

Pain Control: Gate Control Theory

Purpose and benefit

The Gate Control Theory is indicated to produce immediate analgesic effect. The analgesia may allow for functional exercise that would otherwise have been difficult to perform because of the pain. Analgesia only occurs as long as stimulation is delivered.

Indication

Acute or chronic pain.

Background

Pain is perceived when noxious stimuli enter the spinal cord via A-delta (fast pain) and/or C (slow pain) fibers. According to the Gate Control theory, these signals can be blocked in the spinal cord by sensory information entering the same spinal cord level through fast conducting sensory neurons (A-beta). This approach is supported by significant amounts of empirical evidence.¹⁻⁵

Waveform

Interferential current (traditional 4-polar IFC or Premodulated/2-polar) produces good analgesic effects. Symmetrical and asymmetrical biphasic current also work well. Onset of analgesia is immediate and may last for a period of time (~30 minutes) after the treatment has concluded.

Parameters

	IFC (2-p or 4-p)	Biphasic (symm or asymm)
Carrier frequency:	5,000 Hz	-
Phase duration:	-	100-150 μsec
Frequency:	100 Hz (beat freq)	100 Hz
Frequency modulation:	80-120 (sweep of 40 Hz)	Yes
Cycle time:	Continuous	Continuous
Intensity:	Mild to moderate sensory	Mild to moderate sensory
Amplitude modulation:	-	Yes
Session duration:	20-30 mins	20-30 mins

Treatment session details:

1. Identify the area of pain.
2. Record key metrics: pain rating, strength, ROM, etc.
3. Apply electrodes around the painful area or elsewhere in dermatome of pain. Do not place electrodes outside of dermatome associated with spinal segment of pain.
4. Set up parameters and increase intensity to desired level.
5. Instruct in exercises and/or functional activities to be performed independently or with supervision during the electrotherapy application.
6. Increase intensity as needed based on pain perception.



DJO, LLC | A DJO Global Company

T 800.336.6569 D 760.727.1280 F 800.936.6569
1430 Decision Street | Vista, CA 92081-8553 | U.S.A.
djoglobal.com/longtermcare | DJOglobal.com

Pain Control: Opiate Release

Purpose and benefits

This approach produces lasting analgesic effect to facilitate functional movement during ADL's. The analgesia may allow for functional use during ADL's that would otherwise have been difficult because of the pain. Analgesia may last for several hours after stimulation.

Indication

Chronic pain

Background

Pain is perceived when noxious stimuli enter the spinal cord via A-delta (fast pain) and/or C (slow pain) fibers. This pain can be blocked in the spinal cord by chemicals released in the brain (endogenous opioids). These chemicals have a long half-life resulting in an effective analgesic effect of multiple hours. This approach is supported by significant amounts of empirical evidence.^{2, 4, 6, 7}

Waveform

Interferential current (traditional 4-polar IFC or Premodulated/2-polar) produces good analgesic effects. Symmetrical and asymmetrical biphasic current also work well. Onset of analgesia starts 10-15 minutes after start of treatment and may last for over 4 hours after the treatment has concluded.

Parameters

	IFC (2-p or 4-p)	Biphasic (symm or asymm)
Carrier frequency:	2,500 Hz	-
Phase duration:	-	300 µsec
Frequency:	~5 Hz (beat freq)	~5 Hz
Frequency modulation:	5-10 Hz (sweep of 5 Hz)	Yes
Cycle time:	Continuous	Continuous
Intensity:	Strong to noxious	Strong to noxious
Amplitude modulation:	-	No
Session duration:	Up to 10 mins	Up to 10 mins

Treatment session format

1. Identify the area of pain.
2. Record key metrics: pain rating, strength, ROM, etc.
3. Apply 2 small electrodes around the area of pain. Electrodes placed elsewhere will still produce same analgesic effect.
4. Set up parameters and increase intensity to desired level.
5. Instruct patient to rest during electrotherapy session. Commence exercises or functional activities after the electrotherapy has ended.
6. Increase intensity as needed based on pain perception.



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Muscle Strengthening: Endurance Protocol

Purpose

Increase endurance of muscle groups to improve ADLs, stability, postural tone

Indication

Deconditioning, joint instability, poor posture

Background

Muscles lose the ability to sustain tone whenever they are inactive as a result of disease, status post surgery, general deconditioning, poor posture, etc. The muscle fibers responsible for maintaining tone throughout the day are slow twitch fibers (type I). Exercise and electrotherapy when used in combination shows beneficial results. When voluntary exercise is not possible or difficult, electrotherapy alone is still very beneficial.

Waveform

Biphasic current is the most frequently used waveform for these applications.

Parameters

Waveform:	Biphasic current
Frequency:	25-35 Hz
Phase duration:	200 msec
Cycle time:	5 seconds ON, 5 seconds OFF
Ramp:	1 second RAMP UP, 1 second RAMP DOWN
Amplitude/Intensity:	mild to moderate muscle contraction

Electrode placement

Place 2 large electrodes over each extremity of the target muscle group

Duration of Treatment

30-60 min, 3-5 times per week; gradually increase treatment time to multiple hours

Treatment session format

1. Identify the target muscle group
2. Record strength, ROM, etc.
3. Patient in seated position, apply electrodes
4. Set up parameters and increase intensity to desired level
5. Instruct in exercises or functional activities – perform independently or with supervision during the electrotherapy application

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