

**Motor function and its
disorders.**

**Voluntary movements,
paresis, paralysis**

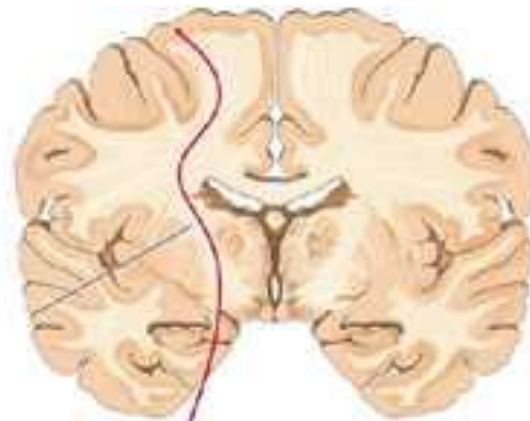
**Professor
Leila Rinatovna Akhmadeeva**

<http://ufaneuro.org>

Sep 5, 2023

- 
- Video-patient

Cortex



Midbrain



Middle Pons



Middle medulla



Caudal medulla

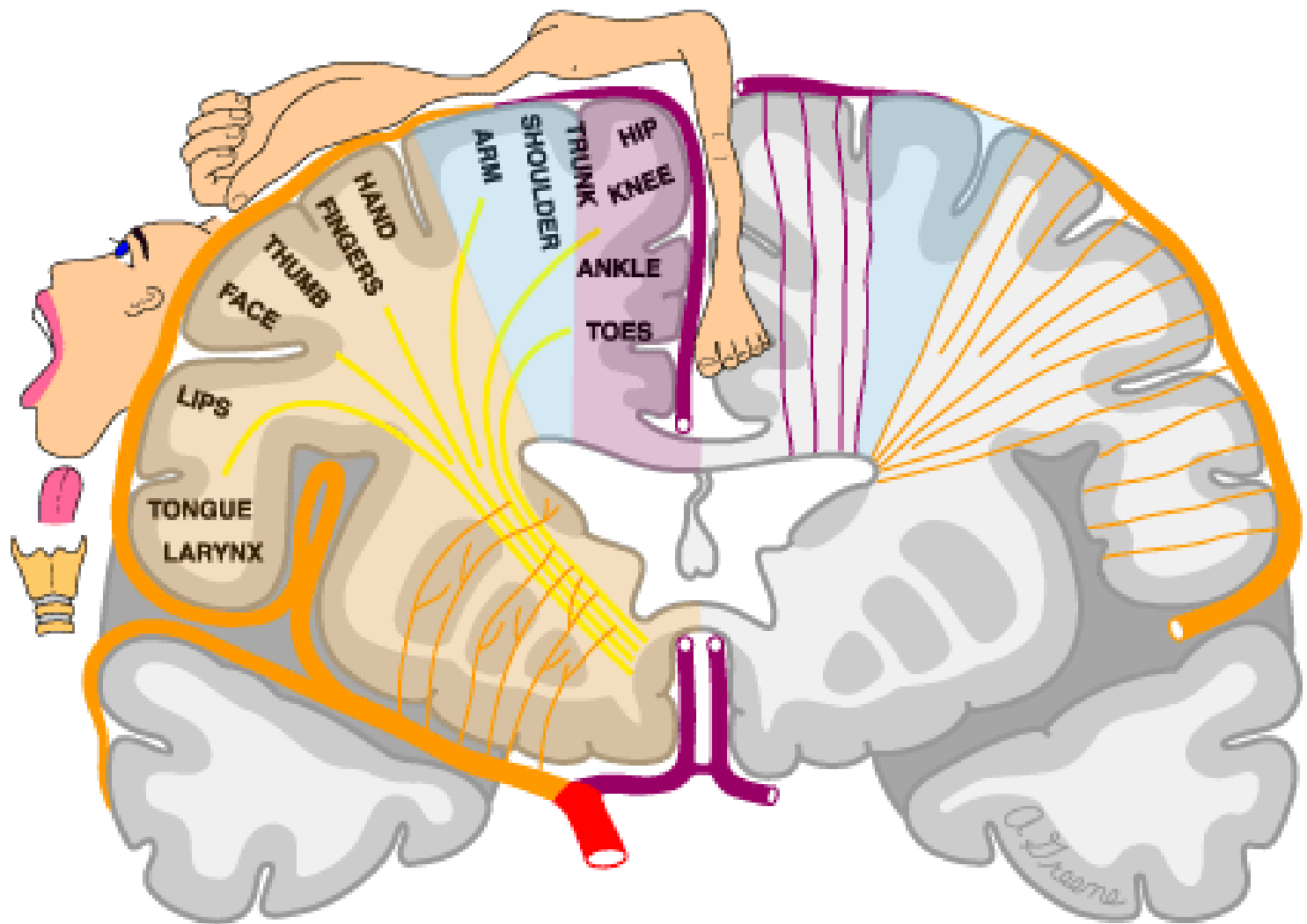


Spinal cord

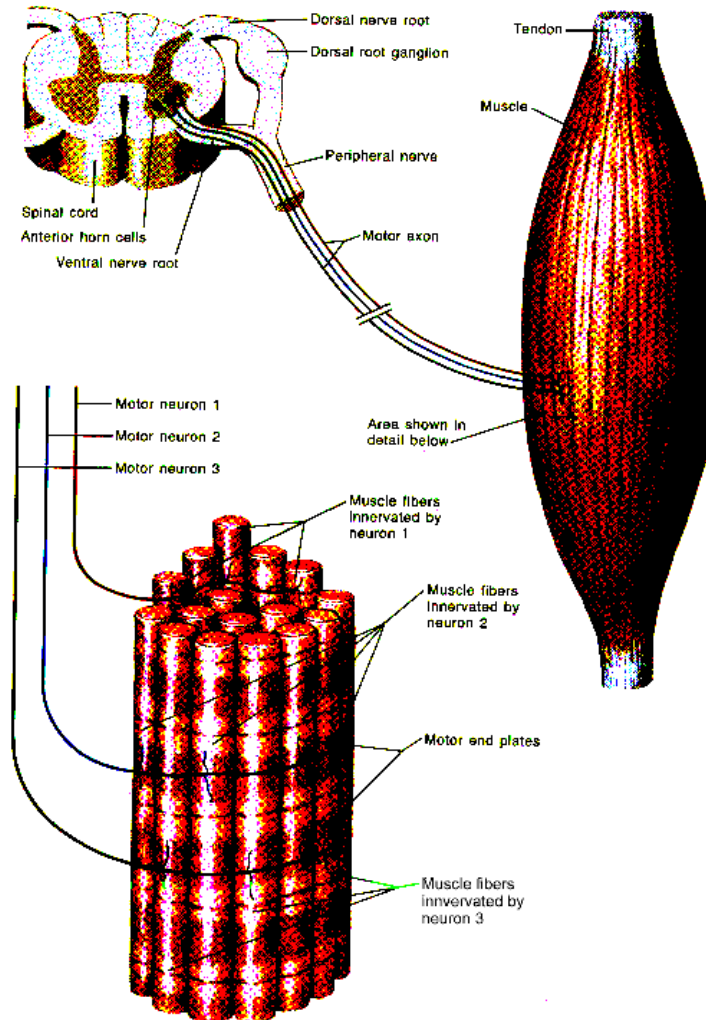


Pyra- midal (cortico- spinal) tract

Cortex – gyrus precentralis – 1st neuron (by P.Penfield)



Spinal cord – anterior horns – 2nd neuron



If a patient has ANY lesion at any point of corticospinal tract:

- **Paralysis (plegia)**
- **Paresis**

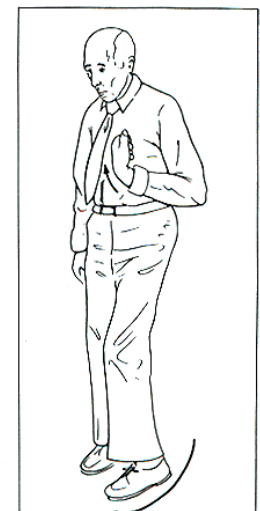


L.Akhmadeeva, 2023

Clinical assessment



Position / posture



BAD POSTURE

VS

GOOD POSTURE

-  ▪ Reduced Spine Motion
-  ▪ Neck & Back Pain
-  ▪ Chronic Fatigue
-  ▪ Bad Blood Circulation
-  ▪ Potential Disc Herniation



- More Energy ▪ 
- Looking Good ▪ 
- Prevents Backache ▪ 
- Joint Protection ▪ 
- Spine Protection ▪ 

General Observation:
Spontaneous

- Posture
- Movement

Robinson C.A., 2020e.

Posture Affects Function

Consider posture of extremities, not just trunk and neck

- Position of the eyes
- Produces abnormal strain on muscles and other soft tissue structures
- Can compress nerves and blood vessels
- Changes the position of the COM in relation to the BOS
 - COM- center of mass
 - BOS- base of support
- Impacts UE ROM
- Impacts respiratory function
- For every action, there is an equal and opposite reaction!!



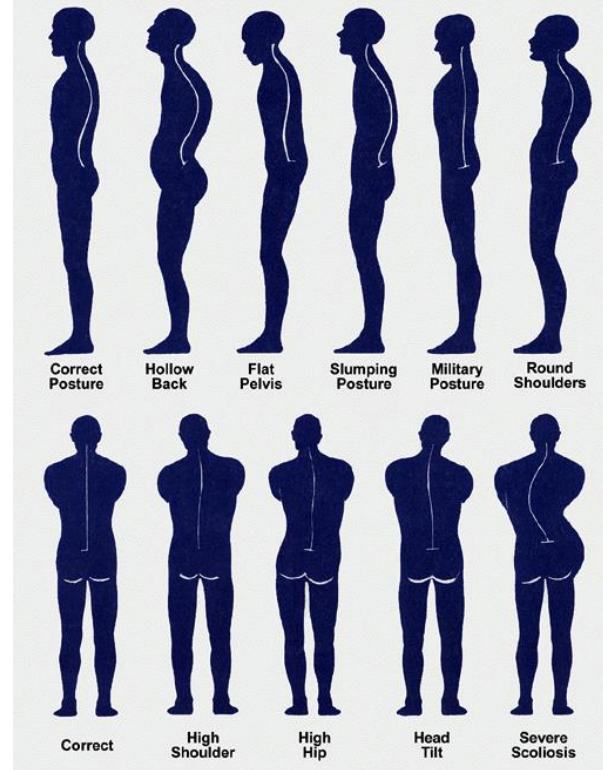
Robinson C.A., 2020e.

General Observation

Use your eyes and your hands

- Symmetry
- Alignment
- Muscle bulk

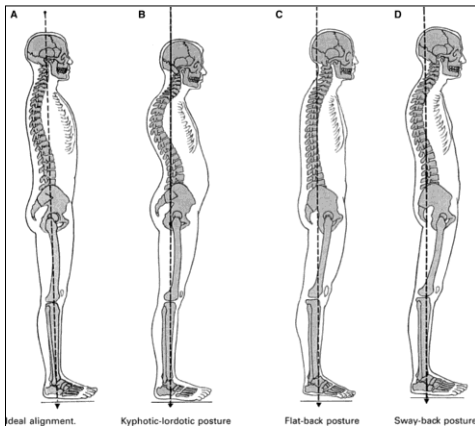
LOOK AT YOUR POSTURE... OTHERS DO






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Objective Examination - Musculoskeletal

- Standing posture
 - Plumb line
 - Kendall's Classification



Robinson C.A., 2020a.

An imaginary plumb line falls:		Think of the body as a series of building blocks. In good body alignment these blocks balance one above the other
just behind the apex of the coronal suture		
through the centre of the external auditory meatus and the upper cervical vertebral bodies		The centre of the head, usually the ear, sits above
through the centre of the thorax and the lumbar vertebral bodies		the centre of the chest which in turn sits above
just behind the axis of the hip joint		the centre of the pelvis, which sits above
just in front of the axis of the knee joint		
just in front of the lateral malleolus		the centre of the feet

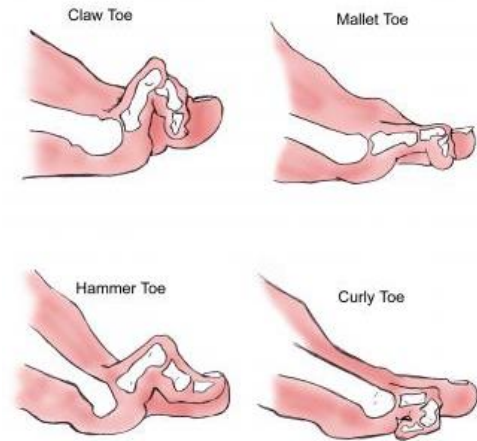
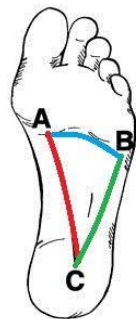
Objective Examination - Musculoskeletal

- Foot and Toes
Observe for calluses in unexpected locations

Longitudinal Arch



Horizontal Arch



Hallux Valgus



Calluses

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Objective Examination - Musculoskeletal

- Sitting posture - Impact on function



Anterior Pelvic Tilt



Pelvic Obliquity



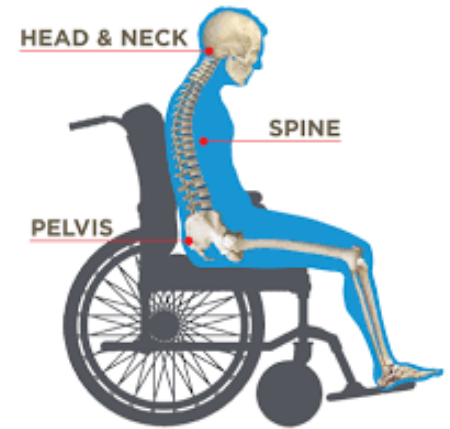
Pelvic Rotation



Posterior Pelvic Tilt



Windswept Deformity





Range of motion

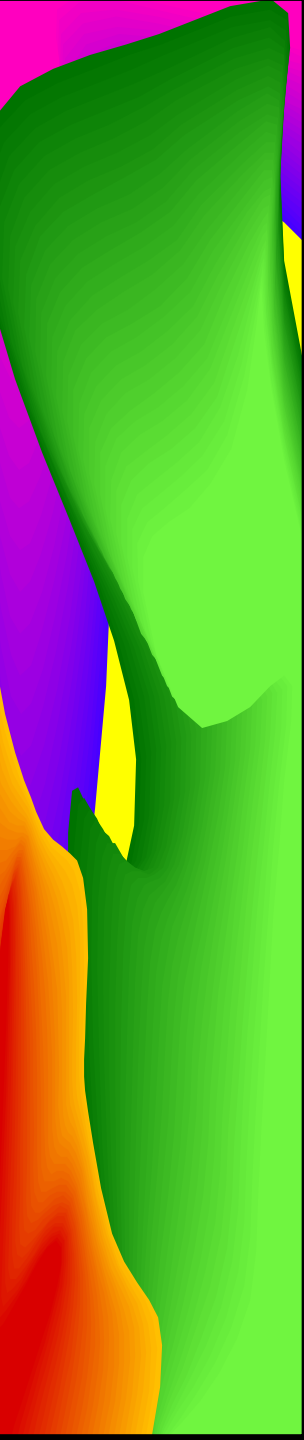
Hip Flexion (0°-115° to 125°)

w/ knee flexed

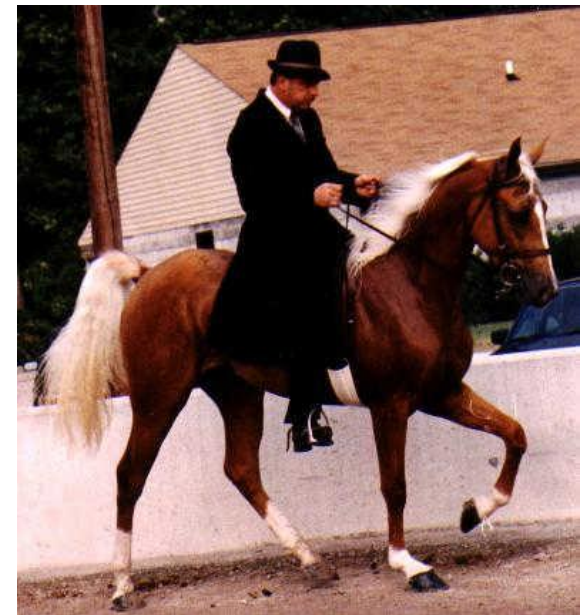
- **Position-** supine, knee extended, end with knee fully flexed.
- **Axis-** 1 finger breath superior/anterior to greater trochanter
- **Stationary Arm-** parallel to long axis of trunk
- **Moving Arm-** midline of femur toward lateral epicondyle
- **Stabilization-** pelvis stabilized by opposite LE. Do not allow posterior pelvic tilt.



Robinson C.A., 2020e.



Gait



Muscle strength



Score	%	Criteria
0		No active movements
1	0-5	Some elements from movements
2	5-20	Minimal movements
3	20-50	Movements against gravity
4	50-90	Strength to resist physician
5	90-100	Normal strength



Manual Muscle Testing Principles

- Subject assumes standardized testing position
- Muscle is moved actively through full range of motion to confirm at 3/5 strength
- Resistance is applied at the furthest distance of the body segment
 - Do not cross more than one joint
- If 3/5 strength demonstrated
 - Patient actively moves to mid-range of muscle
 - Resistance applied in opposite direction of motion
 - Resistance applied at furthest point along body segment, without crossing a second joint
- If 3/5 strength not demonstrated
 - Repeat motion in gravity minimized position

Shoulder Abduction

Supraspinatus and Middle Deltoid

- **Position-** short sit
- **Movement-** abduct arm from 0° to 180°
- **Resistance-** shoulder abducted 90° with palm down, force downward through distal humerus
- **Stabilization-** same or opposite shoulder

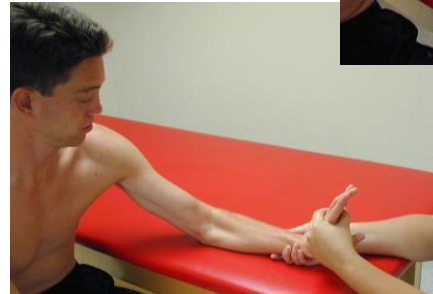


Robinson C.A., 2020e.

Wrist Extension

Extensor Carpi Radialis Longus, Extensor Carpi Radialis Brevis, Extensor Carpi Ulnaris

- **Position-** short sit, arm at side, elbow flexed 90° , forearm pronated (or sit with forearm pronated, supported on table)
- **Movement-** extend wrist
- **Resistance-** dorsum of hand into wrist flexion
- **Stabilization-** forearm



Robinson C.A., 2020a.

Hip Flexion

- **Position-** short sit, post pelvic tilt, hold edge of table
- **Movement-** hip flexion in sagittal plane from 90°-120°
- **Resistance-** anterior surface of thigh proximal to knee
- **Stabilization-** opposite pelvis



Robinson C.A., 2020e.

Knee Flexion

- **Position-** Prone with hips and knees extended
- **Movement-** flex knee in sagittal plane
- **Resistance-** posterior surface of distal leg
- **Stabilization-** distal thigh

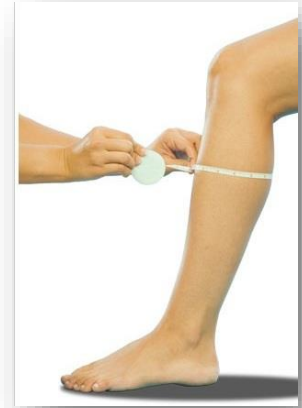


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Hypotrophy

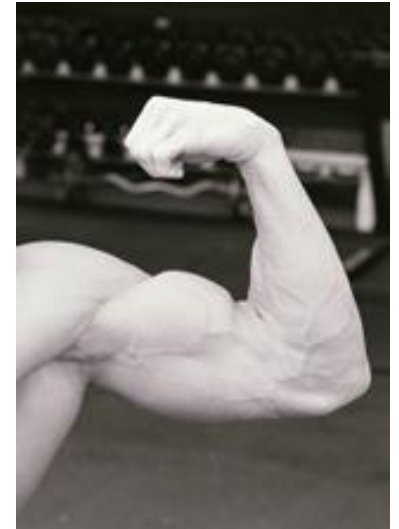


Symmetry



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Muscle tone



Objective Examination - Musculoskeletal

- Supine posture



Low tone



High tone

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Assessing Muscle Tone

Modified Ashworth Scale	
Grade	Description
0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM*
2	More marked increase in muscle tone through most of the ROM, but affected part(s) easily moved
3	Considerable increase in muscle tone, passive movement difficult
4	Affected part(s) rigid in flexion or extension

An international survey of patients living with spasticity.

Barnes M¹, Kocer S², Murie Fernandez M³, Balcaitiene J⁴, Fheodoroff K⁵.

⊕ Author information

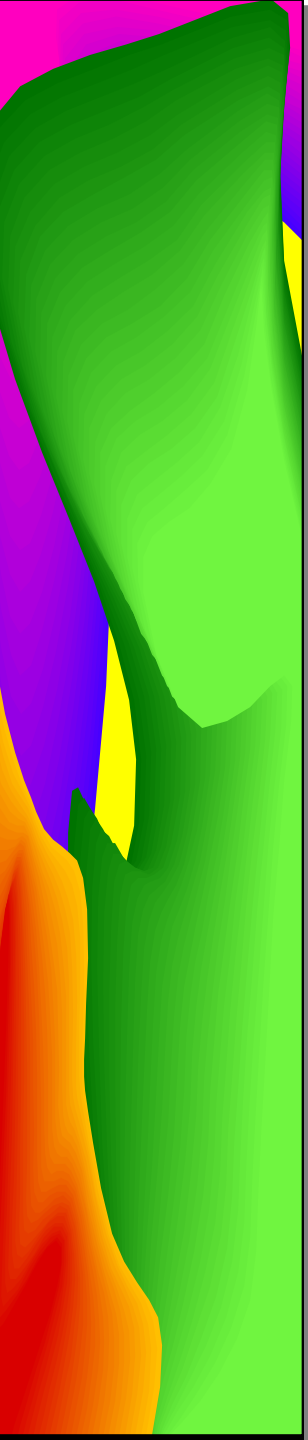
Abstract

PURPOSE: To better understand patient perspectives on the life impact of spasticity.

METHODS: Global Internet survey (April 2014-May 2015) of 281 people living with spasticity.

RESULTS: Respondents indicated that spasticity has a broad impact on their daily-life: 72% reported impact on quality of life, 44% reported loss of independence and 44% reported depression. Most respondents (64%) were cared for by family members, of whom half had stopped working or reduced their hours. Overall, 45% reported dissatisfaction with the information provided at diagnosis; main reasons were "not enough information" (67%) and "technical terminology" (36%). Respondents had high treatment expectations: 63% expected to be free of muscle spasm, 41% to take care of themselves and 36% to return to a normal routine. However, 33% of respondents had not discussed these expectations with their physician. The most common treatments were physiotherapy (75%), botulinum neurotoxin (BoNT, 73%) and oral spasmolytics (57%). Of those treated with BoNT, 47% waited >1 year from spasticity onset to treatment.

CONCLUSIONS: This survey emphasises the broad impact of spasticity and highlights unmet needs in the patient journey. Improvements with regards to communication and the therapeutic relationship would be especially welcomed by patients, and would help manage treatment expectations. Implications of Rehabilitation Spasticity has broad impact on the lives of patients and their families that extends beyond the direct physical disability. Patients with spasticity need to be well informed about their condition and treatments available and should be given the opportunity to discuss their expectations. Physicians need to be aware of the patient's individual needs and expectations in order to better help them achieve their therapeutic goals.



Video-patient



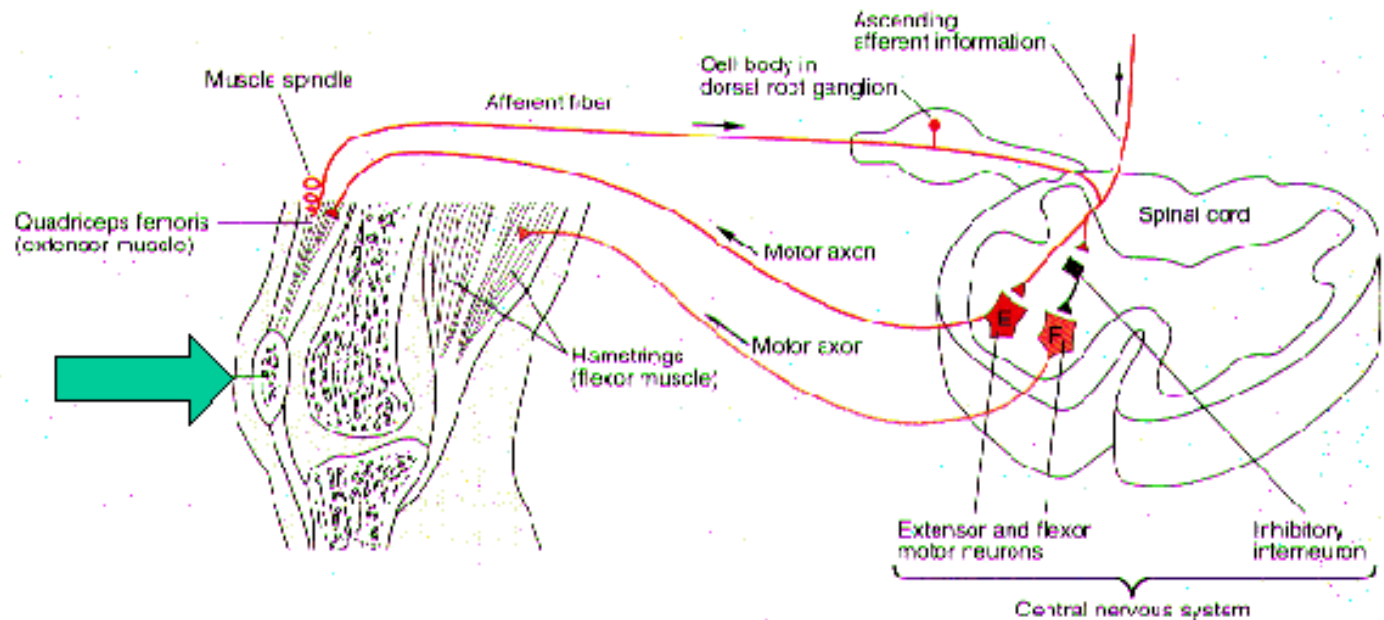
Patient of L.Akhmadeeva, 2023.

Fasciculations



Physiological reflexes

A “typical” monosynaptic reflex system:
the mammalian “knee-jerk”

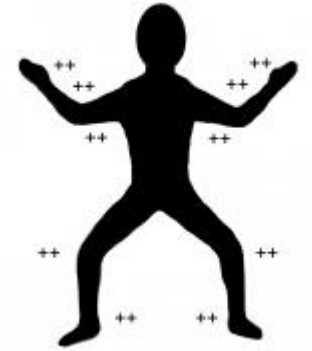


Physiologic Reflex Testing

Muscle	Nerve root	Peripheral nerve	Response
Biceps	C5,C6	Musculocutaneous	Slight contraction of elbow flexors
Brachioradialis	C5,C6	Radial	Slight contraction of elbow flexors, slight wrist extension or radial deviation
Triceps	C6,C7	Radial	Slight contraction of elbow extensors
Quadriceps	L2,L3,L4	Femoral	Slight contraction of knee extensors
Hamstrings	L5,S1,S2	Sciatic, tibial branch	Slight contraction of knee flexors
Achilles	S1,S2	Tibial	Slight contraction of plantar flexors

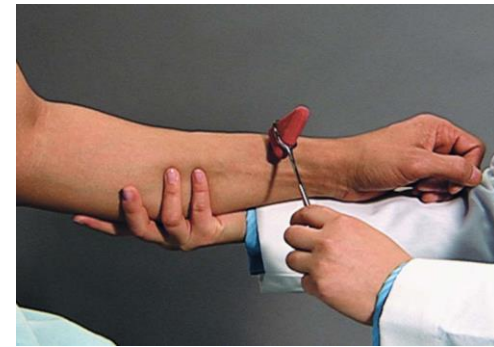
Robinson C.A., 2020a.

Physiological reflexes



4+	Hyperreflexia (with clonus)
3+	Very brisk
2+	Brisk
1+	Low
0	No response
1+(R)	
0(R)	

Physiologic Reflex Testing



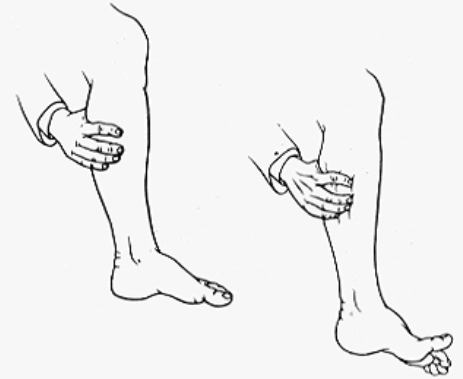
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Pathological signs



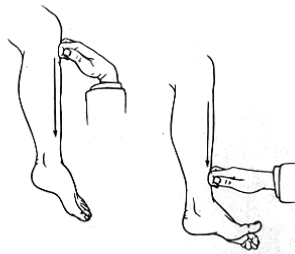
Gordon

Firmly squeeze the calf
The great toe dorsiflexes in a positive test



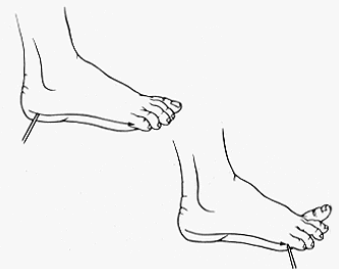
Oppenheim

Firmly press down on the shin and run the thumb and the knuckles along the anterior medial tibia toward the foot
In a positive test, there is dorsiflexion of the great toe



Chaddock

Stroke with a blunt point around the side of the foot, from external malleolus to the small toe
In a positive test, there is dorsiflexion of the great toe



Clonus

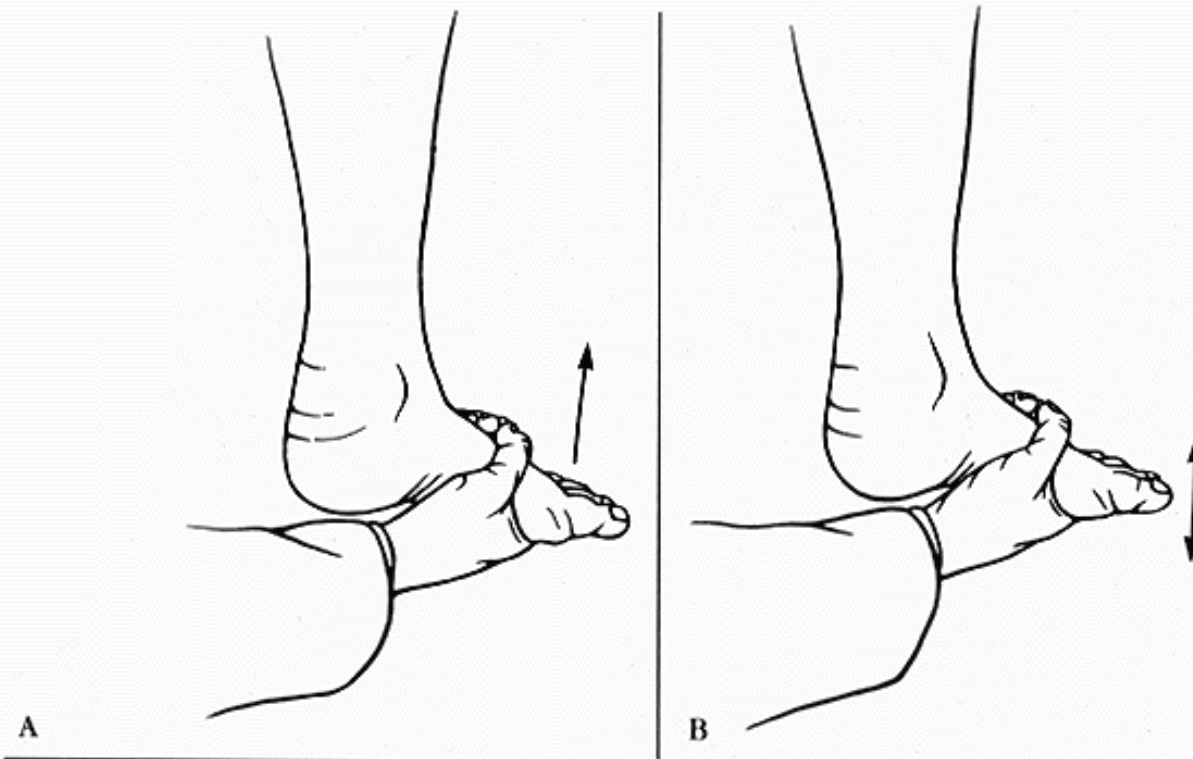


FIGURE 18-17

Testing for clonus at the ankle. A. Grasp and quickly dorsiflex the foot. B. Holding the foot in dorsiflexion, you will feel the rhythmic contractions (“beats”) in your hand.



Clinical assessment

- **Position / posture**
- **Gait**
- **Muscle strength**
- **Trophic function**
- **Muscle tone**
- **Fasciculations**
- **Reflexes (physiological and pathological)**
- **Clonus**



Paralysis (plegia)

- **No active movements**
- **Muscle strength = 0**

Paresis

- Muscle strength more than 0 and less than 5

Paralysis or paresis

Classification

Hemi

Tetra

Para

Tri

UE

LE

Mono

Paresis or paralysis

Classification

Central (1 neuron)

peripheral (2 neuron)

1+2 neurons

Diagnosis

	Centr.	Peripher.
Muscle tone	↑	↓
Trophic func	N	↓
Phys.reflexes.	↑	↓
Pat.reflexes	+	-

- Video-patient