SNS COLLEGE OF PHYSIOTHERAPY

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1. Post-Operative Knee Replacement Pain

A 68-year-old woman 3 days post-total knee replacement has severe pain (8/10) and limited knee flexion to 50°. You decide to use electrical stimulation for pain control.

Puzzle: Which electrotherapy modality will give the fastest pain relief during her physiotherapy session and why?

(Answer: High-frequency TENS – conventional mode – via gate control mechanism)

2. Chronic Low Back Pain with No Radiculopathy

A 45-year-old office worker has had mechanical low back pain for 8 months. Pain is worse at the end of the day.

Puzzle: You choose interferential current (IFC) at 100 Hz carrier with 1–10 Hz sweep. What is the primary physiological effect you are targeting?

(Answer: Pain relief via presynaptic inhibition and endorphin release – pre-modulated interferential)

3. Acute Ankle Sprain (48 hours old)

A soccer player has a grade II lateral ankle sprain with massive swelling.

Puzzle: Which electrical stimulation parameter will most effectively reduce edema in the first 72 hours?

(Answer: High-volt pulsed current (HVPC) with negative polarity at the injury site – promotes fluid dispersion via electro-osmotic effect)

4. Denervated Muscle After Radial Nerve Palsy

A patient has complete wrist drop 3 weeks after a humerus fracture. EMG confirms complete denervation.

Puzzle: What type of current is theoretically indicated to maintain muscle bulk while awaiting reinnervation?

(Answer: Direct current (DC) or very long-duration pulses (>10 ms) to directly depolarize denervated muscle fibers – rarely used in practice due to skin irritation risk)

5. Bell's Palsy – 5 Days Onset

A 32-year-old woman presents with acute right-sided facial paralysis.

Puzzle: Is electrical stimulation contraindicated or indicated at this stage, and why?

(Answer: Contraindicated in the acute phase – risk of promoting aberrant regeneration and synkinesis; only consider after 2–3 weeks if no recovery)

6. Patellar Tendinopathy (Jumper's Knee)

A basketball player has chronic inferior pole patellar pain.

Puzzle: You want to apply a current that penetrates deep to the tendon–bone junction with minimal skin discomfort. Which modality and frequency?

(Answer: Interferential current (IFC) with 4 kHz carrier frequency – vector sweep for deeper penetration)

7. Stress Fracture Healing – Tibia

A runner has a grade 3 tibial stress fracture confirmed on MRI.

Puzzle: A modality using 20–50 µA of direct current is prescribed for 6–8 weeks. Name the modality and mechanism.

(Answer: Low-Intensity Pulsed Electrical Stimulation (LIPES) or capacitively coupled electrical fields – upregulates bone formation via piezoelectric effect)

8. Shoulder Adhesive Capsulitis (Frozen Shoulder)

A 55-year-old diabetic woman has <90° abduction and severe pain at end-range.

Puzzle: Before aggressive stretching, you apply electrical stimulation for 20 minutes. Which mode allows the patient to tolerate stronger stretching afterward?

(Answer: High-frequency TENS + endorphin mode (2–10 Hz burst) or low-frequency acupuncture-like TENS – longer-lasting analgesia)

9. Delayed-Onset Muscle Soreness (DOMS) After Marathon

A runner has severe quadriceps soreness 48 hours post-marathon.

Puzzle: You want to accelerate lactate clearance and reduce soreness. Which current promotes muscle pumping without causing contraction pain?

(Answer: Russian stimulation (2.5 kHz carrier, 50 bursts/sec) at sub-tetanic intensity – increases blood flow via muscle pump)

10. Carpal Tunnel Syndrome – Moderate

A 40-year-old typist has positive Phalen's and Tinel's signs.

Puzzle: You place electrodes proximal and distal to the carpal tunnel and use 50 Hz for 15 minutes. What is the intended effect?

(Answer: Iontophoresis setup (though current alone without drug is just sensory TENS); if dexamethasone is used – anti-inflammatory drug delivery)

11. Non-Union Scaphoid Fracture (9 months)

Orthopedics refers a patient with scaphoid non-union.

Puzzle: Which non-invasive electrical modality has the highest level of evidence for promoting fracture healing?

(Answer: Pulsed Electromagnetic Fields (PEMF) – FDA-approved for non-unions; induces current in bone via Faraday's law)

12. Urge Urinary Incontinence

A 60-year-old woman leaks urine when she feels the urge and cannot reach the toilet in time.

Puzzle: You insert a vaginal electrode and use 20 Hz, 200 µs pulses for 20 minutes. What is the neuromuscular effect?

(Answer: Inhibits detrusor overactivity via sacral/pudendal nerve stimulation + strengthens pelvic floor if intensity increased)

13. Re-educating VMO After ACL Reconstruction 4 weeks post-ACL reconstruction, the patient has poor vastus medialis obliquus activation.

Puzzle: You apply electrical stimulation synchronized with voluntary contraction. What is this technique called and why is it superior to stimulation alone?

(Answer: Neuromuscular Electrical Stimulation (NMES) with EMG-triggered or voluntary overlay – enhances motor recruitment via spatial summation)

14. Wound Healing – Stage III Pressure Ulcer

A spinal cord injury patient has a 3 × 4 cm sacral pressure ulcer with granulating base.

Puzzle: Daily 2-hour treatment with monophasic pulsed current, cathode over wound, 30 minutes then anode 30 minutes. What is the rationale for polarity switching?

(Answer: Cathode increases blood flow, antibacterial effect, and granulation; anode reduces edema and debrides – alternating maximizes both effects)

15. Lateral Epicondylitis (Tennis Elbow) – Chronic

A painter has had lateral elbow pain for 6 months unresponsive to rest and NSAIDs.

Puzzle: You decide to deliver a medication transdermally using electricity. Name the process and the most common drug used.

(Answer: Iontophoresis; most commonly 0.4% dexamethasone sodium phosphate with negative polarity electrode over painful area)