		
IV	2.0	0-1.5	
V	2.5		
VI	3.0		

SYSTEMIC PUVA- MAXIMUM DOSE

Skin type	UVA dose J/cm^2
I	5-8
II	8-11
III	11-15
IV	15-18
V	18-20
VI	

TOPICAL PUVA PHOTOTHERAPY

- BATH PUVA
- SOAK PUVA
- TOPICAL PUVA OINTMENT

BATH PUVA

- 5ml oxsoralen lotion (1% 8MOP) in 100 litres H_2O
- 15 minutes
- Swirl water
- Dry off
- Sunscreen/clothing for non-treatment areas
- Eye protection
- UVA

BATH PUVA

- AFTER TREATMENT
  - Sunscreen
  - Avoid deliberate sun exposure

SOAK PUVA

- 1ml oxsoralen lotion (1% 8MOP) in 2 litres H_2O
- Soak for 30 minutes
- Initial dose 0.25-0.5 J/cm^2
- Increments 0.25-0.5 J/cm^2
- Avoid immersion of dorsum not involved
- Sunscreen to dorsum if not involved
- Avoid sun exposure to immersed areas after treatment
- Goggles

TOPICAL PUVA OINTMENT

- 30ml oxsoralen lotion (1% 8MOP) in 100g WSP
- Apply sparingly 1 hour before treatment
- Same area every treatment
- Initial dose 0.2 J/cm^2
- Increments 0.2-0.5 J/cm^2
- Sunscreen to dorsum if not involved
- Goggles
- Wash hands after treatment
- Sunscreen

PUVA – Missed treatment

- Missed 1 session => same dose
- Missed >1 session => reduce by 0.5 J/cm^2 for each treatment missed

OR

- 3-5 days => routine increase
- 6-14 days => same dose
- 15-21 days => reduce by 25%
- 22-28 days => reduce by 50%
- >28 days => starting dose

Skin type / sunburn history dependent