CHAPTER: C - Ultrasound Therapy – Treatment Parameters & Dosage:

1. A patient with chronic plantar fasciitis is referred for ultrasound. What is the unit of intensity in therapeutic ultrasound? (one word)
2. Intensity range: Typical therapeutic ultrasound machines allow intensity from 0 to ___ W/cm² (give maximum value usually available).
3. For acute soft tissue injury (Day 3), which intensity range is safest to start with? (give range in W/cm²)
4. Mode selection: Continuous mode is used primarily for _____ effects, while pulsed mode is for _____ effects.
5. Pulsed mode scenario: A patient with recent ligament strain needs non-thermal effects. Which mode will you choose and why? (one line)
6. Frequency choice: 1 MHz ultrasound penetrates deeper (up to ___ cm), while 3 MHz is for superficial tissues (up to ___ cm).
7. Clinical frequency dilemma: For deep gluteal muscle strain, which frequency (1 or 3 MHz) and intensity will you select? (justify in one line)
8. Treatment duration: General rule – ultrasound treatment should not exceed ___ minutes per session for most conditions.
9. Duration practical: For a small area like trigger point in trapezius, typical duration at moderate intensity is ___ minutes.
10. Pulsed mark:space ratio (duty cycle): Common ratios are 1:1, 1:3, 1:4, 1:9. Which ratio gives the least thermal effect?
11. Pulsed parameter: If mark:space ratio is 1:4, what is the percentage duty cycle? (calculate)
12. Dosage integration: Define “dosage” in ultrasound therapy (one sentence – include key parameters).
13. Dosage calculation: Area of transducer head (ERA) = 5 cm², intensity = 1.0 W/cm², duration = 8 minutes. Calculate total energy delivered in Joules.
14. Chronic vs acute dosage: Compare dosage parameters (intensity, mode, frequency, duration) for chronic osteoarthritis knee vs acute ankle sprain.
15. Final case: Patient with subacute tennis elbow (2 weeks old). Write your exact treatment parameters: intensity, mode (with ratio if pulsed), frequency, duration, and one reason for each choice.

ANSWER KEY:

1. W/cm² (Watts per square centimetre).
2. 3 W/cm² (some machines up to 3–5 W/cm², but 3 is standard).
3. 0.1–0.5 W/cm² (low to avoid aggravating inflammation).
4. Thermal; non-thermal (or athermal/mechanical).
5. Pulsed mode – to minimize heating and promote repair without increasing inflammation.
6. 1 MHz: up to 5 cm; 3 MHz: up to 1–2 cm.
7. 1 MHz with moderate intensity (0.8–1.5 W/cm²) – deeper penetration needed for gluteal muscles.
8. 10–15 minutes.
9. 5–8 minutes.
10. 1:9 (10% duty cycle – minimal heat).
11. 1:4 = 20% duty cycle (1/(1+4) × 100 = 20%).
12. Dosage in ultrasound is the total amount of ultrasonic energy delivered, determined by intensity, mode, frequency, duration, and treated area.
13. Total energy = Intensity × ERA × Time (in seconds) × 60 = 1.0 × 5 × 8 × 60 = 2400 Joules (or 2.4 kJ).
14. Chronic OA knee: Continuous mode, 1 MHz, 1.0–1.5 W/cm², 8–10 min (thermal for pain/stiffness). Acute sprain: Pulsed mode (1:4 or 1:9), 3 MHz, 0.2–0.5 W/cm², 5–8 min (non-thermal for oedema reduction).
15. Example safe parameters:

- Intensity: 0.8 W/cm² (moderate thermal with safety)
- Mode: Pulsed 1:3 or 1:4 (20–25% duty – mild thermal + mechanical)
- Frequency: 3 MHz (superficial tendon)
- Duration: 6–8 minutes Reasons: Subacute – balance thermal for circulation and non-thermal for healing; 3 MHz for lateral epicondyle depth.