# Luna EMG

## clinical applications

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*The content presented in this document, including that relating to our products, is addressed to specialists – medical professionals and healthcare professionals.*

# Who is it for?

- Neurological patients
- Orthopedic patients
- Oncology patients
- Pediatric patients
- Bedridden patients

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# Patient Qualification for Therapy

## Indications

✔ **Neurology:** Patients with stroke, spinal cord injuries, multiple sclerosis (MS), and cerebral palsy (CP).

✔ **Orthopedics:** Conditions after surgery and injuries

✔ **Bed-site treatment:** Intensive Care Units (ICU), post traumatic, palliative care, geriatric patients immobilized in bed

✔ **Pediatrics:** Muscular dystrophies, motor neuron diseases, myopathies, palsies.

## Contraindications

✘ **General contraindications:** osseous and joint instability, non-consolidated fractures, ataxia, unstable vital functions

✘ **Significant limitation of range of motion:** significant spasticity, fixed contractures, anatomical features that prevent the positioning and stabilization of the patient

✘ **Cognitive impairment :** lack of contact/cooperation preventing active participation and generation of movement intention

# Example Clinical Conditions

## Neurology

- Stroke
- Spinal cord injury
- Peripheral nerve injuries
- Demyelinating diseases
- Paresis

## Bed-site treatment

- ICU-Acquired Weakness
- Critical Illness Myopathy & Neuropathy
- Severe deconditioning & prolonged bed rest
- Acute stroke - early bedside mobilization

## Orthopedics

- Reconstructions (ACL/PCL, rotator cuff)
- Post-operative conditions
- Post-traumatic conditions
- Following limb amputation

## Other

- Pediatrics (Cerebral Palsy, SMA, Dystrophies)
- Geriatrics & Sarcopenia
- Oncology & Cancer-Related Fatigue
- Rheumatoid & Inflammatory Joint Diseases
- Respiratory Muscle Training

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# What Are Customers Looking For?

## tune

**Universal system for assessment and therapy**

## accessibility_new

**Engaging patient training**

## arrow_upward

**A bridge between passive and active therapy**

## spa

**Relieving the therapist of repetitive, hard work**

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# Clinical Application 1: Foot Drop

## Stage 1: Flaccid Paralysis

### ✔ Patient Qualification / Clinical Profile

Complete absence of active motor response in ankle dorsiflectors. Inability to generate trace movement. Flaccid paralysis of lower extremity muscles with no spasticity.

**Lovett: 0 (No contraction) | Ashworth: 0 (Flaccid)**

### → Primary Rehabilitation Goals

Preserve passive ankle Range of Motion (ROM) to prevent joint contractures caused by un-opposed antagonist muscles. Activate venous calf muscle pump and stimulate circulation.

### Prescribed Luna EMG Exercises & Protocols

#### CPM & Progressive CPM

- **Exercise Mode:** Continuous Passive Motion (CPM) & Progressive CPM.
- **Duration:** 5–10 minutes per session.
- **Objective:** Mobilize ankle joint tissues and prevent contracture formation.

#### sEMG Muscle Monitoring

- **Target Muscle:** Tibialis Anterior peroneus muscles
- **Monitoring:** Real-time sEMG tracking during passive movements to detect early neuromuscular firing or reflex activity.

#### Venous Pump Activation

- **Mechanism:** Alternating ankle dorsiflexion and plantarflexion.
- **Role:** Serves as a warm-up protocol prior to secondary therapeutic interventions.

# Clinical Application 1: Foot Drop

## Stage 2: Flaccid Paresis

### ✔ Patient Qualification / Clinical Profile

Trace muscular contraction or minimal non-functional active movement present in dorsiflectors. Inability to overcome limb gravity or achieve functional joint range.

**Lovett: 1–2 (Trace / Slight) | Ashworth: 0**

### → Primary Rehabilitation Goals

Promote neuromuscular re-education and assist active movement initiation. Maintain passive/active ROM, stimulate calf muscle pump, and enhance motor recruitment.

### Prescribed Luna EMG Exercises & Protocols

#### Warm-up & Preparation

- **CPM / Progressive CPM:** 5–10 minutes warm-up to prepare tissue and mobilize joint before active biofeedback work.

#### sEMG Biofeedback & Games

- **Tibialis Anterior:** More focus on short, rapid bursts (<2s) with high threshold (>80% MVC), but also longer contractions
- **Peroneus Longus:** Phase 1 short bursts; Phase 2 sustained holds (10–15s @ 50–60% MVC).

#### Reactive EMG & Active Control

- **Reactive EMG (T&R / T&H):** Dual-channel mode (TA + PL as agonists) for dorsiflexion with lateral stability.
- **Proprioception:** Dynamic Reversal if active motion occurs.

# Clinical Application 1: Foot Drop

## Stage 3: Active Flaccid Paresis

### ✔ Patient Qualification / Clinical Profile

Active ankle dorsiflexion movement restored against gravity and moderate resistance without hypertonia. Voluntary control returning, requiring progressive strength loading.

**Lovett: 3-4 (Fair to Good) | Ashworth: 0**

### → Primary Rehabilitation Goals

Expand active dorsiflexion Range of Motion (ROM). Build muscle force, power, and endurance. Refine foot stability, dynamic direction changes, and ankle proprioception.

### Prescribed Luna EMG Exercises & Protocols

#### Warm-up

- **CPM / Progressive CPM:** 5–10 min if joint stiffness is present prior to active loading.

#### Resisted EMG Biofeedback

- **Biofeedback Games:** Target threshold recruitment under added mechanical resistance.
- **Resistance setup:** Elastic band around feet during dorsiflexion and pronation.

#### Active & Resisted Strength

- **Dynamic Reversal:** Bi-directional ankle movement training.
- **Strength Training:** Elastic resistance & Weight Lifting tailored to patient capabilities.

# Clinical Application 1: Foot Drop

## Stage 4: Spastic Paresis Management

### ✔ Patient Qualification / Clinical Profile

Dorsiflexor muscle weakness combined with elevated hypertonia/spasticity in Gastrocnemius/Soleus complex. High resistance during passive movement requires strict precautions.

**Lovett: 1-2 (Trace / Weak) | Ashworth: 1-2 (Low / Moderate)**

### → Primary Rehabilitation Goals

Maintain/improve joint ROM while actively suppressing calf spasticity. Promote reciprocal inhibition between Tibialis Anterior and Gastrocnemius. Increase strength safely.

### Prescribed Luna EMG Exercises & Protocols

#### Low-Speed CPM & Safety Guard

- **Low Speed CPM:** Smooth passive movement to avoid triggering spastic stretch reflexes.
- **Safety Threshold:** Enable "Return on Max Torque" (3s limit) to handle spastic surges.

#### Agonist / Antagonist Biofeedback

- **TA & Peroneus Training:** Active dorsiflexion and inversion recruitment.
- **Triceps Surae Training:** Voluntary muscle relaxation focus (15–40s hold @ 20–30% MVC).

#### Reactive EMG (Agonist & Antagonist)

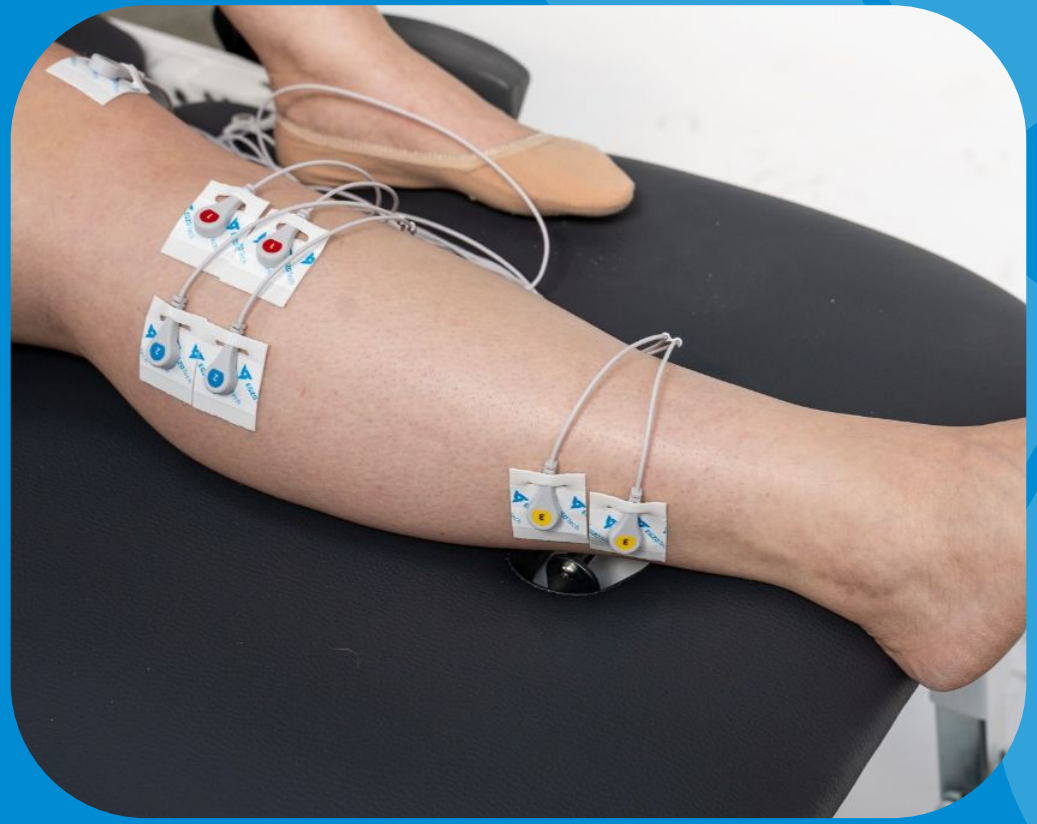
- **Agonist Mode:** Dorsiflexion with lateral stability (TA + Peroneus Longus).
- **Antagonist Mode:** Alternating Tibialis Anterior activation with Gastrocnemius relaxation.

# Clinical Application 1: Foot Drop

## Electrodes Positioning:

- red - tibialis anterior,
- blue - peroneus longus
- yellow - peroneus brevis

reference - knee cap



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# Clinical Application 2: Stroke

## Stage 1: Early Stage (24–48h to 2 Weeks Post-Stroke)

### Patient Qualification

Patients in the early post-stroke phase, immediately following vital signs stabilization.

**Flaccid paresis**

**Vital stability**

**Initiation:** Start as early as medically feasible.

### Therapeutic Objectives

- Activate muscle pump and improve peripheral circulation.
- Prevent edema in distal limb extremities.
- Early neurorehabilitation and prevention of immobility complications.

### Exercise Program

- **Bedside Exercises:**
  - Continuous Passive Motion (CPM)
  - Reactive EMG (T&R / T&H)
- **sEMG Isometrics:**
  - EMG Biofeedback, Advanced Biofeedback, EMG Games
  - Short isometric contractions (tailored to prevent fatigue)
  - Optional sEMG Preview without enforced threshold

# Clinical Application 2: Stroke

## Stage 2: Subacute Stage (2 Weeks to 6 Months)

### Patient Qualification

Window of high neuroplastic potential. Patients exhibiting gradual return of motor control and strength.

**Spasticity Risk**

**Associated Movements**

**Precaution:** Do not introduce resistance training too early to avoid triggering synkinesis!

### Therapeutic Objectives

- Isolate movements and inhibit unwanted synkinesis.
- Promote correct movement patterns without compensation.
- Enhance muscle strength and neuromuscular control.

### Exercise Program

- **2-Channel Reactive EMG (Isolation):**
  - *Relaxation / Antagonists:* Ankle dorsiflexion (Tibialis Anterior) + antagonist relaxation (Biceps Femoris / Gastrocnemius)
  - *Relaxation:* Arm flexion (Deltoid) + Trapezius relaxation
  - *Agonists*: Dorsiflexion with lateral stabilization (ankle)
- **sEMG Endurance:** Contractions up to 15s (50% MVC threshold).
- **Later Phase:** Elastic Resistance, Dynamic Reversal.

**Dosage:** 45 min (2-3 min breaks every 15 min), 5 days/week.

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# Clinical Application 2: Stroke

## Stage 3: Chronic Stage (> 6 Months Post-Stroke)

### Patient Qualification

Chronic stroke patients (>6 months post-onset) with established movement habits and contractures.

**Persistent Neuroplasticity**

**Fixed Compensations**

**Safety Rule:** Work strictly within existing contracture ranges - never force joints!

### Therapeutic Objectives

- Rebuild muscle mass and increase strength.
- Further eliminate compensatory motor patterns.
- Maximize functional independence in daily living.

### Exercise Program

- **sEMG Biofeedback & Games:** Complex tasks demanding fine-grained muscle tension control.
- **Active & Resisted Training:**
  - Dynamic Reversal
  - Proprioception
  - Elastic Resistance and Weight Lifting
- **Ongoing Focus:** Modes suppressing synkinesis.

**Model:** Comprehensive (up to several hours daily). Robot as a supplement to training

# Clinical Application 3: Total Knee Arthroplasty

## Stage 1: Early Post-Op Stage (24h to 2 Weeks)

### Patient Qualification

Early post-operative phase following total knee joint replacement surgery.

**Acute Healing Phase**

**Swelling & Pain Focus**

**Early Mobilization:** Essential for preventing adhesions and surgical complications.

### Therapeutic Objectives

- Promote early mobilization and prevent post-operative complications (DVT, joint stiffness).
- Gradually improve passive and active joint Range of Motion (ROM).
- Activate distal muscle pump to improve peripheral venous circulation.
- Re-establish early motor unit recruitment in quadriceps and gluteal muscles.

### Exercise Program

- **Knee CPM (Passive Motion):** Tailored strictly to patient pain tolerance to preserve ROM.
- **Ankle CPM / Active Motion:** Pumping exercises to activate distal leg muscles and boost circulation.
- **Advanced EMG Biofeedback Isometrics:**
  - Gluteal Muscle Isometrics: Short (<3s), medium (5–10s), and long (>15s) contractions.
  - Thigh Muscle Isometrics: Performed in full knee extension with short, medium, and long contractions.

**Dosage:** Gentle sessions tailored to individual pain and swelling limits.

# Clinical Application 3: Total Knee Arthroplasty

## Stage 2: Subacute & Chronic Stage

### Patient Qualification

Patients in the subacute and chronic phase post-TKA (2–8 weeks up to 6 months).

**Healed Surgical Incision**

**Progressive Resistance Ready**

**Evidence-Based:** Resisted strength training yields significantly superior recovery outcomes compared to unresisted active exercises.

### Therapeutic Objectives

- Rebuild quadriceps and hamstring muscle mass and strength.
- Activate Vastus Medialis (VMO) in terminal extension range.
- Restore full functional knee extension and extension lag control.
- Enhance proprioception and neuromuscular control of the thigh.

### Exercise Program

- **Knee CPM Warm-up:** 5–10 minutes passive motion before active training.
- **Reactive EMG (T&R / T&H): V**MO muscle activation specifically in the last 15° of knee extension.
- **Resisted Active Training:**
  - Dynamic Reversal, Elastic Resistance, Weight Lifting
  - Progressive load overload: 3–4 sets of 8–12 repetitions
- **Proprioception & Orthopedic Games:** Thigh muscle control exercises.

**Frequency:** Minimum 3 times per week with progressive overload.

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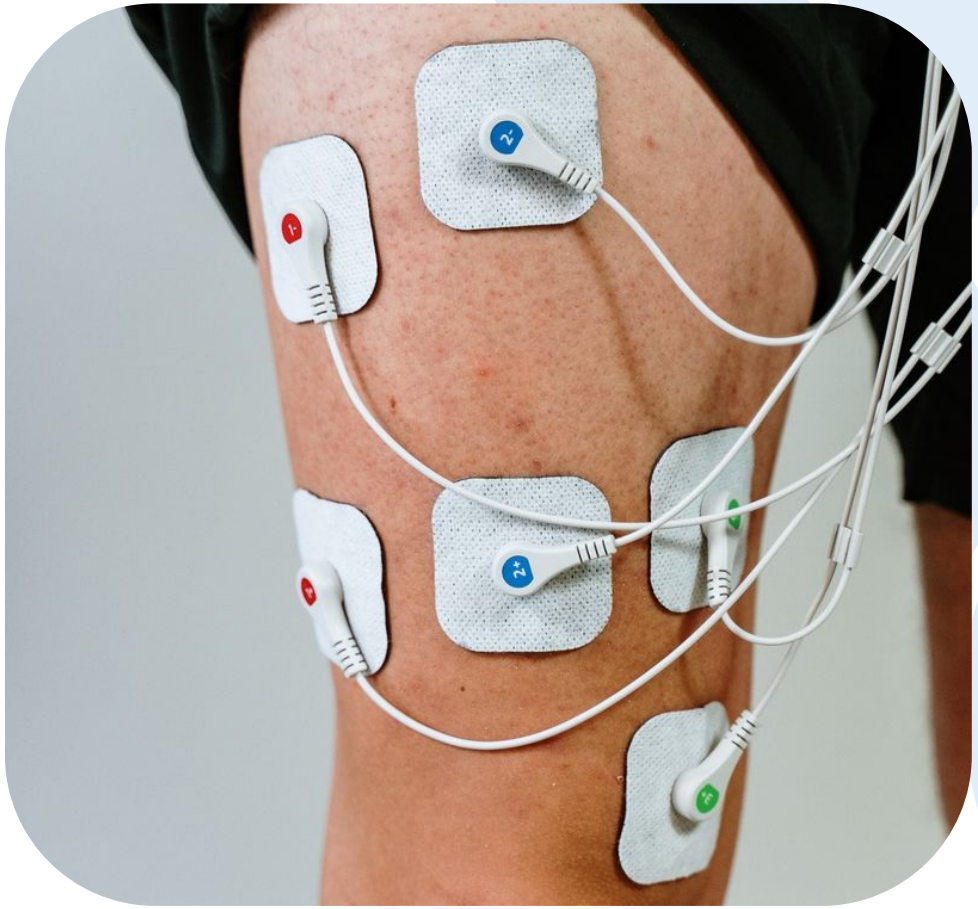
# Quadriceps muscle - Electrode Placement



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