



Mastering Movement Disorders for the Movement Specialist

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A 4-Part Series

Part 1 – Peripheral Nervous System

Part 2 - Central Nervous System

Part 3 – Connective Tissue Disorders

Part 4 – Psycogenic

Peripheral Nervous System Disorders

The peripheral nervous system is divided into the somatic nervous system and the autonomic nervous system

Somatic Nervous System

- Sensory Nerves

- Somatosensory Nerves (Motor)

Autonomic Nervous System

- Smooth muscles and glands

- Digestion, respiration, vasodilation, sweating, skin perfusion

Nerves affected by neuropathy

- **Sensory nerves** transmit information such as the feeling of a light touch, temperature, or the pain from a cut.
- **Motor nerves** control the movement of all muscles under conscious control, such as those used for walking, grasping things, or talking.
- **Autonomic nerves** control organs to regulate activities that people do not control consciously, such as breathing, digesting food, and heart and gland functions

Peripheral Neuropathy Disorders



What is peripheral neuropathy?

Peripheral neuropathy is the result of damage to the peripheral nerves in the hands and feet, and is often associated with weakness, numbness and / or pain.

(Mayo Clinic)

About three-fourths of polyneuropathies are "length-dependent," meaning the farthest nerve endings in the feet are where symptoms develop first or are worse.

Types of sensory peripheral neuropathy?

Physical injury (trauma)

***Diabetes** - 50% of diabetics experience DPN symptoms (NIH)

Autoimmune diseases - Guillain-Barré syndrome and chronic inflammatory demyelinating polyneuropathy, lupus, and rheumatoid arthritis

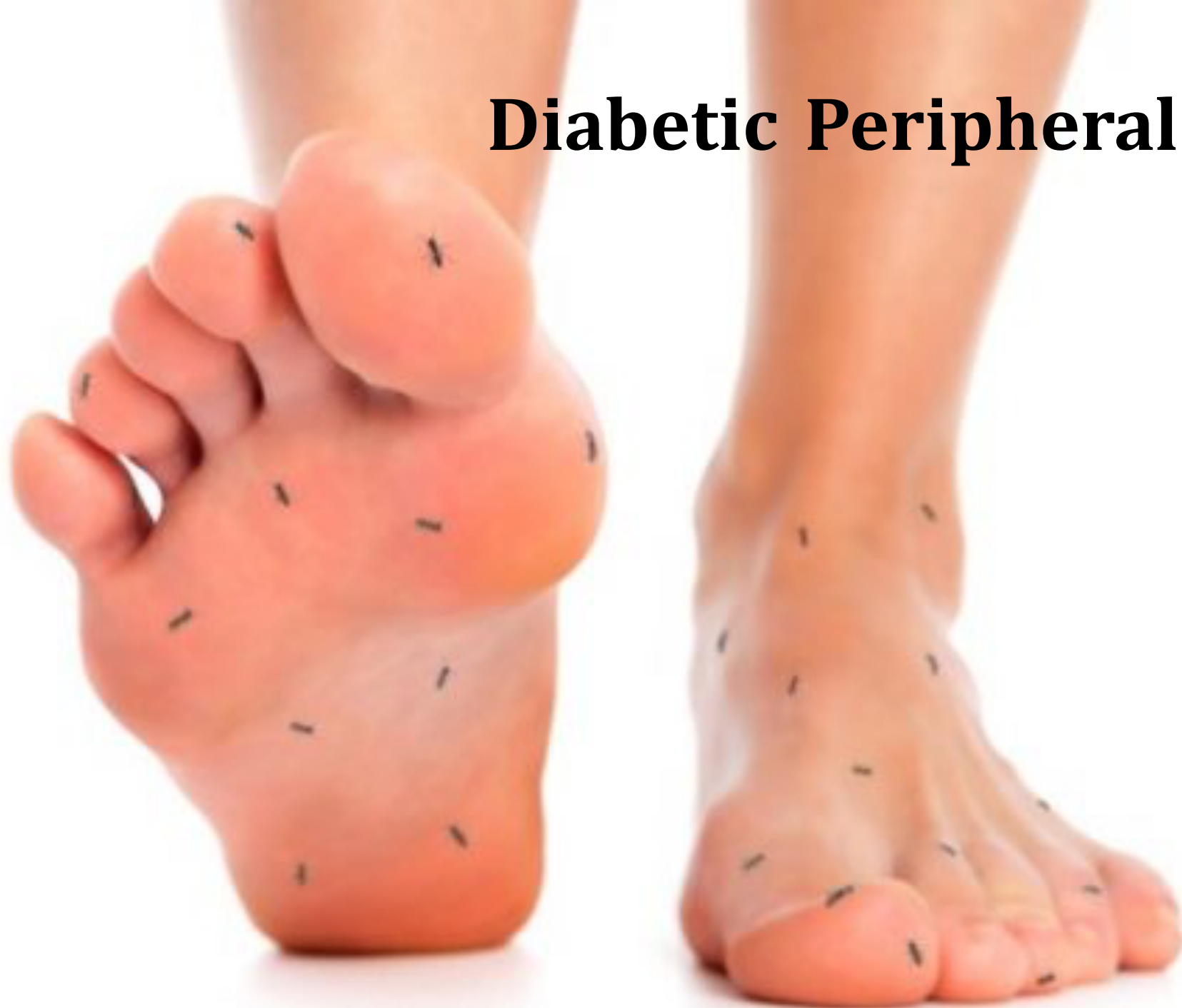
Nutritional or vitamin imbalances – alcoholism, Vit B12 deficiency, excess Vit B6,

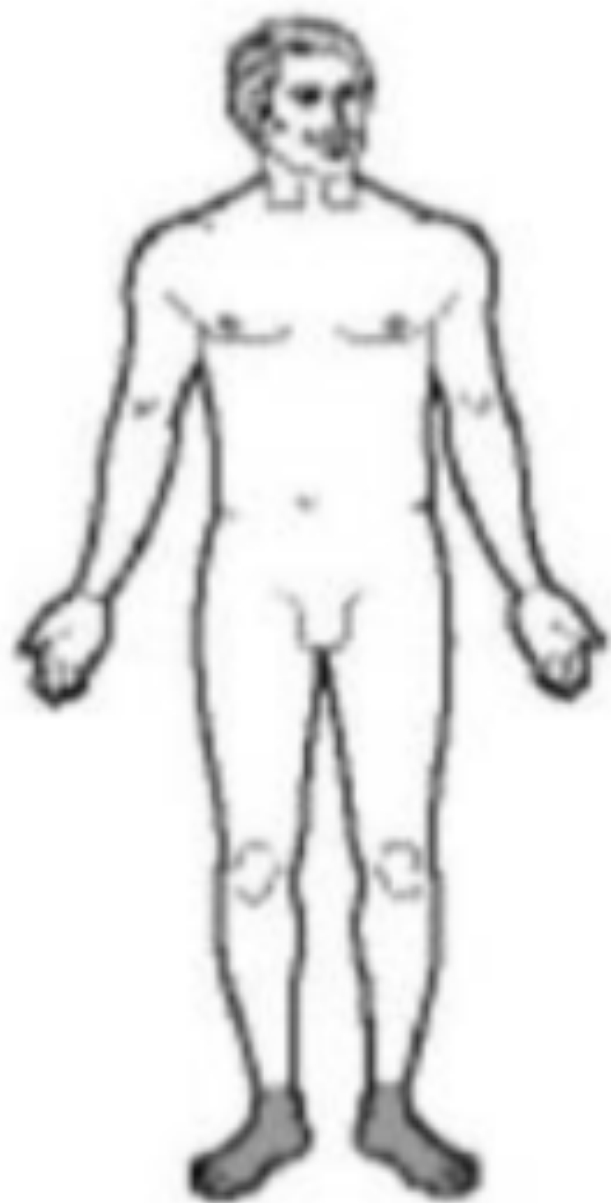
***Chemotherapy drugs** – 68% of those undergoing chemotherapy get neuropathy - breast, lung, ovarian, prostate most common

***Idiopathic** –

HIV/ AIDS -

Diabetic Peripheral Neuropathy





Mild/Early Stage



Moderate



Severe/Late

DPN and AGEs

Aging, disease & injury processes are associated with **inflammation** and **free radical formation**

Glycation / Glycosylation leads to formation of advanced glycation end products (**AGEs**)

One of the largest targets of aging & inflammation is **collagen**



Collagen – Long Life Protein

Collagen half-life varies between tissues but remains generally **large**

Long half life makes it susceptible to interaction with metabolites
especially glucose

Collagen half life 1–2 years for bone
Collagen to about 10 years for Type I in skin

The low biological turnover of collagen



Formation of AGEs – Maillard Reaction

Phase 1: Schiff base formation

Glucose attaches to a free amino acid (mainly lysine and arginine) of a protein, lipid or DNA, in a non-enzymatic way to form a Schiff base
(Takes Hours and **is reversible** at this phase)

Phase 2: Amadori Product formation

Schiff base undergoes chemical rearrangement to form Amadori products (early glycation products). The Amadori products are more stable compounds (**hemoglobin A1c** is the most well known)
(Takes Days but **is still reversible** at this phase)

Phase 3: Formation of crosslinked proteins

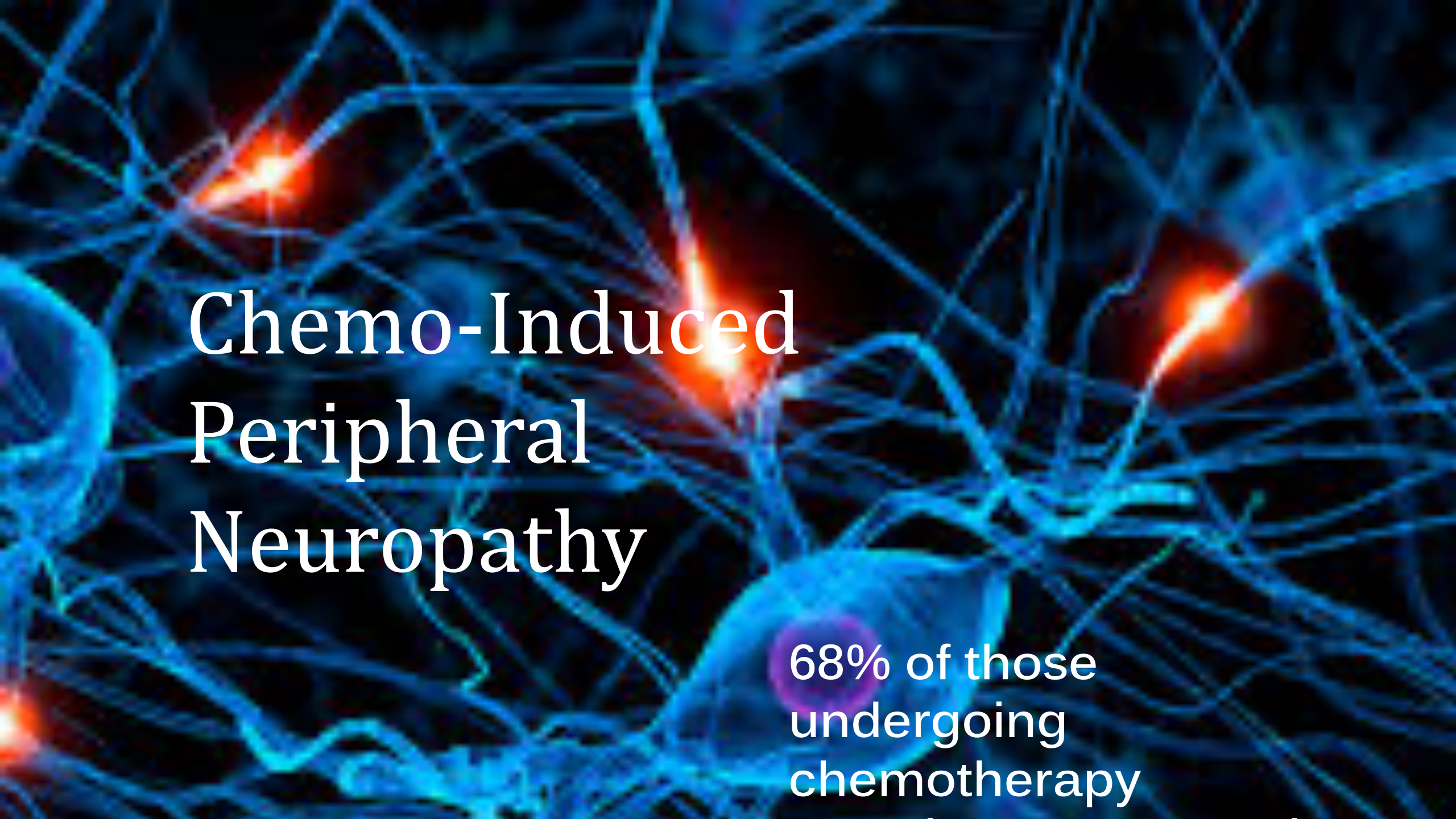
Accumulation of amadori products undergoes oxidation, reductions, hydrations to form non-enzymatic crosslinks
(Takes weeks / months and **is not reversible**)

AGEs and Microvascular Health

Collagen-AGEs cross-linking will produce stiffness of blood vessels

Glycation of LDL particles leading to atheroma formation and narrowing of arteries

Decreased nitric oxide activity (vasodilator) by decreasing NO synthase



Chemo-Induced Peripheral Neuropathy

68% of those
undergoing
chemotherapy

Chemotherapy Agents

CIPN associated with axonopathy or dying back axon damage and neurotoxicity to cell bodies of dorsal root ganglia .

Risk factors for CIPN include dose per cycle, cumulative dose, treatment schedule, duration of infusion, administration of other chemotherapeutics, comorbidity and pre-existing peripheral neuropathy.

Progressive to the end of treatment to several months after.

Vitamin E demonstrated neuroprotective effects (Argyriou et al.)

Positive vs. Negative Symptoms



Peripheral Neuropathy Symptoms (Sensory)

Positive Symptoms

Burning

Radiating

Sharp

Hot, Cold

Sensitivity to socks (texture)

Negative Symptoms

Numbness

Tingling

Treatments for Peripheral Neuropathy

Address the positive symptoms of PN

Gabapentin (Neurontin), Lyrica (Pregabalin), Duloxetine, Capsacin

Medications increase production of GABA. GABA is a neurotransmitter that acts as a natural 'nerve-calming' agent. It helps keep the nerve activity in the brain in balance.

Medications reduce the release of glutamate. Glutamate is a neurotransmitter that acts as a natural 'nerve-exciting' agent. It's released when electrical signals build up in nerve cells and subsequently excites more nerve cells.

Understand the side effects of all medications

New Treatments for Peripheral Neuropathy

Address the negative symptoms of PN

Metanx, L-methyl folate, Benfotiamine, R-lipoic acid, Acetyl-L-carnitine,
L-Carnosine

Thiamine / Benfotiamine (Vit B1)

One of the B vitamins that blocks the production of free radicals which in turn prevents dangerous DNA injury that

L-Carnosine

Combination of L-Alanine & L-histidine

Anti-glycation agent via free radical scavenger, metal chelator

Dosages of Vitamins for DPN & CIPN

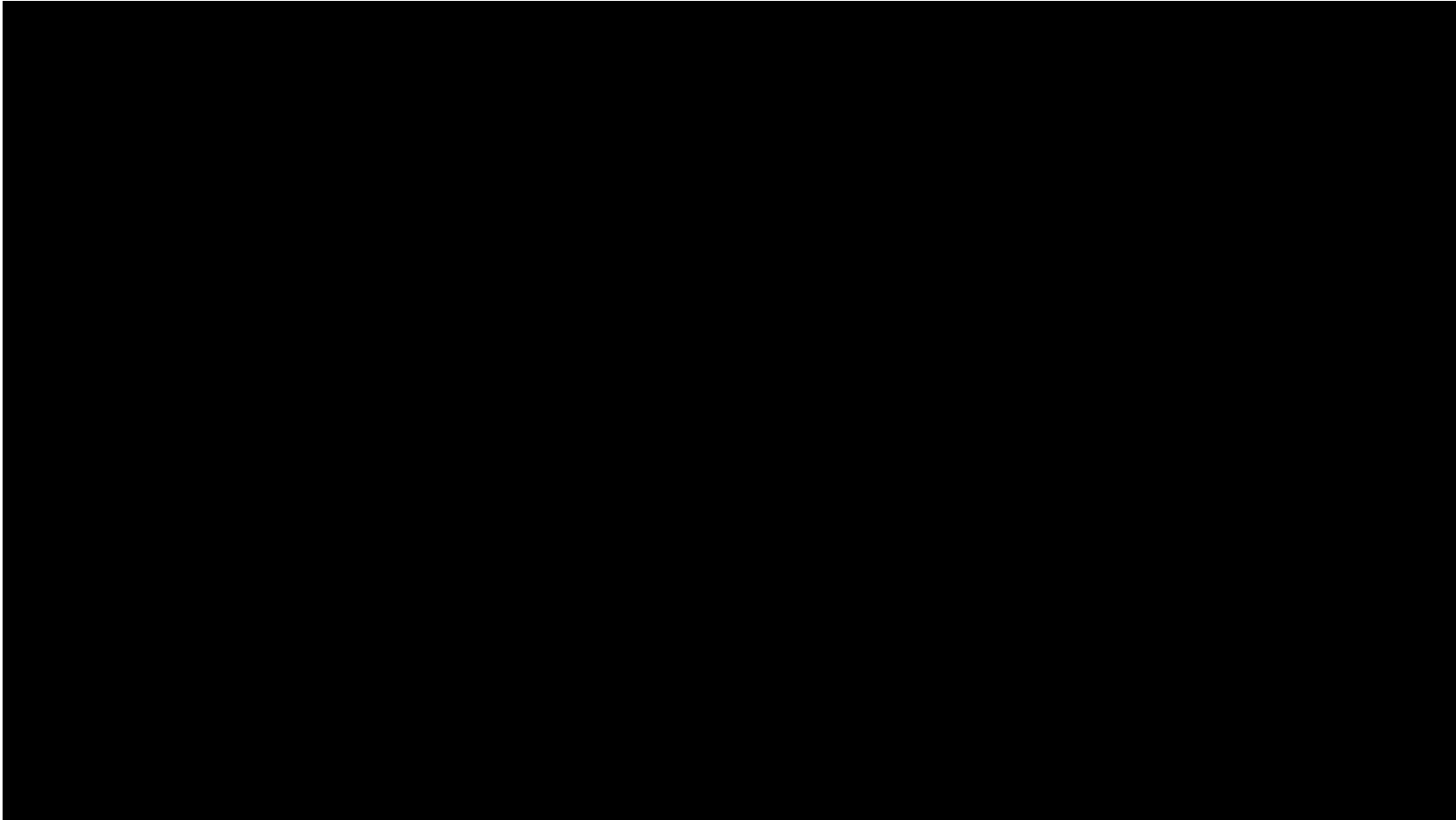
Benfotiamine (300mg bid)

R-lipoic acid (600mg qdaily)

Acetyl-L-carnitine (500mg qdaily)

L-Carnosine (1000mg qdaily)

L-Methyl folate (1000ug tid)



Clinical Presentation of Sensory Neuropathy

Considerations for the Movement Specialist

How can you workout safely with neuropathy?

What workouts can offset the progression of the disease?

How can you enhance a workout with sensory stimulation?



A close-up photograph of two human feet, showing the texture of the skin and the lines on the palms and soles. The feet are positioned with the palms facing each other, with the fingers pointing upwards. The background is a soft, out-of-focus light color.

Barefoot Training & Peripheral Neuropathy

Clean , controlled environment

Foot checks before / after training

Focus on foot engagement / activation

Use palmar skin to aid in plantar stimulation



Increasing sensory stimulation

Understanding Types of Sensory Nerves

Nociceptors – Sharp vs. Dull

Thermoreceptors – Hot vs. Cold

Mechano (haptic) ceptors – Shape, Texture, Vibration

Proprioceptors - Stretch

Two Streams of Sensory – Cortical Pathways

1. Mechanoceptors
2. Proprioceptors

1. Nociceptors
2. Thermoreceptors



Receptors



SAI

Two Point Discrimination



SAII

Skin Stretch



FAI

Low Frequency Vibration



FAII

High Frequency Vibration

www.radroller.com



www.nabosotechnology.com



www.powerplate.com

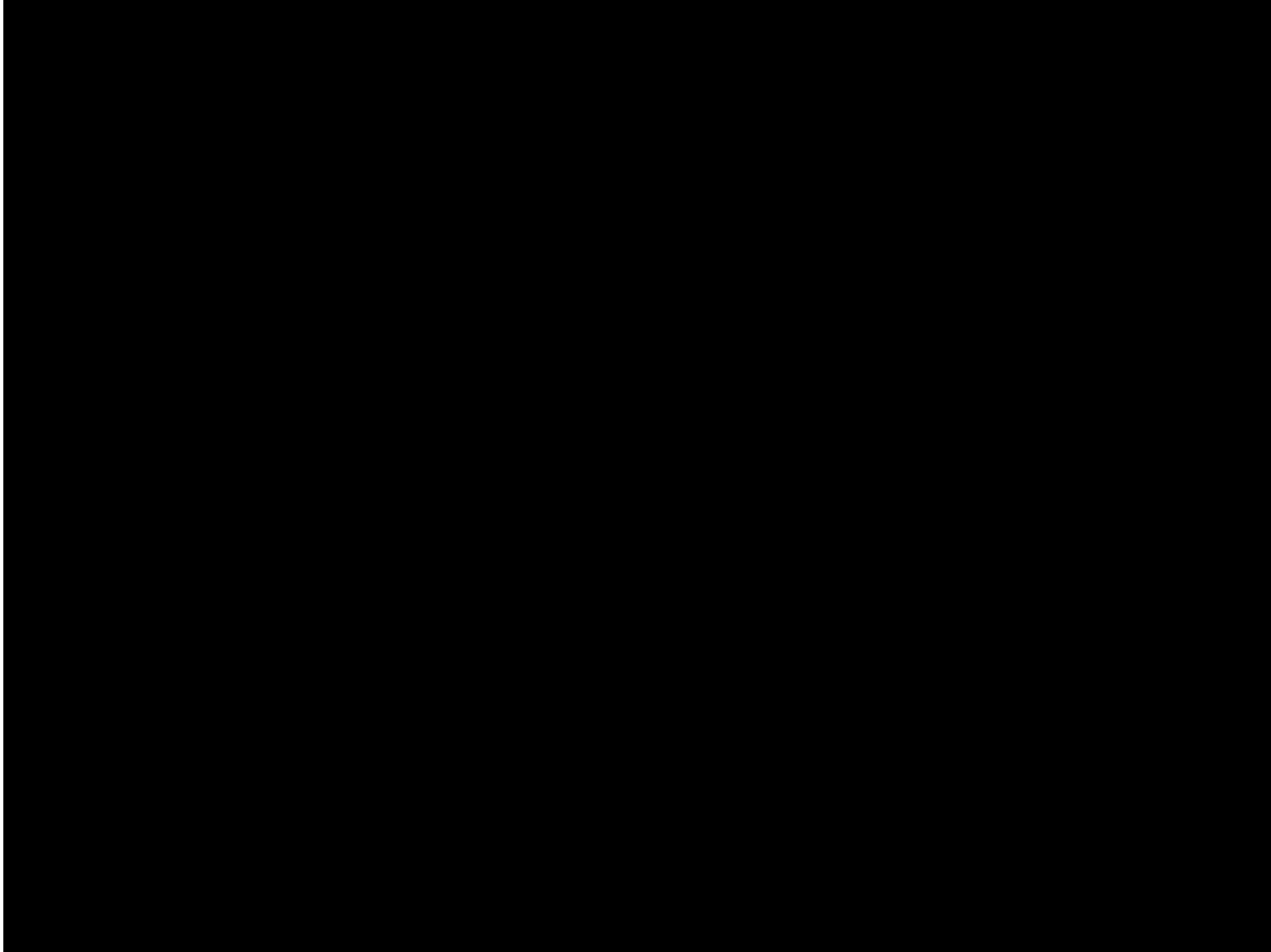
Motor Neuropathy



Charcot Marie Tooth

- One of the most common inherited neurological disorders
- Also known as hereditary motor and sensory neuropathy (HMSN) or peroneal muscular atrophy
- CMT affects both motor and sensory nerves
- Weakness of the foot and lower leg muscles, which may result in foot drop and a high-stepped gait with frequent tripping or falls.

Classic presentation of CMT



Optimizing Movement in CMT

ASO Brace for lateral ankle

Correct Toes for hammertoes

AFO if needed for foot drop

Daily SMR of plantar foot and posterior group

Daily sensory stimulation & kinesthetic training

Naboso Insoles, Vibration, Trigger Point

**How can I help my client improve balance
if they have peripheral neuropathy?**

Balance Strategy #1



A close-up photograph of two hands, palms facing each other, fingers slightly curled, as if about to clasp or hold something. The skin is a warm, light brown tone. The background is a soft, out-of-focus white.

Balance Strategy #2



Balance Strategy #3

Balance Strategy #4

Breathe

The background of the slide features a series of overlapping, translucent, flowing ribbons or smoke-like shapes. The colors transition from a warm yellow and orange on the left, through a vibrant green, into a deep teal and blue, and finally into a soft purple and magenta on the right. The ribbons have a sense of movement and depth, creating a dynamic and ethereal visual effect.



Autonomic Neuropathy



Complex Regional Pain Syndrome

Complex Regional Pain Syndrome

Poorly understood and progressive pain syndrome often leading to impairments, disabilities, and handicaps

Developing most often after trauma to a limb or a surgical procedure and sometimes presenting with no precipitating event,

A chronic condition with involvement of the sensory, motor, and autonomic nervous systems

- CRPS I (RSD), which occurs without evidence of nerve damage

- CRPS II (causaligia), which is associated with evidence of significant nerve damage

Presentation of CRPS

Continuing pain that is disproportionate to the inciting event

The patient must report at least one symptom in three of the four categories:

- Sensory: Allodynia

- Vasomotor: Temperature asymmetry and/or skin color changes

- Sudomotor/edema: Edema and/or sweating changes

- Motor/trophic: Decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nails, skin)

There is no other diagnosis that better explains the signs or symptoms.

Treatment options for CRPS

Strain Counterstrain (SCS)

Lymphatic massage / dry brushing

Nerve blocks

Movement / restrict
immobilization



Part 2

Central Nervous System Disorders

Multiple Sclerosis

Parkinson's Disease

Stroke

Hypertonia / Hypotonia

Dystonia

