Gain-Control Theory:
A Guide for Pain Relief Nursing:

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Historical Understandings of Pain

- Pain is mystical / spiritual
- Pain is purely emotional
- Pain is purely physical
- Pain is social / culturally learned
- Pain is multidimensional

20th Century Theories of Pain

- Specificity Theory
- Pattern Theory
- Psychological Theory
- Learned Behavior Theory
- Gate Control Theory
Gate Control Theory of Pain

How can a “shot” hurt worse than being shot?

Pain fiber activity “opens gate”

Thoughts, feelings, motivation

Think, feel and respond to pain

Activity of larger fibers “closes gate”

Pain Transmission Gate

Pain Signal Transmitter

Physiological Categories of Pain

- Nociceptive
  - Somatic
  - Visceral
- Neuropathic
  - Central
  - Peripheral
- Sympathetically Maintained

Merits & Limits of Gate Control

- Stimulated research
- Synthesize other theories under one “Grand” perspective
- Revolutionized education re: pain
- Emphasis on spine
- Nerves fixed, unidirectional?
- Fits nociceptive pain better than other forms
- No on-off switch

Paradigm Shift: From Gate Control to Gain Control
Peripheral Sensitization

Windup & Central Sensitization

Neuroplasticity
Gain Control Model of Pain

**Dampeners**
- Turn down the pain signal “volume,” facilitating activity, healing & Quality of Life

**Amplifiers**
- Turn up the pain signal “volume,” inhibiting activity, healing & Quality of Life


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**Gain Control: Tissue Level**

**Dampeners**
- Tissue repair, healing
- Good circulation
- Adequate O2
- Adequate nutrients
- Positional support
- Rest / activity balance
- Muscle relaxation

**Amplifiers**
- Ongoing tissue damage
- Inflammation
  - TNF-α, IL-1β, Ca++
- CGRP, Substance P
- Infection
- Hypoxia
- Muscle tension
- Muscle spasm

*Partial list

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**Gain Control: Peripheral Nerves**

**Dampeners**
- Cut nerve inflammation
- A-beta fiber activity
- Topical warmth
- Topical cooling
- Light touch
- Parasympathetic activity

**Amplifiers**
- Dermatone overstimulation (summation)
- Sensitization (cuts threshold)
- Nerve ending growth
- Na+ Channels multiply
- K+ Channels decline
- Cl- Channels change (peripheral nerves)
- Sympathetic NS activity
Gain Control: Central Nerves

**Dampeners**
- Pre-emptive analgesia
- Descending inhibition
- Endorphin release
- Cut limbic/RAS excitability
- Norepinephrine
  - Blocks hyper-excitability created by excess Ca++

**Amplifiers**
- Nerve inflammation/death
- Dendritic sprouting
- New synapses
- Neuronal cross-talk
- Glial cell activation
- Ca++ channel hyperactivity
- Elevates prostaglandins & glutamate
- Hyper-excitabale state
- Long-term potentiation
- CNS reorganization

Gain Control: Whole Body

**Dampeners**
- Homeostasis
- Comforting environment
- Low stress / eustress
- Quiet immune system
- Muscle relaxation
- Balance activity / rest
- Healthy sleep pattern

**Amplifiers**
- Physiological imbalances
- Fluid/electrolyte
- Thermal
- Acid/base
- Environmental extremes
- High stress/distress
- Generalized infection
- Muscle tension
- Fatigue/spasm
- Sleep deprivation

Gain Control: Mind Level

**Dampeners**
- Emotional stability
- Feel loved
- Self efficacy, optimistic
- Acceptance
- Realistic beliefs and expectations
- Mental distraction
- Pain & stress coping

**Amplifiers**
- Emotional distress
- Anxiety, fear, depression, etc
- High or prolonged stress
- Unhelpful thoughts
- Catastrophizing
- Self doubts
- Helplessness, hopelessness
Gain Control: Spiritual Level

**Dampeners**
- Strong faith
- Essence unchanged
- Sense of purpose
- Sense of connection
- Energy flow balanced

**Amplifiers**
- Spiritual distress
- Lost connections
- Dire meaning
- Suffering
- Energy imbalance

Gain Control: Social Level

**Dampeners**
- Socially engaged
- Meaningful, pleasurable activities pursued
- Effective communication
- Work, volunteering

**Amplifiers**
- Socially isolated
- Relationship/role conflict
- Over-dependency
- Dysfunctional coping

**Net Effect**

**Dampeners**
- Pain prevented / controlled
- Distress avoided or transient
  - Emotional
  - Spiritual/Existential
- Behaviors can change
  - Functional improvement
  - Adaptive coping
  - Socially engaged
  - Wellness behaviors

**Amplifiers**
- Amplifies, spreads & prolongs pain
- Distress persists
  - Emotional
  - Spiritual/Existential
- Behaviors can change
  - Functional decline
  - Maladaptive coping
  - Social discord
  - Costly illness behaviors
Transduction targets to dampen pain

- Local anesthetic before tissue injury
- Protect from/minimize tissue damaged
- Prevent inflammation/infection
- Preemptive analgesia
- Control pain once established

Prevent peripheral sensitization and lowered pain thresholds

Transmission targets to dampen pain

- Prevent/minimize nerve damage
- Reduce neuronal excitability
  - Fluid/electrolyte
  - Acid/base
- Limit exposure to intense pain

Prevent neuronal hyperexcitability, long-term potentiation and sensitization

Modulation targets to dampen pain

- Reduce prolonged pain, stress/distress
- Stimulate release of endorphins
  - Laughing, crying, exercise
  - Accupuncture
  - “Healer effect”
    - Realistic expectations
    - Conditioned responses (use what has worked)
      - Promote physiological and psychosocial wellness and balance
Perceptual targets to dampen pain

- Lower physical/emotional arousal levels
- Explore meaning of pain and treatment
- Cope with existential suffering and losses
- Motivators to transcend pain
- Attention directed away from pain
- Meaningful people, places and rituals
- Develop capacity

Prevent pain and suffering from becoming the focus of existence

Nursing Care Target: Tissue

- Pharmacological
  - Cause-directed
  - Inflammation
    - NSAIDs
    - Substance P
    - TNF-α
  - Na⁺ Channel Blockers
- Non-drug
  - Massage, rubbing
  - Moist heat
  - Application ice
  - Positioning
    - Braces, orthotics, compression
  - Remove source of pain or irritation

Nursing Care Target: Nerves

- Pharmacological
  - Acetaminophen
  - Opioids
  - Anticonvulsants
  - Antidepressants
  - Local anesthetics
  - Alpha blockers
- Non-drug
  - Reduce summation
    - Excessive dermatone stimuli
  - Activate inhibitors
    - Regional A-B fibers
      - Contra-lateral stimulation
      - Proximal/distal stimulation
      - Endorphins
Nursing Care Target: Body

- **Promote**
  - Good nutrition, hydration,
  - Good oxygenation, diaphragmatic breathing
  - Paced activities and exercise

- **Consider**
  - Dietary supplements
  - Acupuncture/acupressure
  - Functional/multidisciplinary rehabilitation

Nursing Care Target: Mind

- **Promote**
  - Relaxation techniques
  - Knowledge about condition/sensations
  - Distraction (music, reading, writing)
  - Change thinking, attitudes
  - Reduce sadness, helplessness
  - Reduce fear, anxiety, stress

- **Consider**
  - Biofeedback, Counseling
  - CBT, Coping skills training

Nursing Care Target: Spirit

- **Promote**
  - Prayer, Meditation, Spiritual Healing
  - Self-reflection, re: life/pain
  - Meaningful rituals

- **Consider**
  - Energy work (e.g., TT, reiki)
  - Magnetic Therapy
  - Homeopathic remedies
Nursing Care Target: Social

- Promote
  - Improved communication
  - Caring presence
  - “Healer effect”
- Consider
  - Psychosocial Counseling, Family therapy
  - Pet therapy
  - Support groups
  - Vocational training, Volunteering

Multimodal Approaches

- Address multiple amplifiers/dampeners
- Combine “active” & “passive” approaches
- Integrate therapies the patient believes in
  - Medical modalities
  - Physical modalities
  - Psychosocial modalities
  - CAM modalities
- Consistent evidence

Meeting the Challenges

Learn and teach the use of a variety of tools available to reduce pain, improve functioning.

Best tools are:
- Multi-modal
- Multidisciplinary
- Tailored for the individual