

Clinical Neurology Review

- Action potentials are propagated and non-graded
- Receptor and synaptic potentials are graded and non-propagated
- Proper interpretation of test results requires a tremendous amount of practice and experience
- Sensory stimulation should always utilize the lowest perceptible stimulus

History

- O – Onset
- P – Palliative / Provokes
- Q – Quality
- R – Radiating
- S – Severity
- T – Time / Pattern

Tone

- Pt. should be relaxed
- Passively stretch the muscle group and look for **normal resistance**
- Palpate the muscles
- Perform deep tendon reflexes
- What you find
 - Normal
 - Decreased tone (Flaccid / Hypotonia)
 - Increased tone (Hypertonic / Spastic / Rigid)

Motor Examination

- More accurate than sensory
- Establish postural alignment / faults
- Identify perceived muscle imbalance
- Know the nerve and nerve roots that make up the brachial, lumbar, and lumbosacral plexuses
- Observe – performance, initiation, speed, and termination of event / action

Motor Examination

- Muscles are usually innervated by one nerve and by more than one nerve root
- **Observe** position of the joints and note any signs of wasting and fasciculation in the muscles.
- **Perform** each test bilaterally and **compare** the two sides. The joint should be supported and Pt. moves the joint against the doctor's resistance.

Axillary C5

MC C5-C6

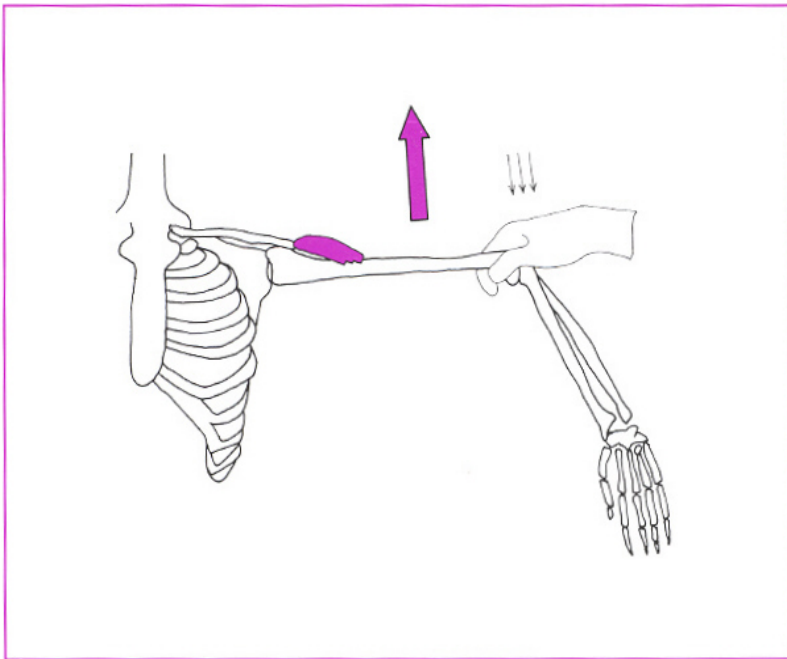


Figure 17.1
Testing shoulder abduction

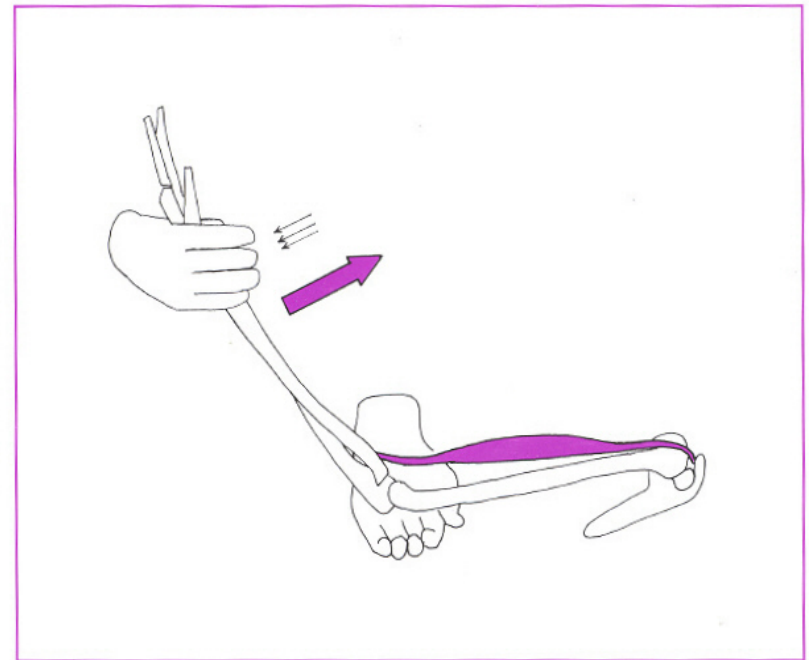


Figure 17.2
Testing elbow flexion

Radial, C7

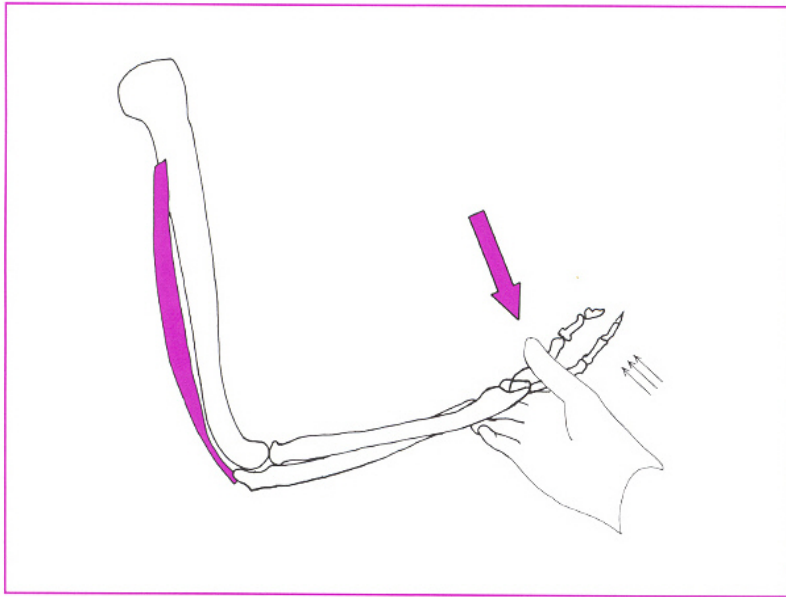


Figure 17.3
Testing elbow extension

Radial, C7

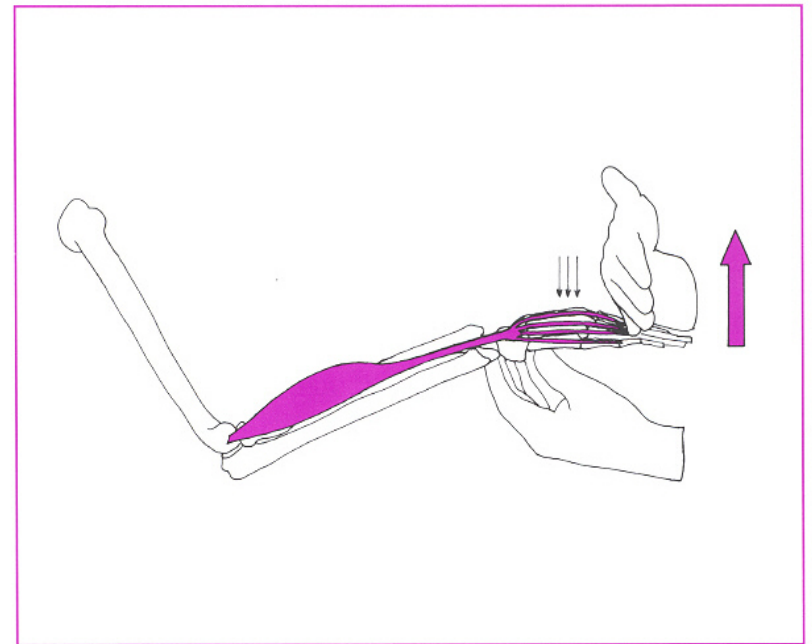


Figure 17.4
Testing finger extension

Median & Ulnar, C8

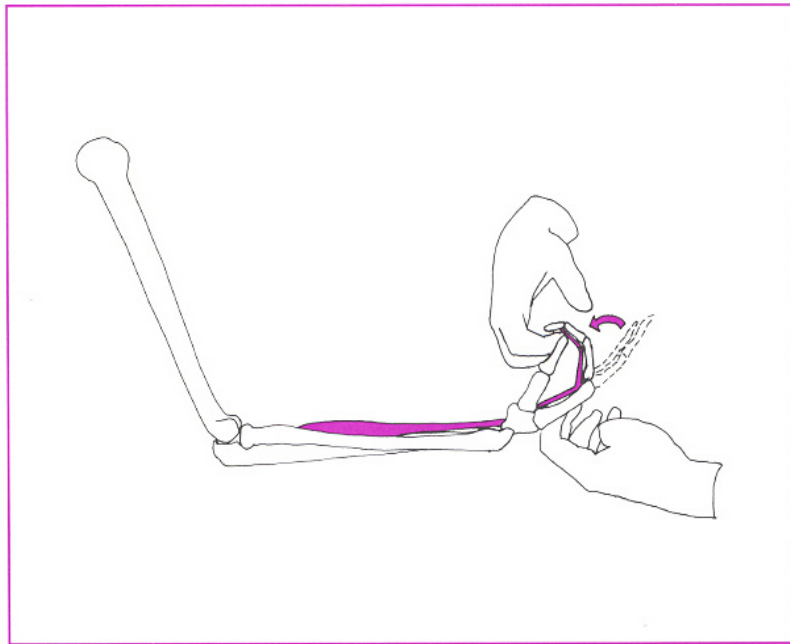


Figure 17.5
Testing finger flexion

Ulnar, T1

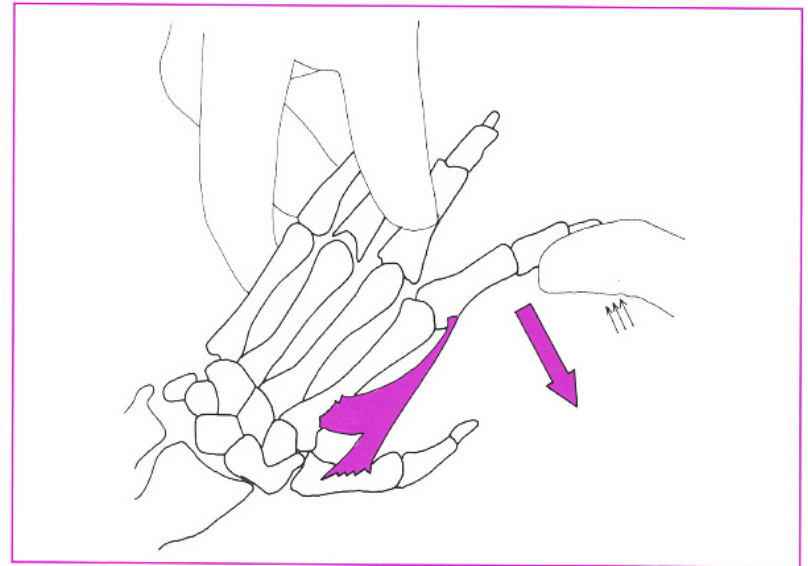


Figure 17.6
Testing finger abduction

Ulnar, T1

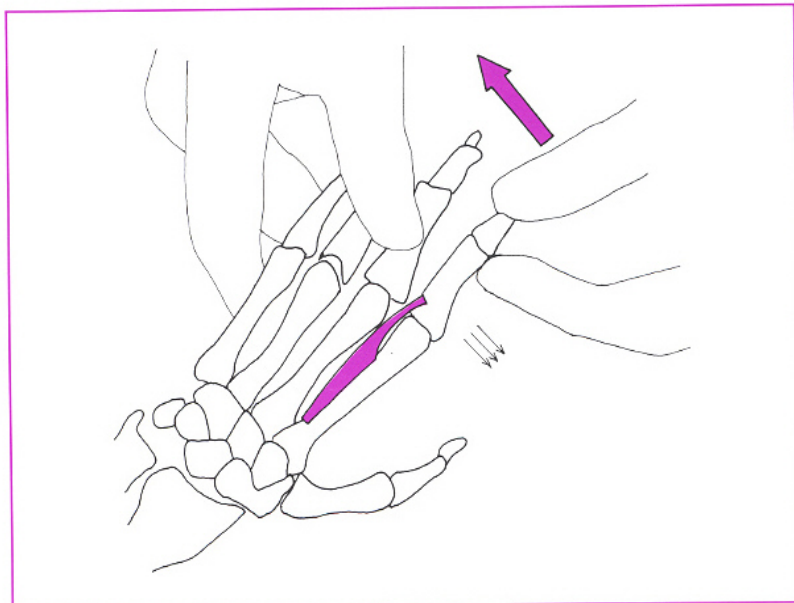


Figure 17.7
Testing finger adduction

Median, T1

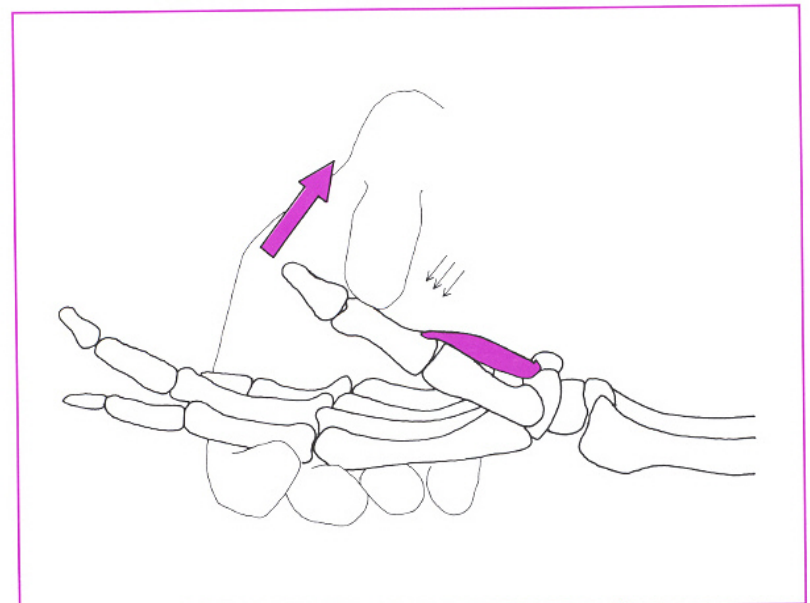


Figure 17.8
Testing thumb abduction

LT, C5, 6, 7

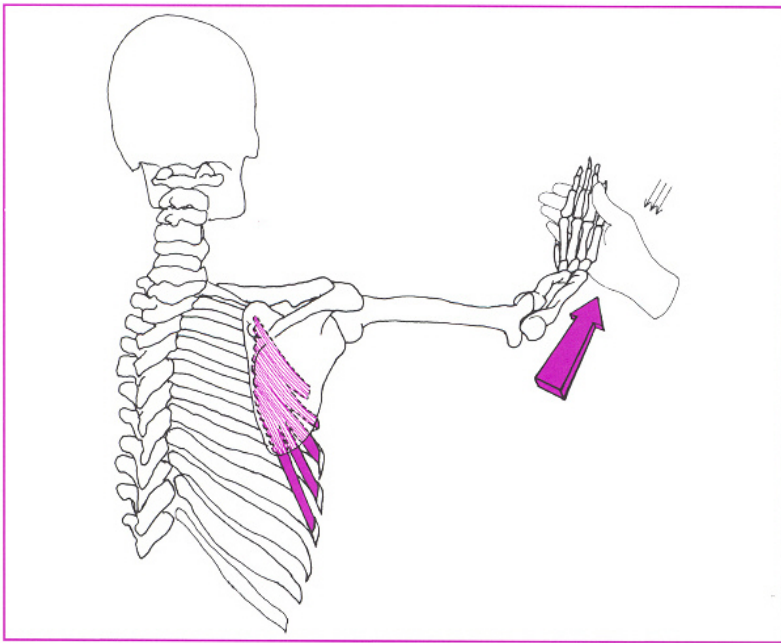


Figure 17.9
Testing strength of serratus anterior

Dorsal Scap., C4, 5

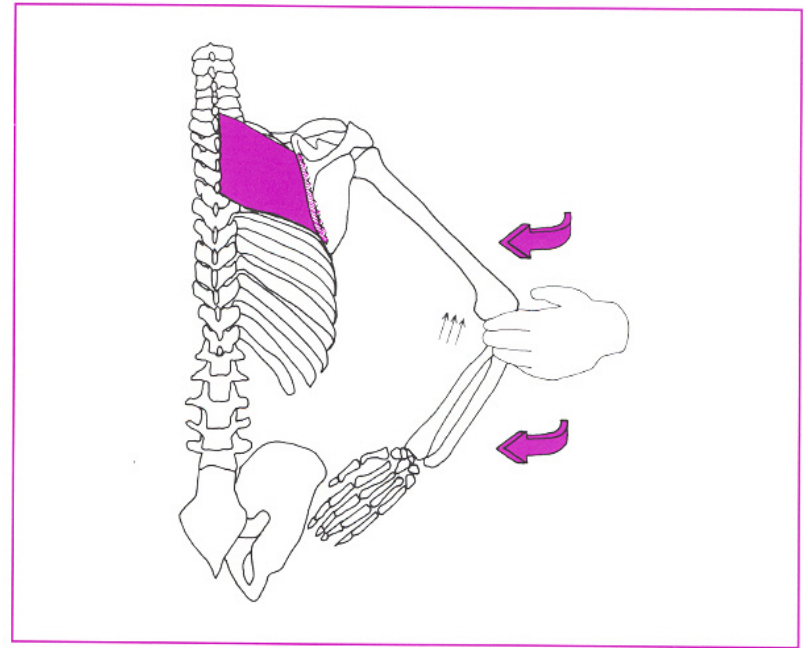


Figure 17.10
Testing strength of rhomboids

Sup. Scap., C5

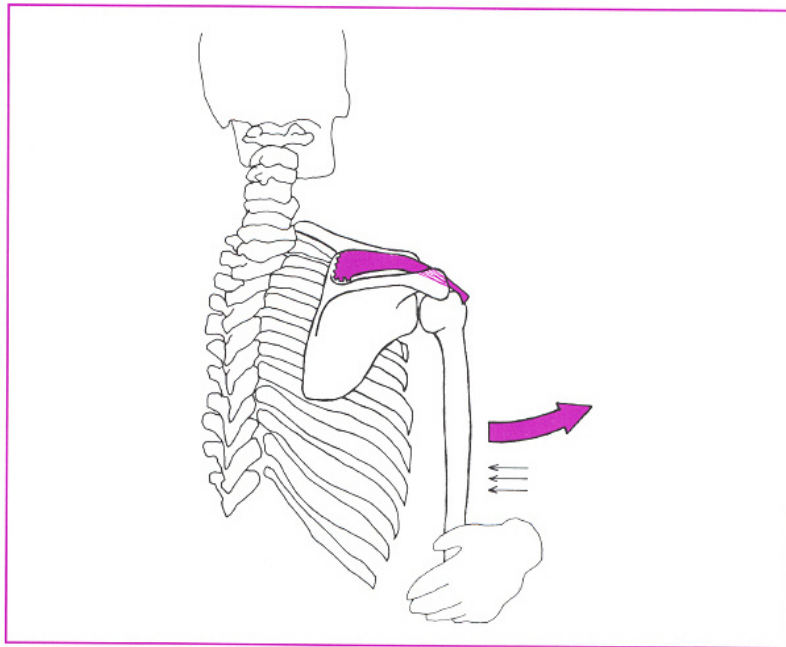


Figure 17.11
Testing strength of supraspinatus

Sup. Scap. C5, 6

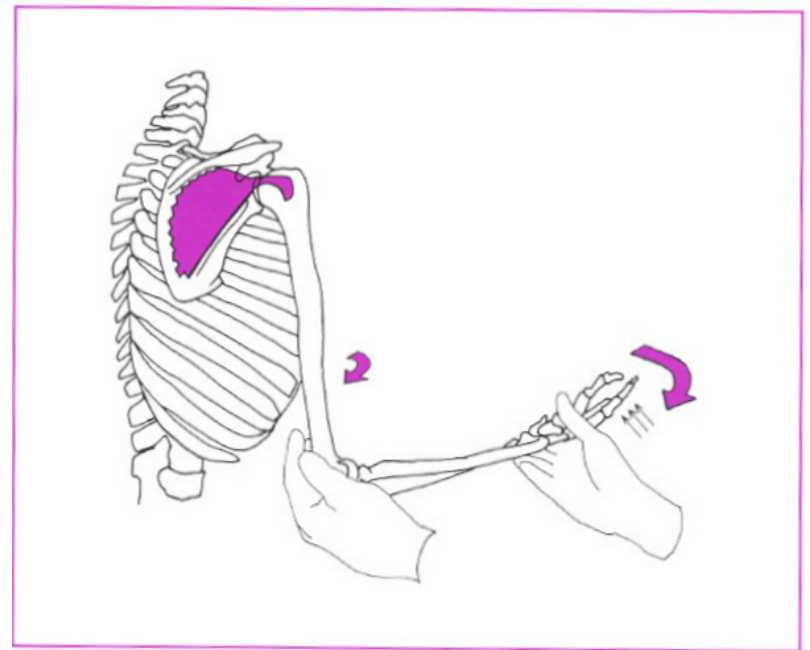


Figure 17.12
Testing strength of infraspinatus

Radial, C6

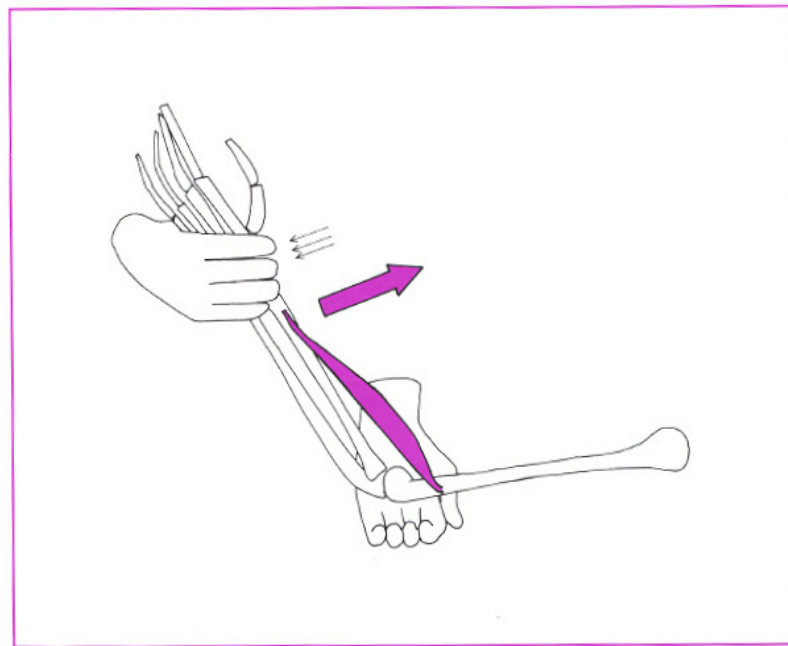


Figure 17.13
Testing strength of brachioradialis

Lumbar Plexus L1-3

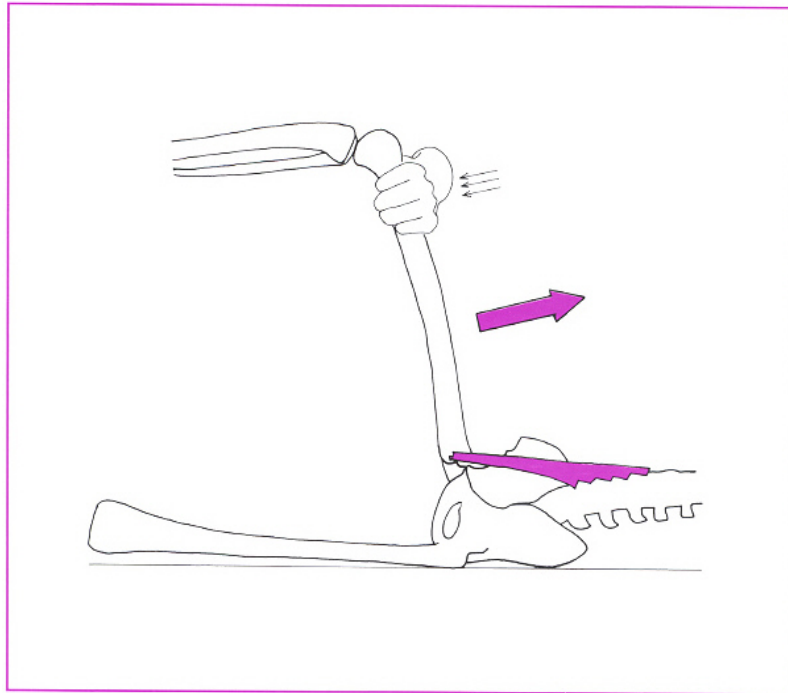


Figure 18.1
Testing hip flexion

Inferior Gluteal L5-S1

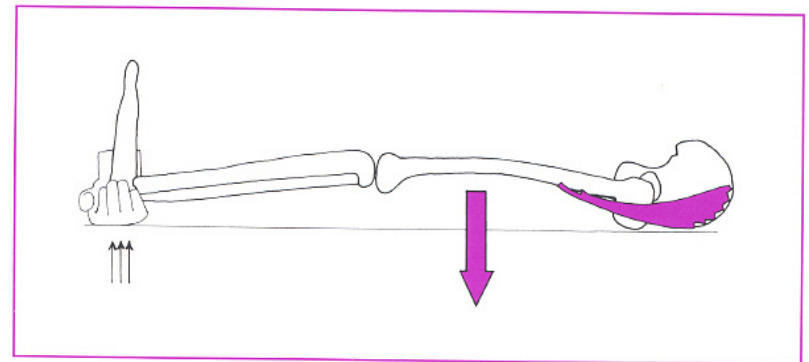


Figure 18.2
Testing hip extension

Femoral, L3,4

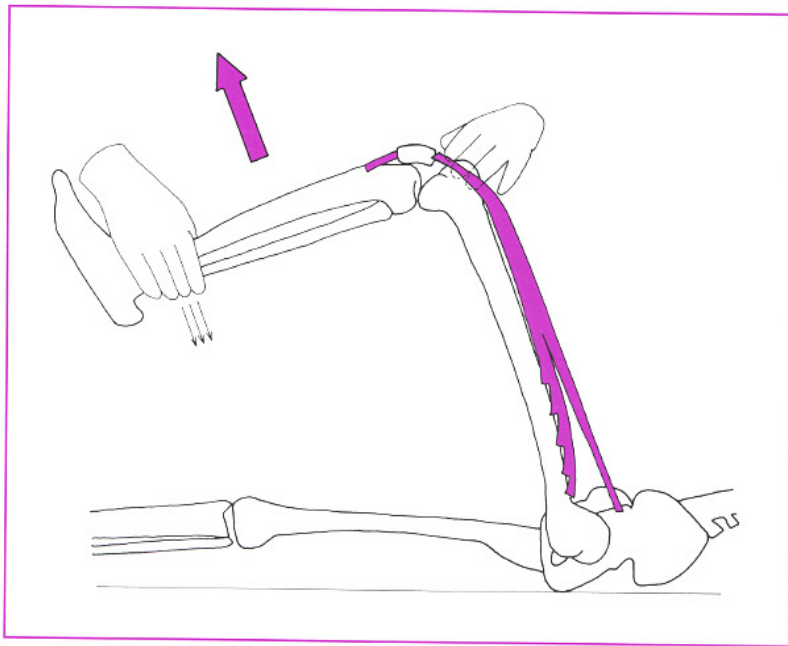


Figure 18.3
Testing knee extension

Sciatic, L5, S1

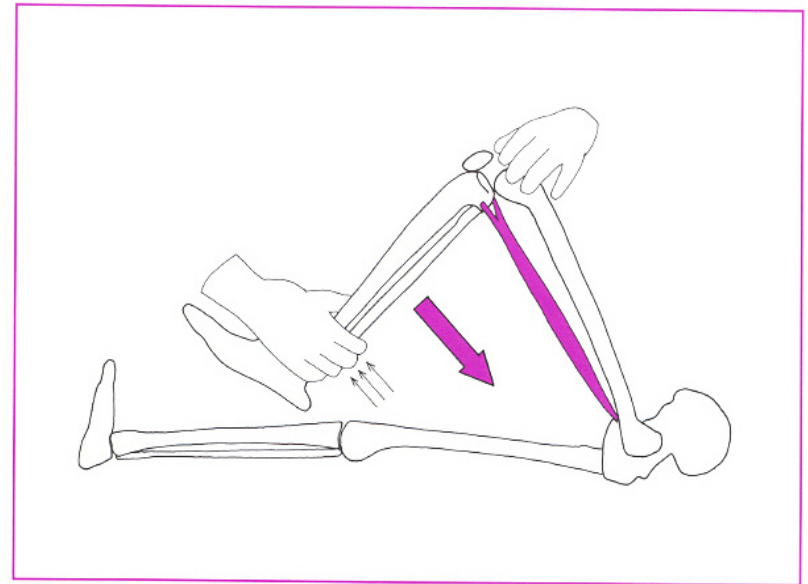


Figure 18.4
Testing knee flexion

Deep Peroneal, L4,5

Tibial, S1

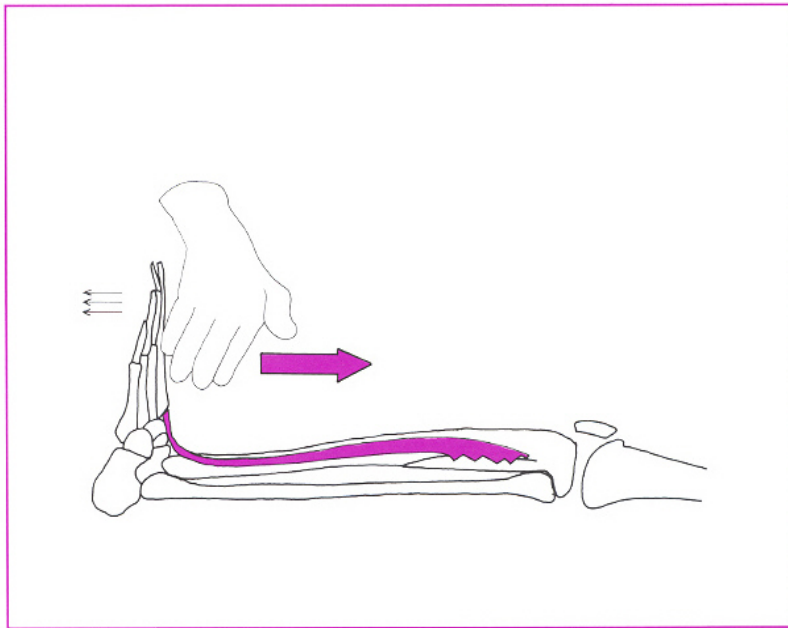


Figure 18.5
Testing dorsiflexion of the foot

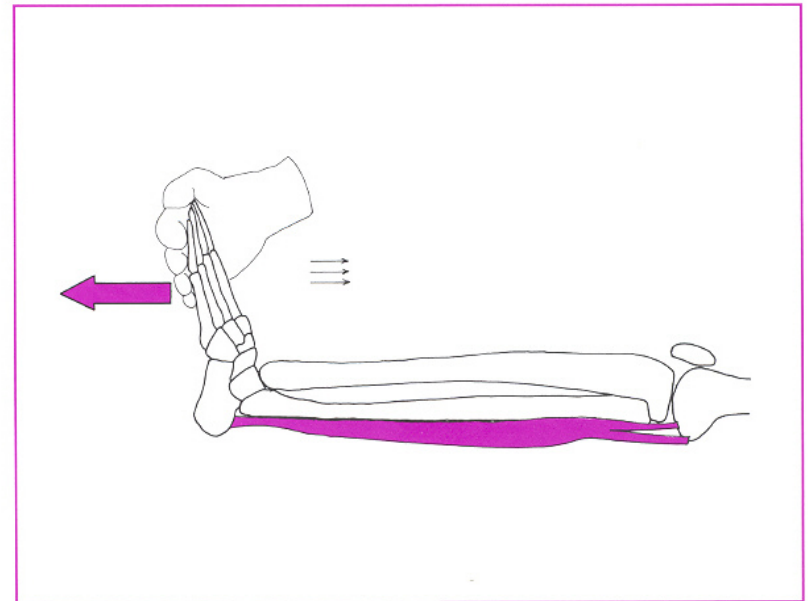


Figure 18.6
Testing plantarflexion of the foot

Deep Peroneal, L5

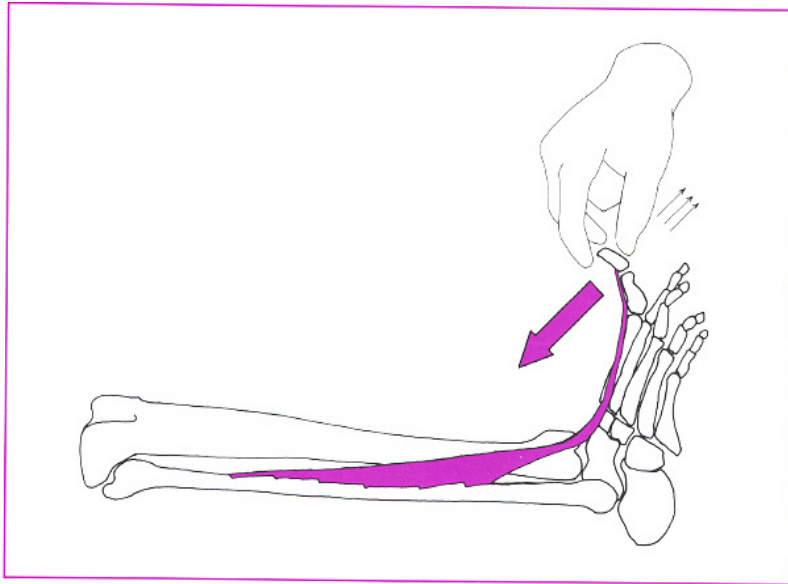


Figure 18.7
Testing big toe extension

Deep Peroneal, L5, S1

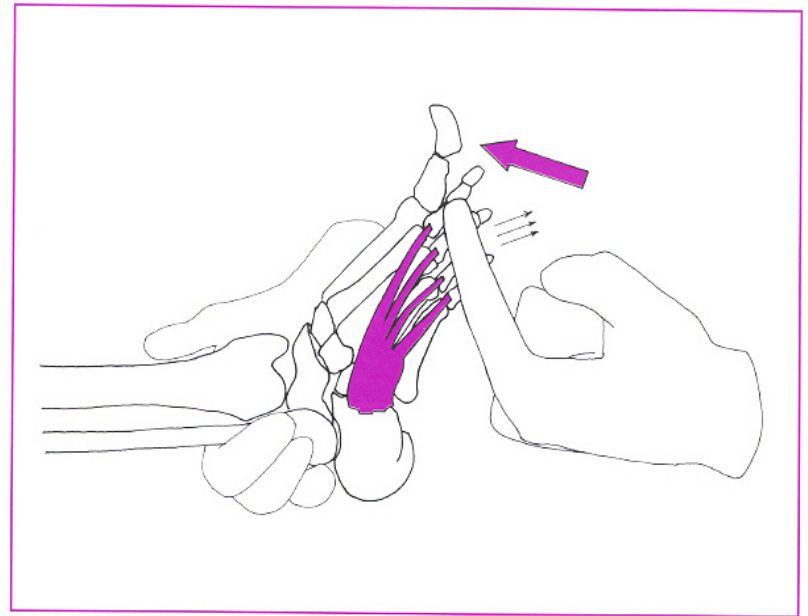


Figure 18.8
Testing extension of the toes

S.G., L5, S1

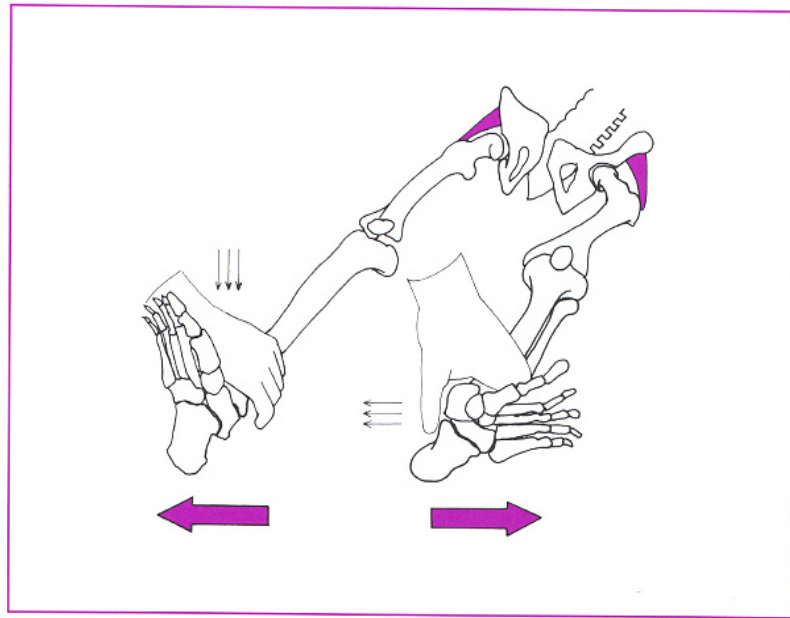


Figure 18.9
Testing strength of hip abductors

Obturator, L2,3

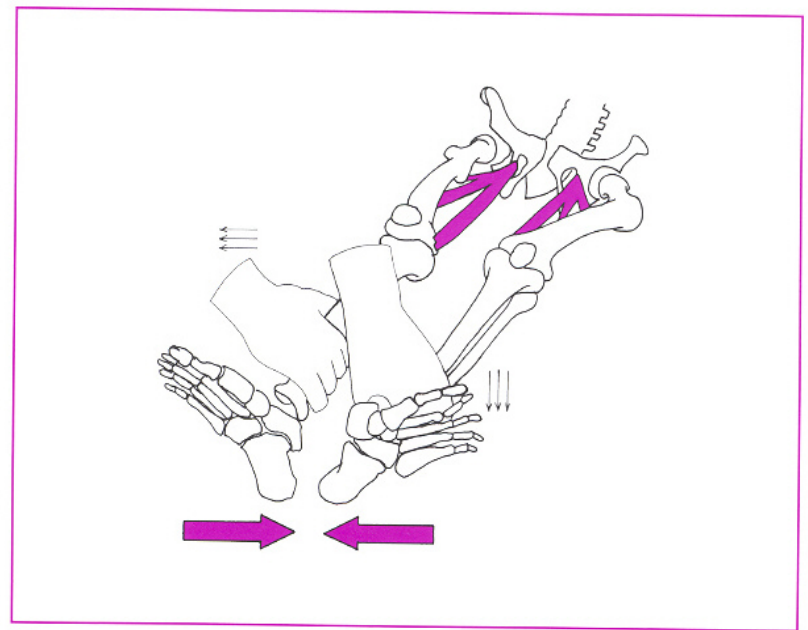


Figure 18.10
Testing strength of right hip adductors

Tibial, L4,5

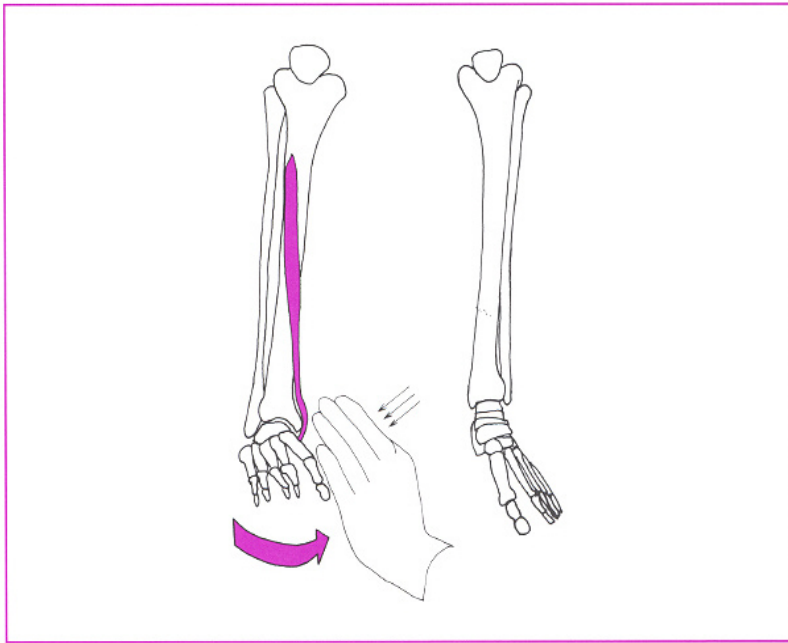


Figure 18.11
Testing inversion of the foot

Sup. Peroneal, L5, S1

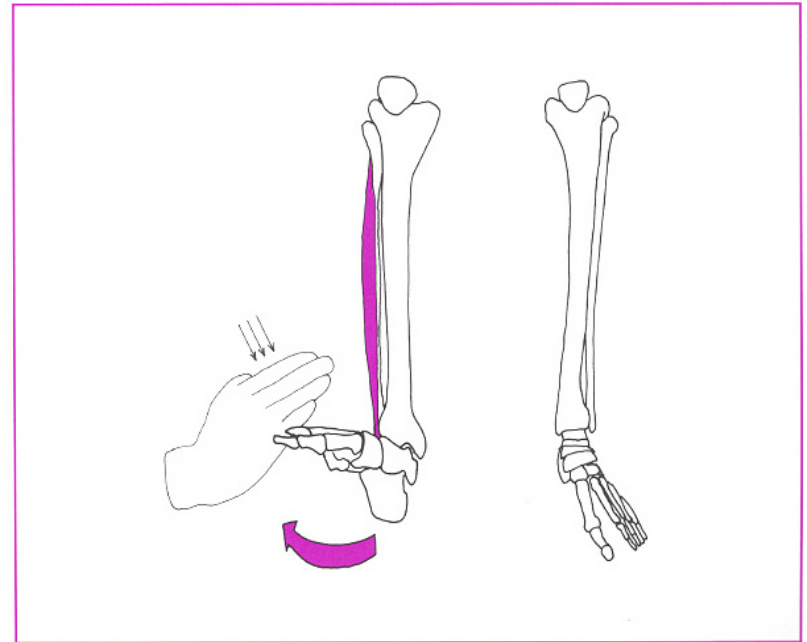


Figure 18.12
Testing eversion of the foot

Grading motor examination

Power when tested is graded conventionally using the Medical Research Council scale (MRC). This is usually amended to divide grade 4 into 4+, 4 and 4–, as below:

- 5 = normal power
- 4+ = submaximal movement against resistance
- 4 = moderate movement against resistance
- 4– = slight movement against resistance
- 3 = moves against gravity but not resistance
- 2 = moves with gravity eliminated
- 1 = flicker
- 0 = no movement

Power should be graded according to the maximum power attained, no matter how briefly this is maintained.

Muscle stretch reflexes

(Deep tendon reflex)

- Use the whole length of the hammer
- Let the hammer swing
- Ensure the patient is **relaxed**
- Avoid telling the Pt. to relax
- MSR stimulates the muscle spindle stretch receptors.
- It is recommended to place a slight tension on the tendon being examined either with positioning the joint or with manually stretching the tendon. (reference: DeMyer, "Technique of the Neurologic Examination").
- Try reinforcement (Frontal lobe distraction, Jendrassik maneuver) if no reflex occurs.



FIG. 7-7. *Biceps reflex.* The Ex's thumb places slight tension on the Pt's biceps tendon. The Ex strikes his thumbnail a sharp blow.

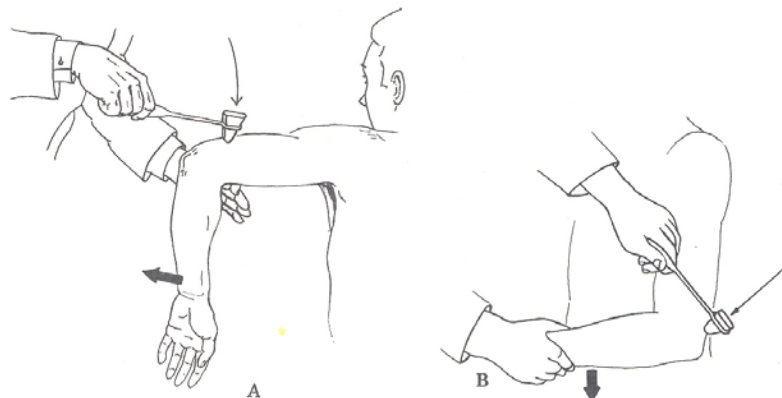


FIG. 7-8. *Triceps reflex.* (A) Dangle the Pt's forearm over your hand and strike the triceps tendon. (B) Cradle the Pt's forearm in your hand and strike the triceps tendon.



FIG. 7-9. *Brachioradialis reflex.* Cradle the Pt's forearm in one hand, placing the thumb on top of the radius. The hammer strikes the Ex's thumbnail rather than the Pt's radius. Don't whack away on the Pt's unprotected bone. Both forearms may be cradled simultaneously to compare more accurately the responses of the two arms.



FIG. 7-13. *Quadriceps femoris reflex, Pt supine.* The Ex bends the Pt's legs to place slight tension on the patellar tendon. The blow then will deform the tendon and transmit a stretch to the muscle.

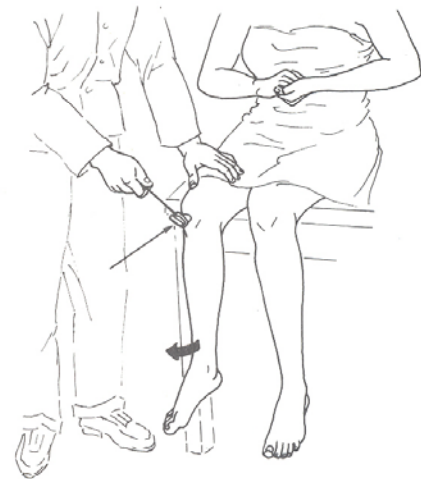


FIG. 7-14. *Pull method (of Jendrassik)* for reinforcing the quadriceps reflex. The Pt locks the hands and pulls apart hard while the Ex strikes the tendon.



FIG. 7-15. *Counterpressure method* for reinforcing the quadriceps reflex. The Ex applies slight thumb pressure (small arrow) against the Pt's tibia. The Pt counteracts the thumb pressure by slight tension in the quadriceps femoris muscle. Then the Ex strikes the quadriceps tendon.

Different ways of performing the same test.

Testing Achilles' reflex Tibial, S1,2

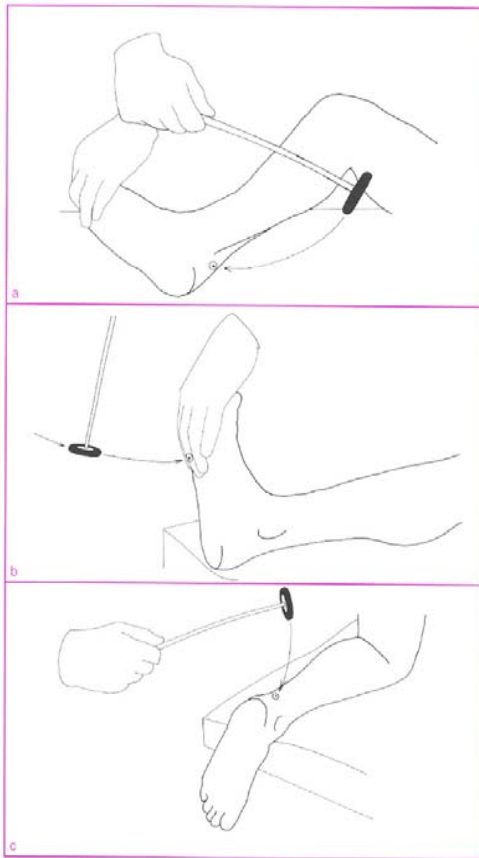


Figure 19.6
The ankle reflex—three ways to get it



FIG. 7-16. *Triceps surae reflex*, Pt sitting. The Pt completely relaxes the leg. The Ex places slight tension on the Achilles tendon by dorsiflexing the foot. Try reinforcement if no reflex occurs.



FIG. 7-17. *Triceps surae reflex*, Pt supine. With the Pt'd, the Ex dorsiflexes the Pt's to control the tension on the triceps surae muscle. Try reflex occurs.

M.C., C5,₆
Radial, C7

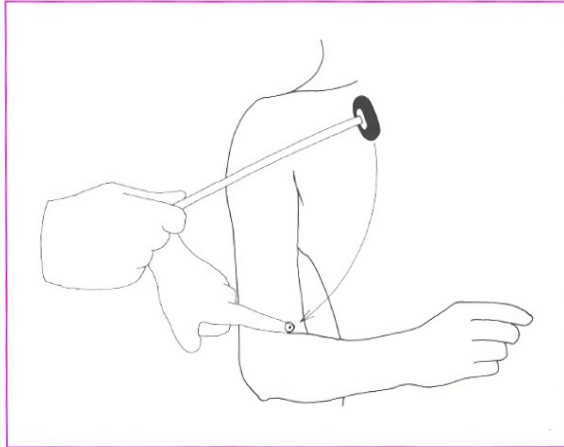


Figure 19.2
Testing the biceps reflex

Radial, C6
Femoral, L3,4

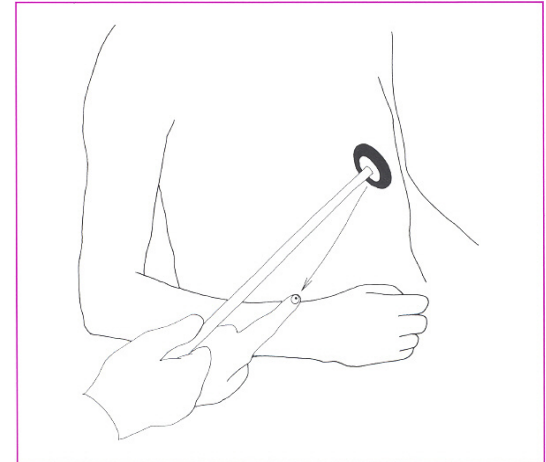


Figure 19.3
Testing the supinator reflex

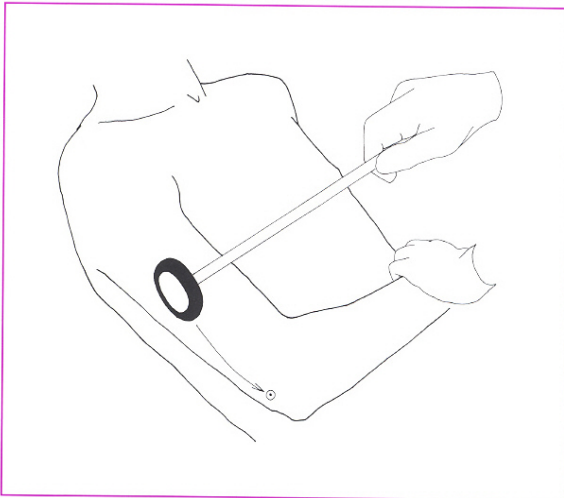


Figure 19.4
Testing the triceps reflex

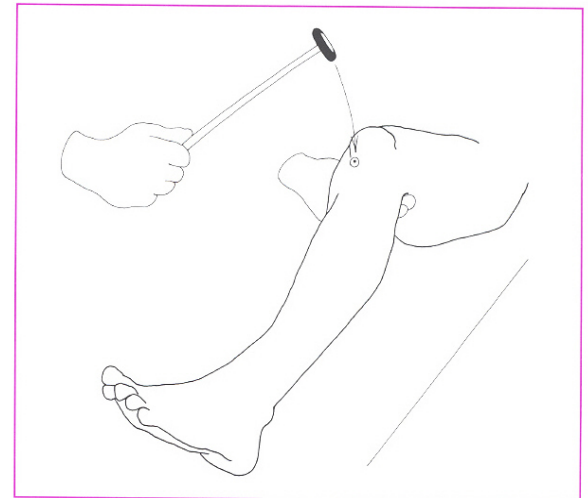


Figure 19.5
Testing the knee reflex

Jendrassik maneuver:

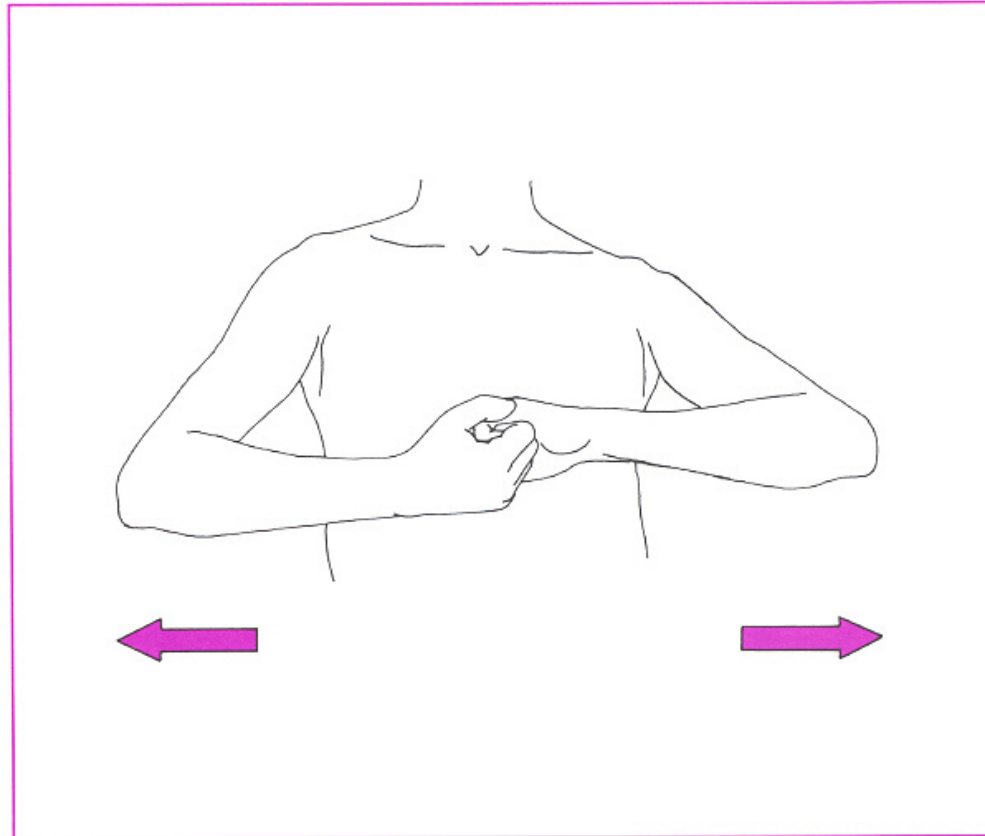


Figure 19.7
Reinforcement

Grading reflexes

0	= absent
±	= present only with reinforcement
1+	= present but depressed
2+	= normal
3+	= increased
4+	= clonus

Sensory examination

- Perform bilaterally
- It is a subjective evaluation
- Compare the two sides for quantity and quality differences
- Identify accurate and non-accurate modalities
- Non-accurate modalities have a 2-3 level overlap
- Hypoesthesia, hyperesthesia, paresthesia

TABLE 9.1 Five Important Nerves in the Arm

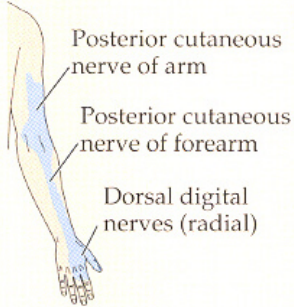



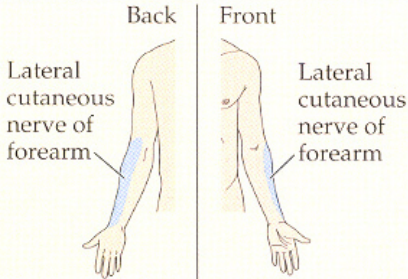
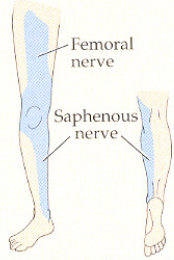

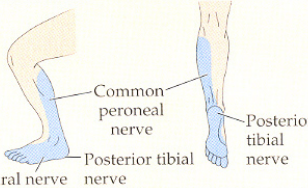
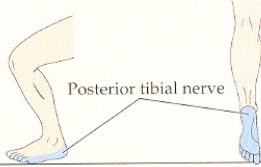
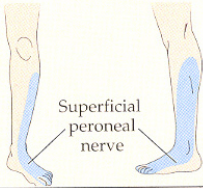

NERVE	MOTOR FUNCTIONS	REGION OF SENSORY LOSS WITH NEUROPATHY
Radial nerve	Extension at all arm, wrist, and finger joints below the shoulder, forearm supination, thumb abduction in plane of palm	 <p>Posterior cutaneous nerve of arm Posterior cutaneous nerve of forearm Dorsal digital nerves (radial)</p>
Median nerve	Thumb flexion and opposition, flexion of digits 2 and 3, wrist flexion and abduction, forearm pronation	 <p>Median nerve</p>
Ulnar nerve	Finger adduction and abduction other than thumb, thumb adduction, flexion of digits 4 and 5, wrist flexion and adduction	 <p>Ulnar nerve</p>
Axillary nerve	Abduction of arm at shoulder beyond first 15°	 <p>Axillary nerve</p>
Musculo-cutaneous nerve	Flexion of arm at elbow, supination of forearm	<div> <div>Back</div> <div>Front</div> </div>  <p>Lateral cutaneous nerve of forearm Lateral cutaneous nerve of forearm</p>

TABLE 9.3 Important Nerves in the Leg

NERVE	MOTOR FUNCTIONS	REGION OF SENSORY LOSS WITH NEUROPATHY
Femoral nerve	Leg flexion at the hip, leg extension at the knee	 <p>Femoral nerve Saphenous nerve</p>
Obturator nerve	Adduction of the thigh	 <p>Obturator nerve</p>
Sciatic nerve	Leg flexion at the knee (see also tibial and peroneal nerves below)	 <p>Common peroneal nerve Posterior tibial nerve Sural nerve</p>
Tibial nerve	Foot plantar flexion and inversion, toe flexion	 <p>Posterior tibial nerve</p>
Superficial peroneal nerve	Foot eversion	 <p>Superficial peroneal nerve</p>
Deep peroneal nerve	Foot dorsiflexion, toe extension	 <p>Deep peroneal nerve</p>

Vibratory sense

- 128 Hz tuning fork



Vibration sense

May use a bony prominence or muscle location.
Be sure to interpret the results appropriately.

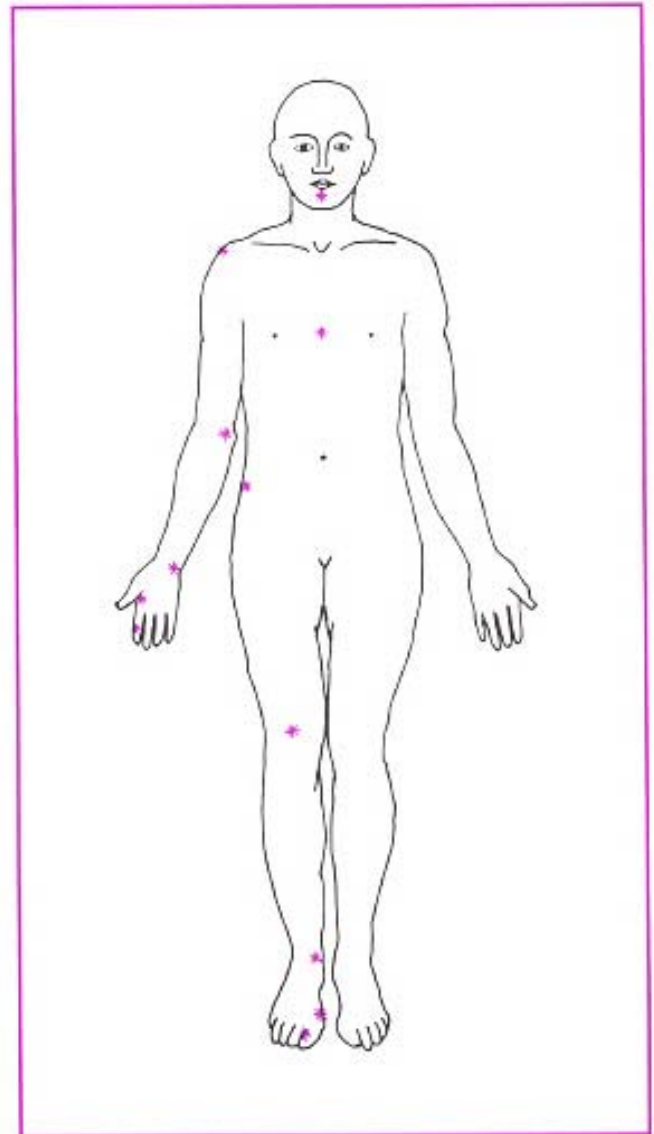
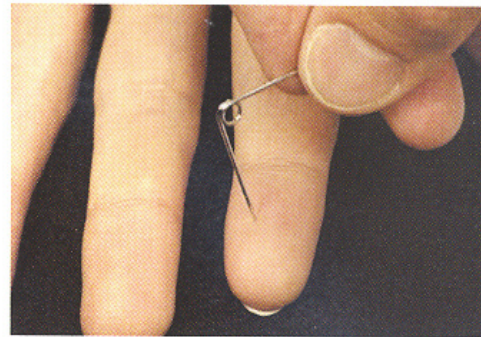
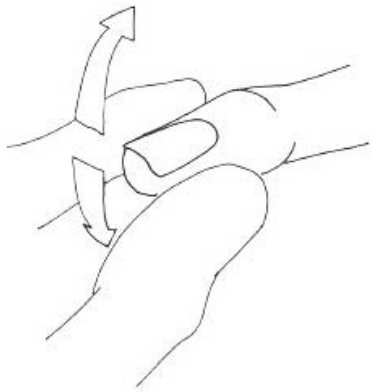


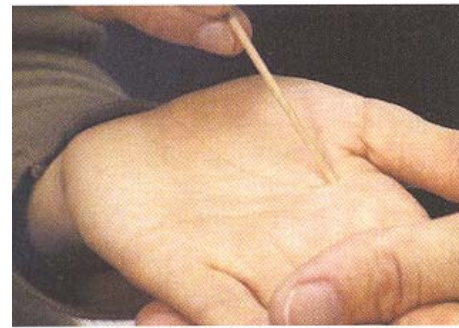
Figure 21.7

Potential sites for testing vibration sense

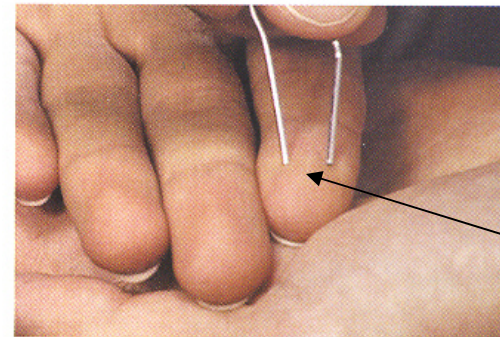
Joint positioning sense, Pin Prick, Light touch, Temperature sensation,
Two-point discrimination, and Fine touch.



Pinprick



Temperature sensation



Two-point discrimination

Better to use
aesthesiometer
as this method
is highly
inaccurate

Figure 21.8
How to test joint position sense

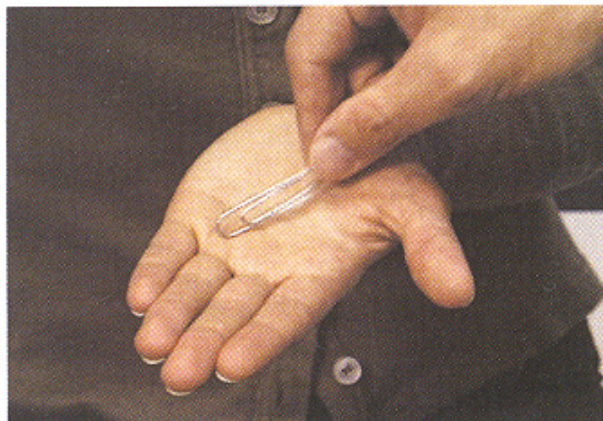
Grading sensory examination

- Subjective
- Identify modality
- Assess location of dysfunction – nerve, nerve root, plexus, spinal cord, brainstem, thalamus-cortex
- Do they feel? What do they feel? How does it compare?
- Hypoesthesia, hyperesthesia, paresthesia

Graphesthesia, Graphognosis, Stereognosis, Sensory inattention, Barognosis



Graphesthesia



Stereognosis



Tactile extinction

Graphesthesia – do they feel you writing on their hand

Graphognosis – do they know what you wrote on their hand

Barognosis – ability to discern weight of an object in their hand

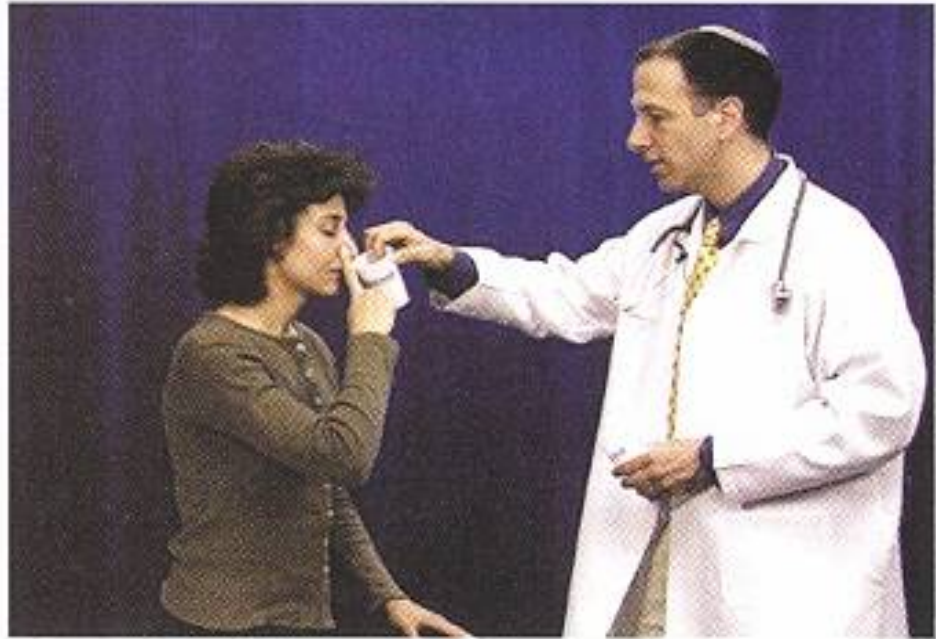
Sensory inattention found primarily in the non-dominant right hemisphere

Cranial nerves examination

- 12 pair primarily (some with identify cranial nerve 0 which is part of olfaction)
- Organization by functional classification – 3,4, and 6; 5,7,9, and 10; 7,9,and 10; etc.
- Somites – midline – 3,4,6, 12, and erector spinae
- Useful for localization of dysfunction – lateral gaze palsy, facial paresis, tongue deviation, lazy eye, affect

Olfactory nerve:

- Cribriform plate
- Diencephalon
- Temporal lobe
- Anosmia, parosmia
- Lesions cause perverse behaviours associated with the anterior temporal lobe



Olfaction

The eye (pupils, acuity, fields)

- Pupils

- PERRRLA – size, shape, regularity, reactivity, accommodation (near / far)

Acuity

- Focal distance

- Ocular problem- dense cataracts

- Optical problem- Abnormal focal length

- Retinal or retro-orbital lesion

- Fields

- Peripheral and Central

- Monocular field defect

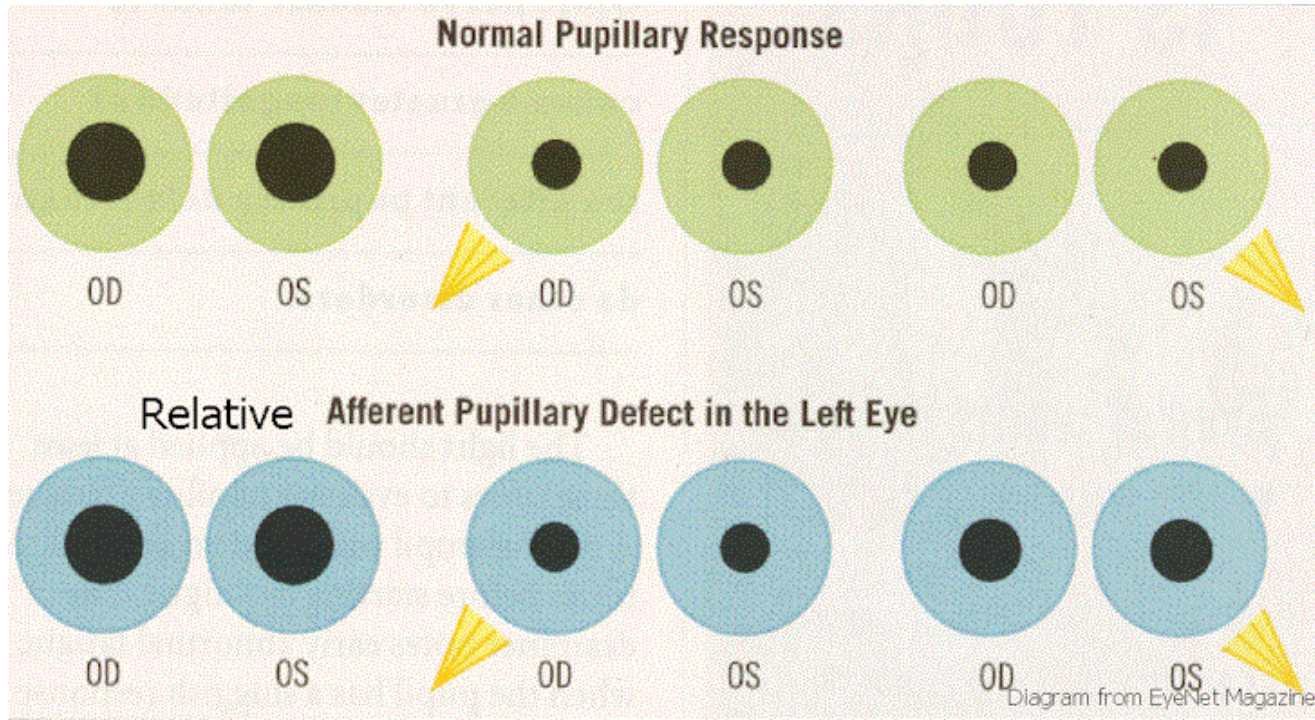
- Bitemporal field defect

- Incongruous homonymous field defect

- Congruous homonymous field defect

Swinging light test:

- One second intervals
- Relative afferent pupillary defect
 - Marcus Gunn pupil

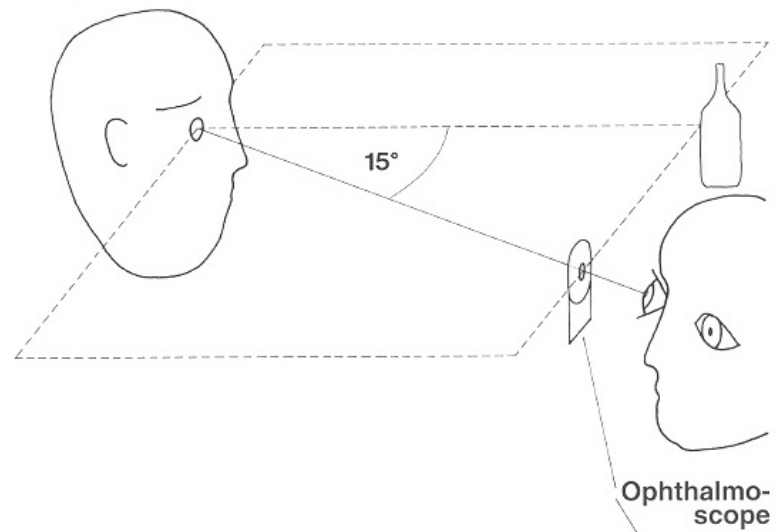


Pupils:

- Anisocoria
- Senile miosis
- Holmes-Adie pupil
- Afferent pupillary defect
- Argyll Robertson pupil
- Horner's syndrome
 - Centrally
 - Peripherally

- Snellen's Chart
 - Look through a pinhole / use lenses
- Visual inattention / neglect
- Blind spot test – anatomic / physiologic

patient



Section of the eye through the horizontal plane

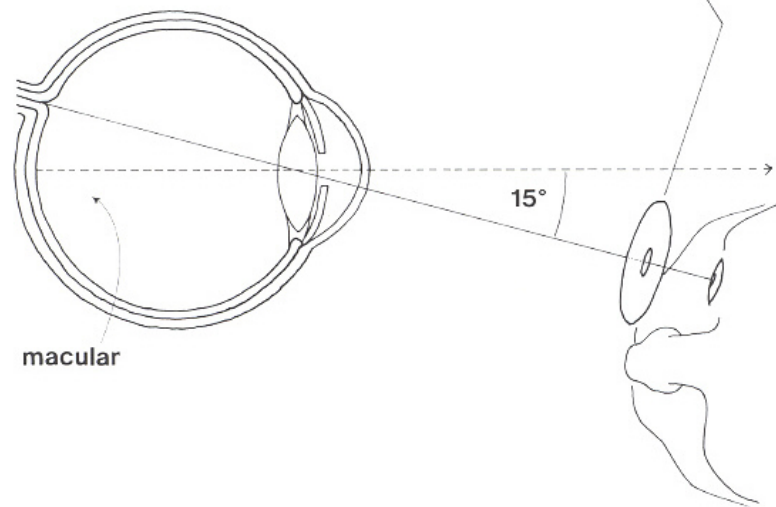
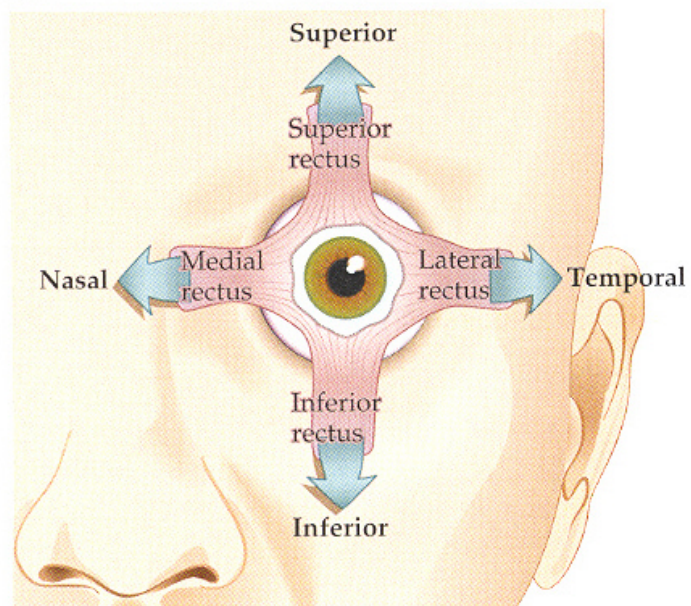


Figure 8.2
Approaching the patient with an ophthalmoscope

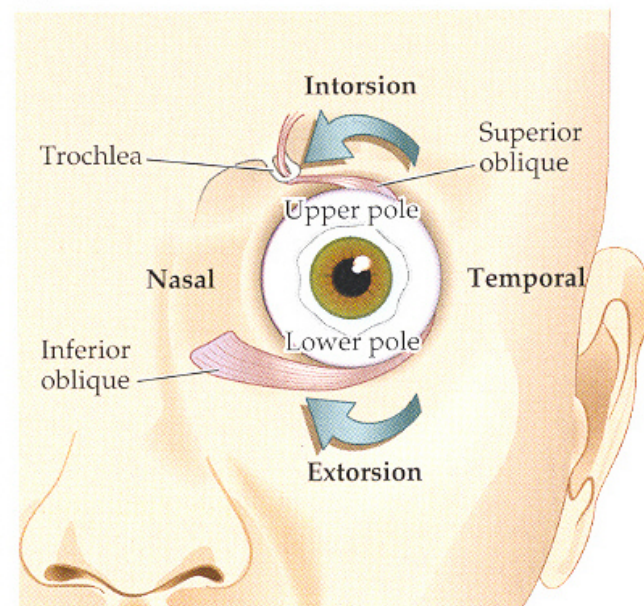
Eye movements:

- Saccadic eye movements (Frontal)
- Pursuing eye movements (Occipital – Parietal)
- Vestibular-positional eye movements – VOR, Head Impulse Test
- Convergence

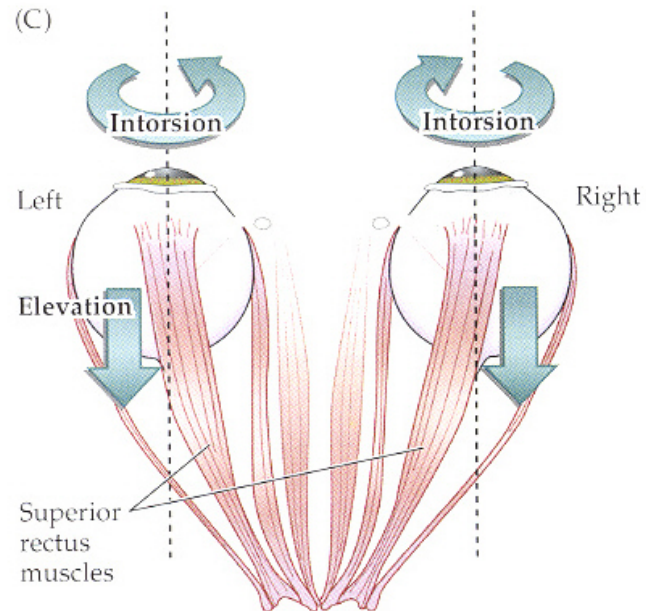
(A)



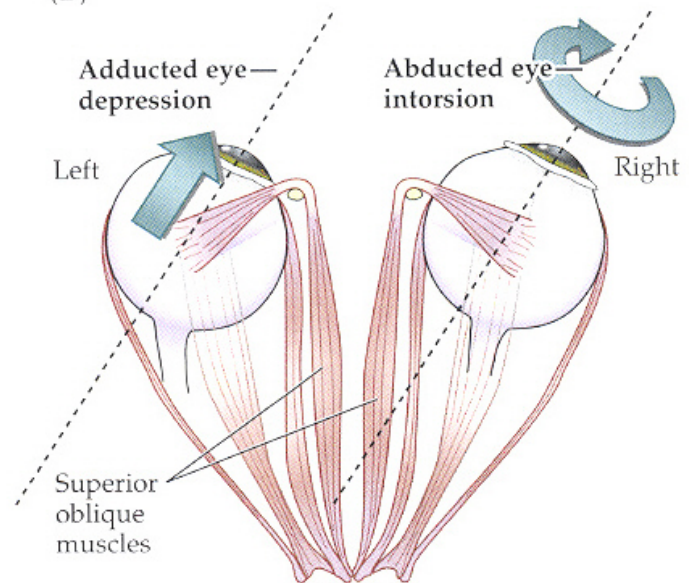
(B)



(C)



(D)

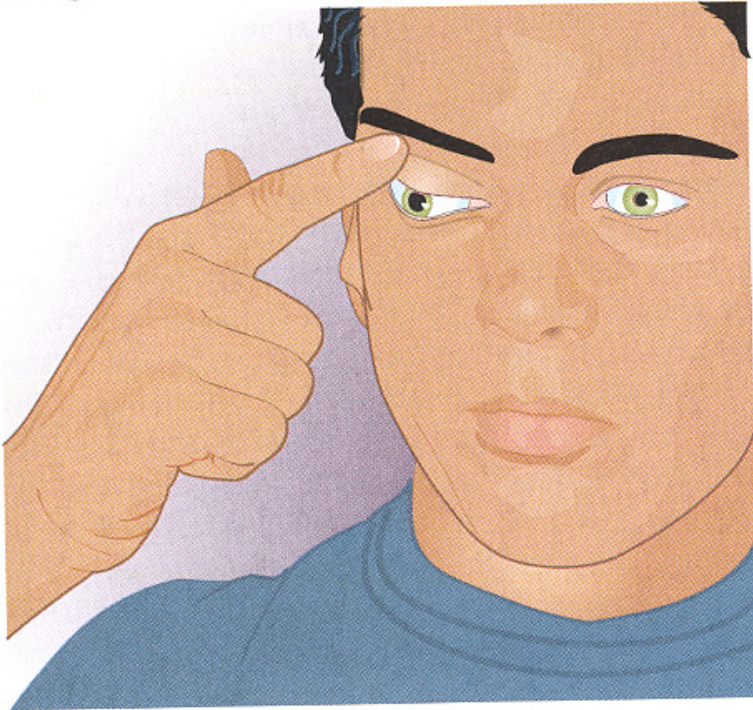


Double vision:

- False and True images
- Establish the direction where the images are widest apart
- Doll's eye maneuver
 - Unconscious patient, discern brainstem from cortex
- VI nerve palsy (inward deviation)
- III nerve palsy (outward deviation)
- IV nerve palsy (head tilt and rotation)
- Internuclear ophthalmoplegia (cn 6 drives cn 3; lesion is usually on side of weak adduction)

- Ask the patient to look at different directions and to tell when he sees two images of a single object the farthest apart.

(A) Right oculomotor nerve (CN III) palsy



(B)

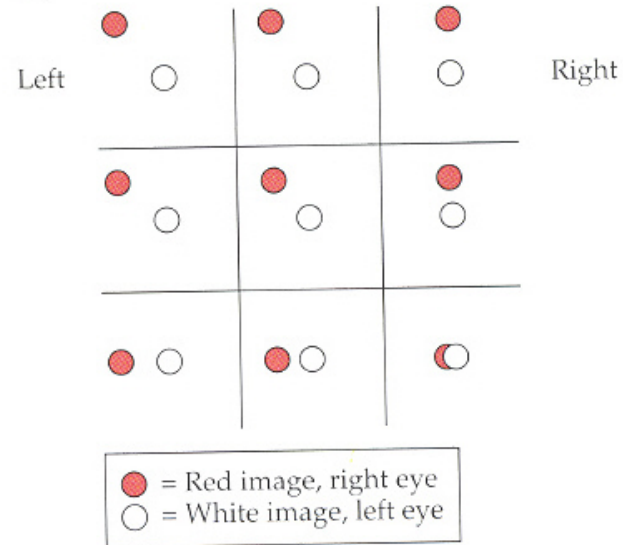


Figure 13.5 Oculomotor Nerve (CN III) Palsy (A) Appearance of eyes in the presence of a right oculomotor nerve palsy. (B) Results of red glass testing with right oculomotor nerve palsy. Red glass was placed over the right eye.

Cover / Uncover Test

- Cover test
 - Latent Strabismus
 - exophoria vs. exotropia and esophoria vs. esotropia

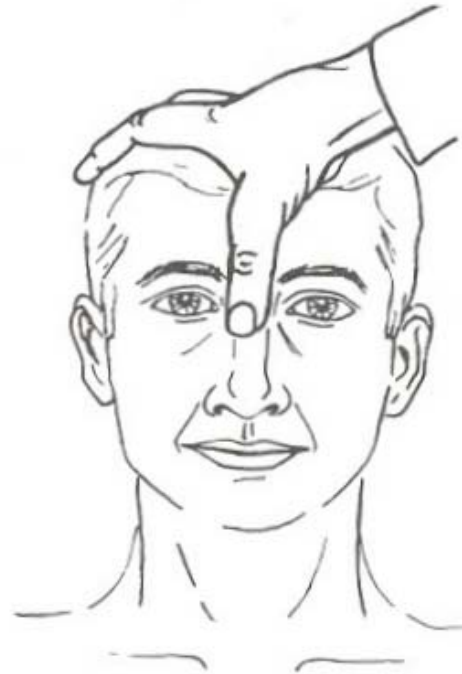


FIG. 4-22. Resting position of the Ex's thumb for the cover-uncover test.

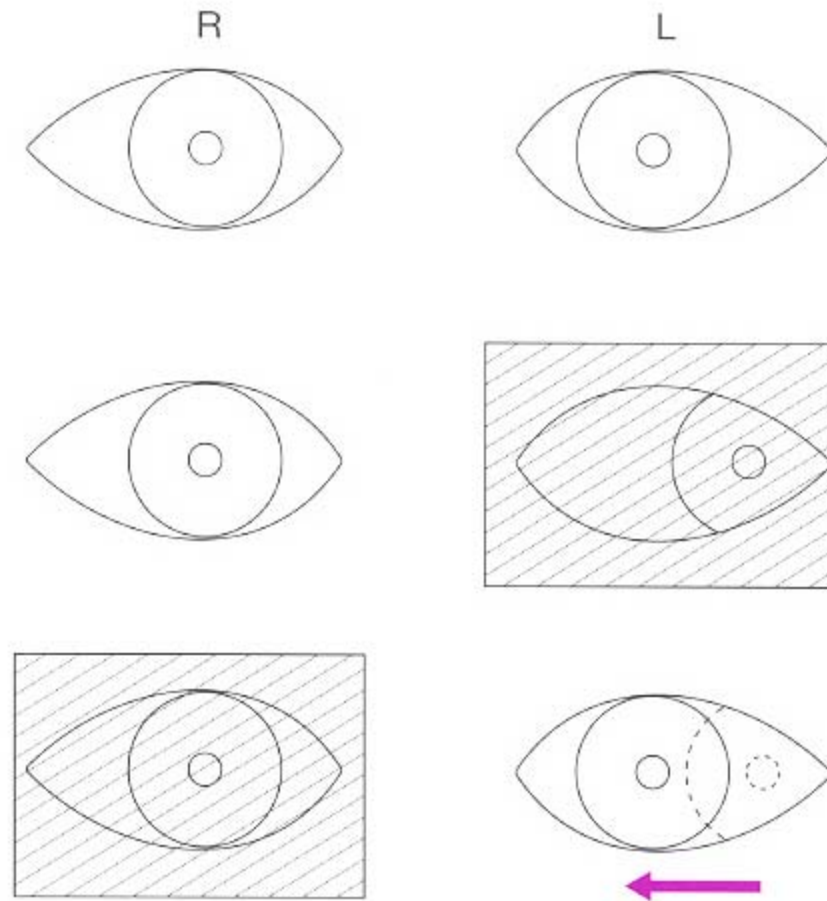


Figure 9.3
The cover test—for explanation, see text

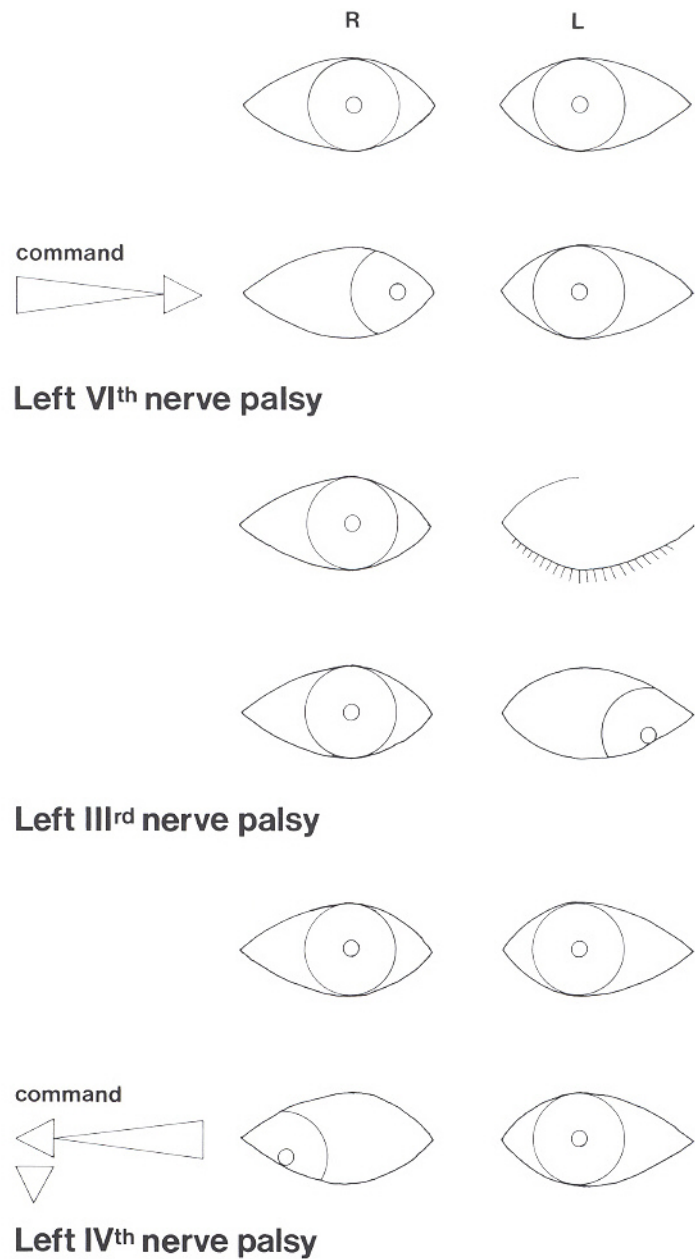


Figure 9.4
Single nerve palsies

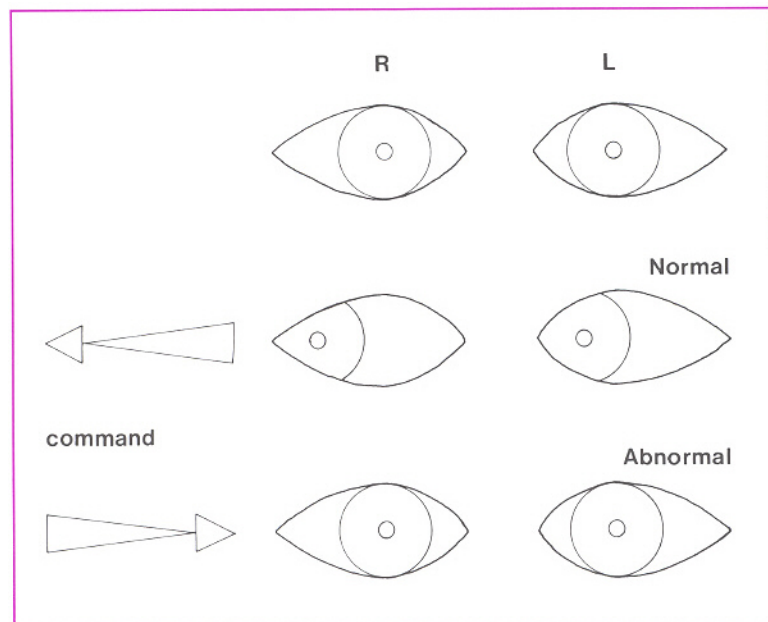


Figure 9.5
Left lateral gaze palsy

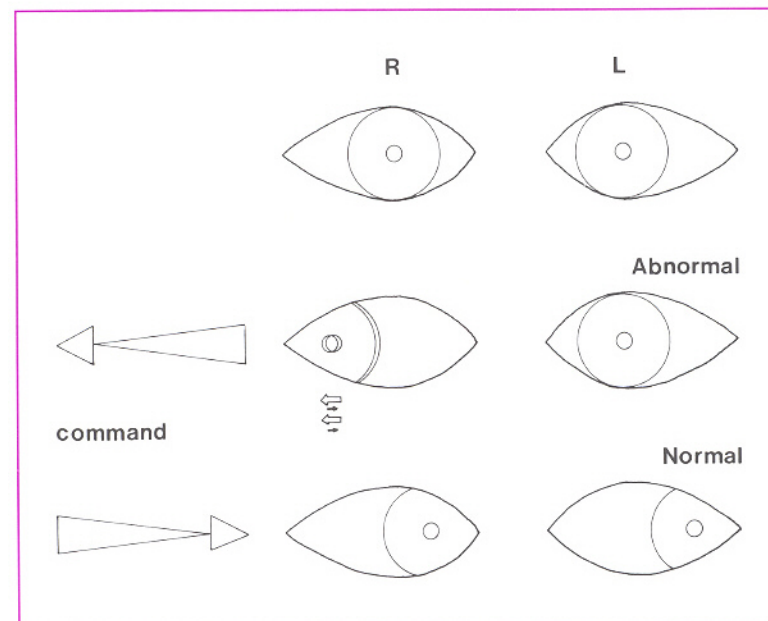


Figure 9.6
Left internuclear ophthalmoplegia

Trigeminal:

- **Sensory**
 - **Ophthalmic, maxillary, mandibular branches loss**
 - **Muzzle loss- Syringomyelia**
- **Motor**
 - **Mandibular**
- **Jaw jerk reflex**
- **Corneal reflex (5 & 7)**
- **Hearing (Tensor Tympani)**

Exam



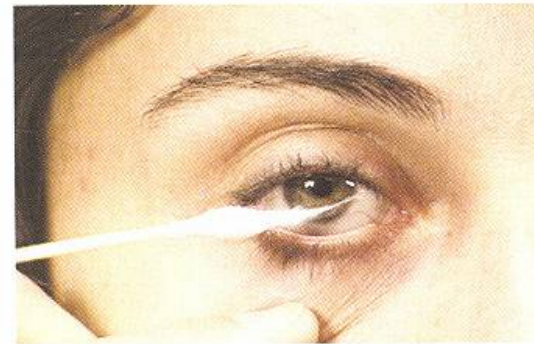
Facial muscles



Taste



Hearing



Corneal reflex

Facial nerve:

- Face, ear, taste, tear**
- Symmetry**
- Bell's palsy and Bell's phenomenon**
- External auditory meatus sensory**
 - Ramsey Hunt syndrome**
- Taste (salt and sugar)**
- Hearing**
- Salivation and lacrimation**

Look at the face generally

- Emotional paralysis**
- Abnormal movements**
- Medical syndrome**

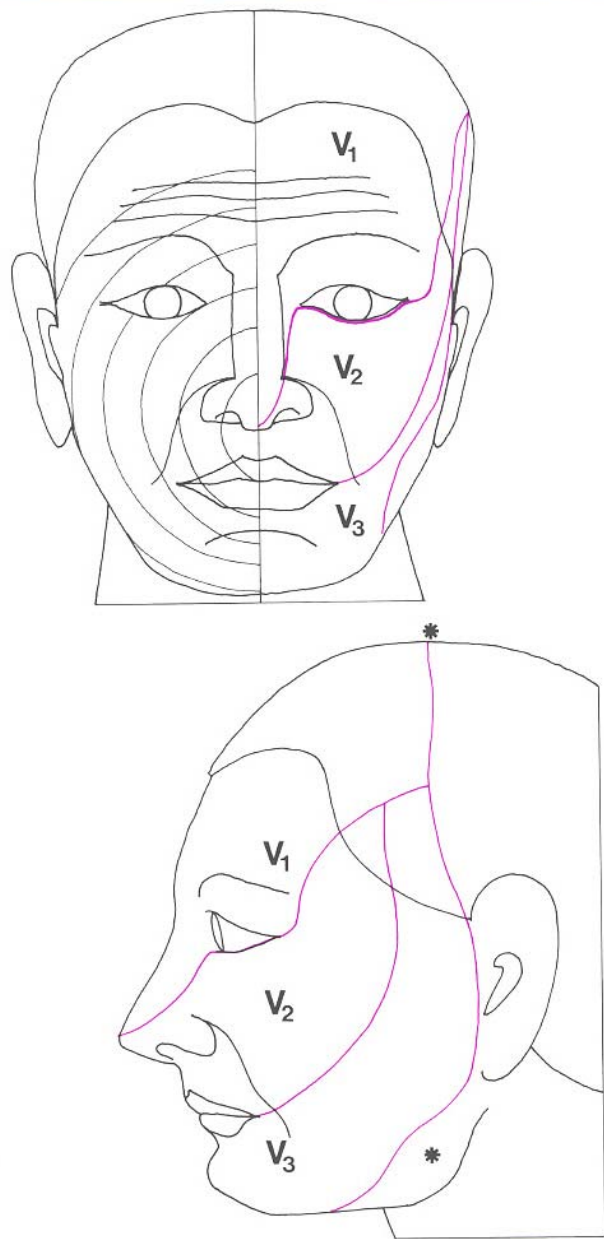


Figure 11.1
 Facial sensation: Left side—ophthalmic (V_1), maxillary (V_2) and mandibular (V_3) divisions of the trigeminal nerve. Right side—muzzle pattern of innervation. Rings further from the nose go further down the brainstem *N.B. Angle of the jaw is not supplied by trigeminal nerve

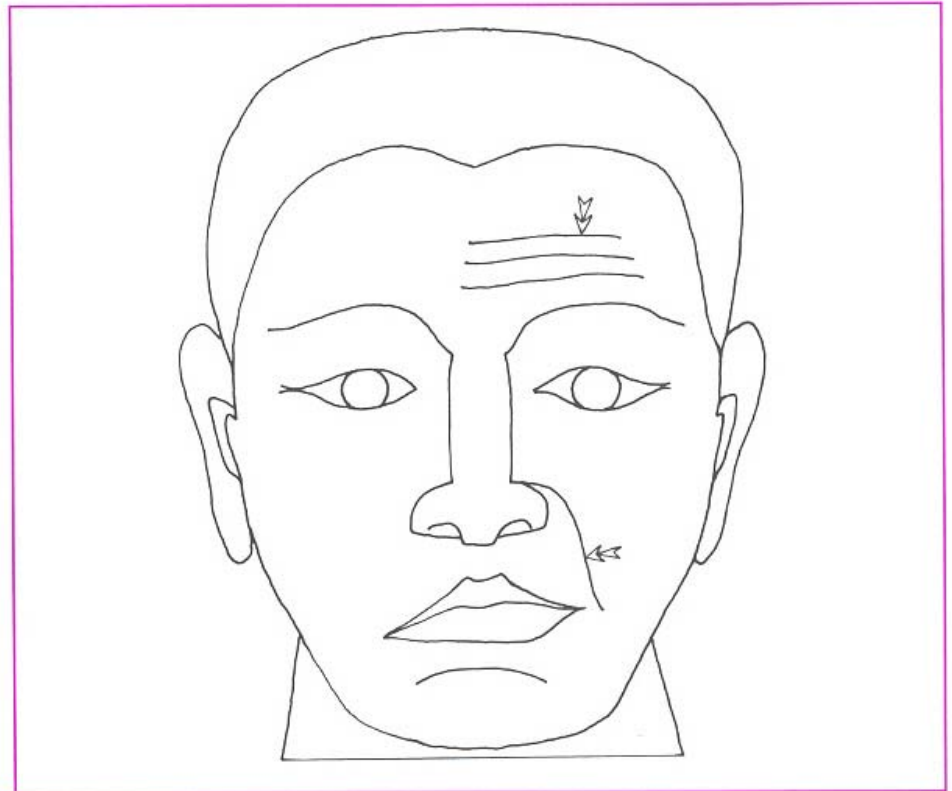


Figure 11.2
 Right-sided lower motor neurone VII—note absent facial lines, droopy mouth

Auditory nerve

- Test the hearing**
- Rinne's test (AC)**
- Weber's test (BC)**
 - Conduction vs. sensorineural deafness**

Vestibular nerve

- Heel-toe walking**
- Nystagmus**
- Caloric testing**
- Hallpike's maneuver**
- Turning test (Mittlemeyer's)**
- OPK testing**

Weber's and Rinne's test

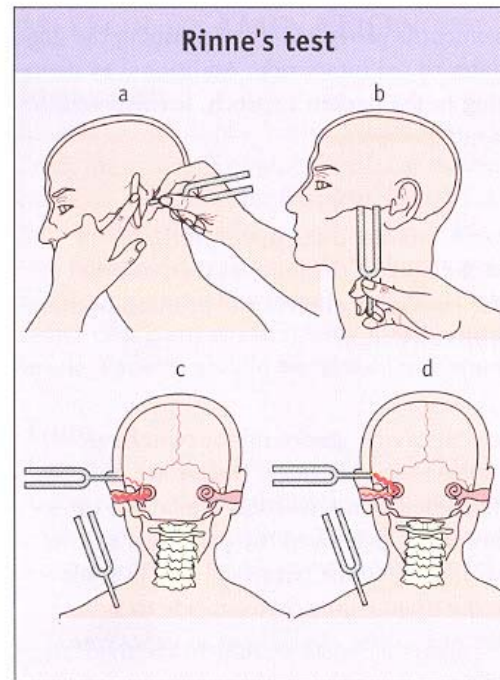


Fig. 1.19 Rinne test. Comparison of (a) bone conduction and (b) air conduction, (c) perceptive deafness and (d) conductive deafness.

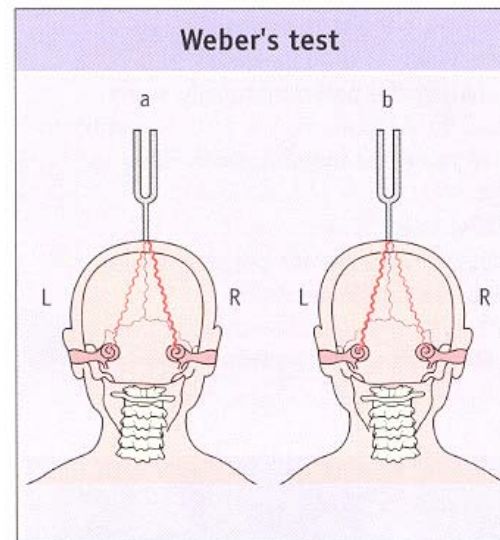


Fig. 1.20 Weber's test. Left-sided perceptive deafness (a) and left-sided conductive deafness (b).

The down ear is being excited or facilitated

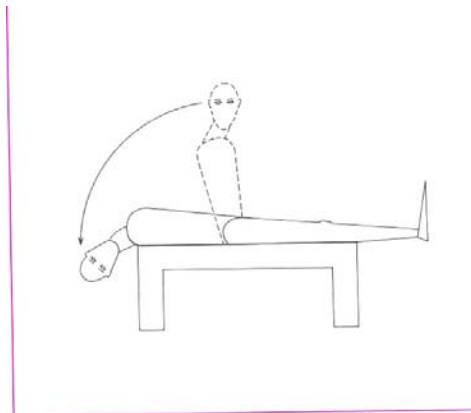
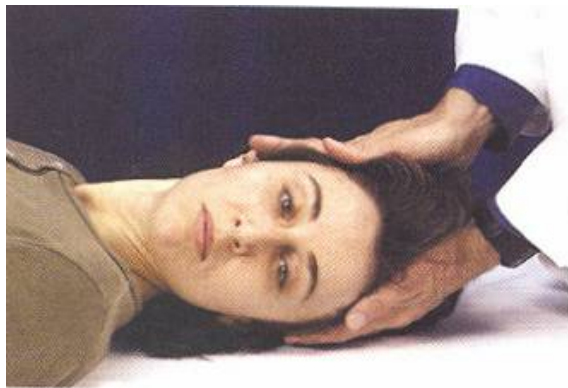


Figure 12.1
Hallpike's manoeuvre



Positional vertigo test



Oculocephalic testing



OKN

- **Glossopharyngeal (IX)**
 - **Sensory: Tongue, pharynx, middle ear**
 - **Motor: Stylopharyngeus**
 - **Autonomic: Parotid gland**
- **Vagus (X)**
 - **Sensory: Tympanic membrane, ext. auditory canal, external ear**
 - **Motor: Palate, pharynx, larynx**
 - **Autonomic: Carotid baroreceptor, parasympathetic thorax and abdomen**
- **Hypoglossal (XII)**
 - **Motor: intrinsic tongue muscles**
- **Look at the tongue appearance**
- **Assess weakness, repeated movements, test speech**
- **Uvula positioning**
- **Gag reflex**

Spinal Accessory nerve:

- **- Trapezius**
- **- Sternocleidomastoid**
 - Ipsilateral corticobulbar to SCM**
 - Contralateral corticobulbar to Trapezius**
- **Lower motor neuron – pt looks to the low shoulder**
- **Upper motor neuron – pt looks to the high shoulder**

Vestibulo-cerebellar tests and signs

- **Balance / Coordination**

- Gait – spastic, ataxic, apraxic, dyskinetic, steppage, hemiplegic**

- Outstretched arms test (Pronator Drift)**

- Finger-nose test, Finger-to-Finger**

- Heel-shin test**

- Feet- Incoordination**

- Truncal Ataxia**

- Archimedes spiral test**

- Muscle tone test**

- Diadochokinesia**

- Romberg's test**

- Heel-toe test**

- March in Place**

- Turn / Mittlemyer's**

- One Leg Stand**

- **Do tests with eyes open and then with eyes closed to remove visual cuing**

Reflexes / Frontal Release Signs

Primitive reflex

Snout reflex

Palmo-mental reflex

Grasp reflex

Superficial reflexes

Superficial abdominal reflex

Tests for meningeal irritation

Brudzinski's sign

Kernig's sign

- **Gait analysis**
 - **Observe patient's gait**
 - **Note their performance – initiation, speed, termination; what is muscle imbalance, tone, strength, etc..**

Special Tests

Tinel's test

Lhermitte's phenomenon (sign)

Straight leg raising

UMNL tests

Tromner's test – UPEX, finger up

Hoffman's test – UPEX, finger down

Babinski test – sole of foot, S1

Chaddock test – lateral aspect of foot, S1

Schaeffer test – squeeze the Achilles, S1

Oppenheim test – scrape down the tibia, L5

Gordon test – Squeeze the calf, S1

**Bing test – sharp pin just distal to 5th metatarsal,
S1**

**Gonda Stransky test – pull the 4th toe down,
hard and quick, S1**

Around the level of C3-5 cervical vertebrae (carotid bifurcation)

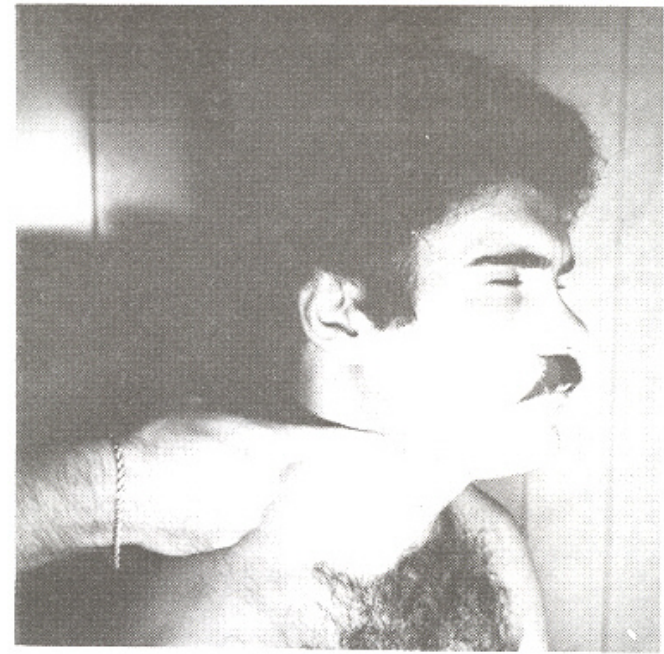


Figure 32

CAROTID SINUS: Reflex

Procedure: Pressure over the carotid sinus in the neck (at the level of the Carotid Artery bifurcation) produces slowing of the heart rate and a fall in blood pressure (Fig. 32).

Significance: This reflex is abolished with lesions of Cranial Nerves IX (afferent branch) and X (efferent portion).

The reflex is hyperactive in certain persons with vasomotor instability, e.g. cardiac disease, hyper or hypotension, etc. in which slight stimulation of this sort could produce fainting or worse.

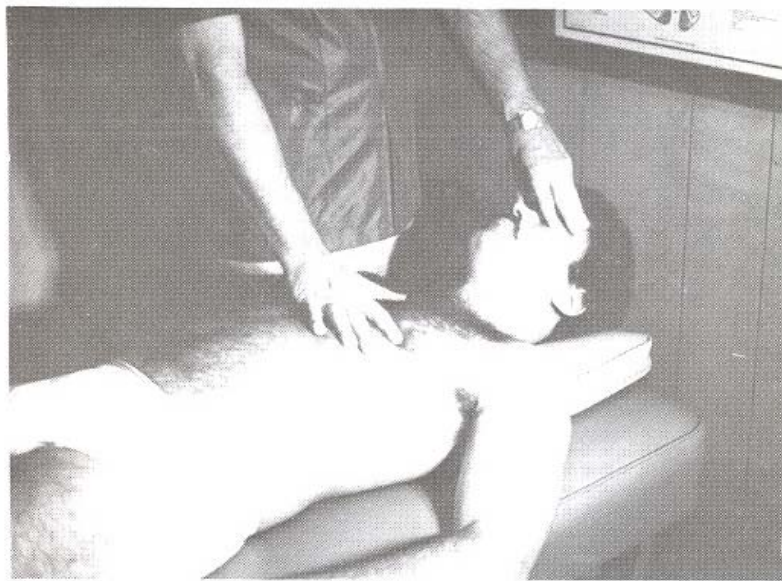


Figure 106

OCULOCARDIAC: Reflex

Procedure: For one minute the examiner monitors the heart rate of the patient in a comfortable position of recumbency, then with the patient in the supine position and the eyelids closed, the examiner palpates the cardiac apex impulse directly (best method), the Carotid Artery, or the Radial Artery (worst method), while applying tolerable digital pressure over the eyeballs. A slowing of from 5 to 13 beats per minute is normal (Fig. 106).

Significance: A slowing of from 13 or more, or from 1 to 5 beats indicates a lesion of Cranial Nerves V or X.

When ocular compression produces an acceleration of the heart it is called Inverted Oculocardiac Reflex with the same significance as above.

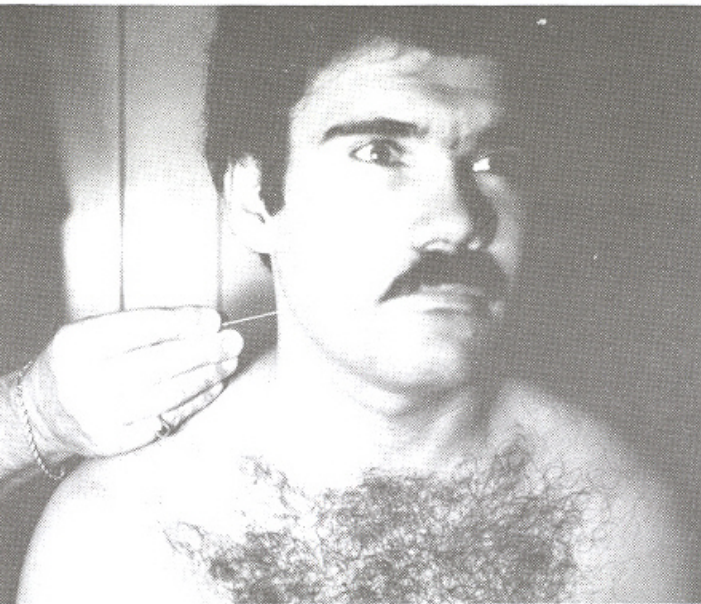


Figure 35 A

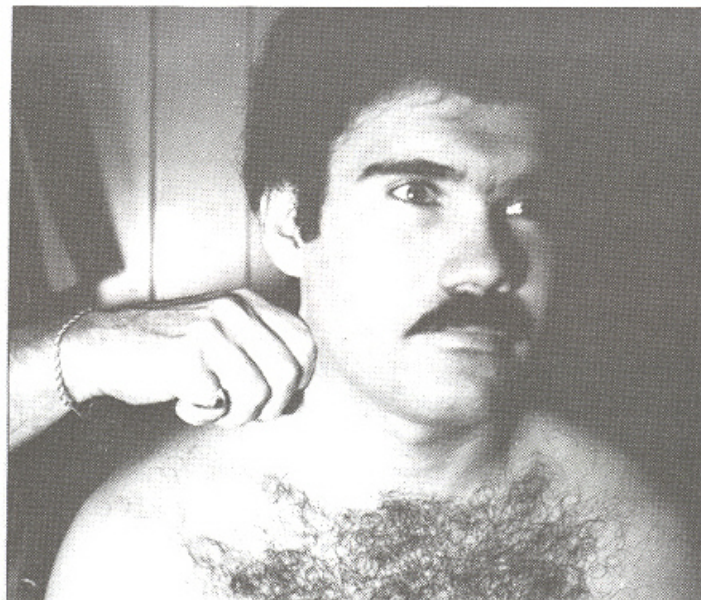


Figure C
Pupillary Dilatation

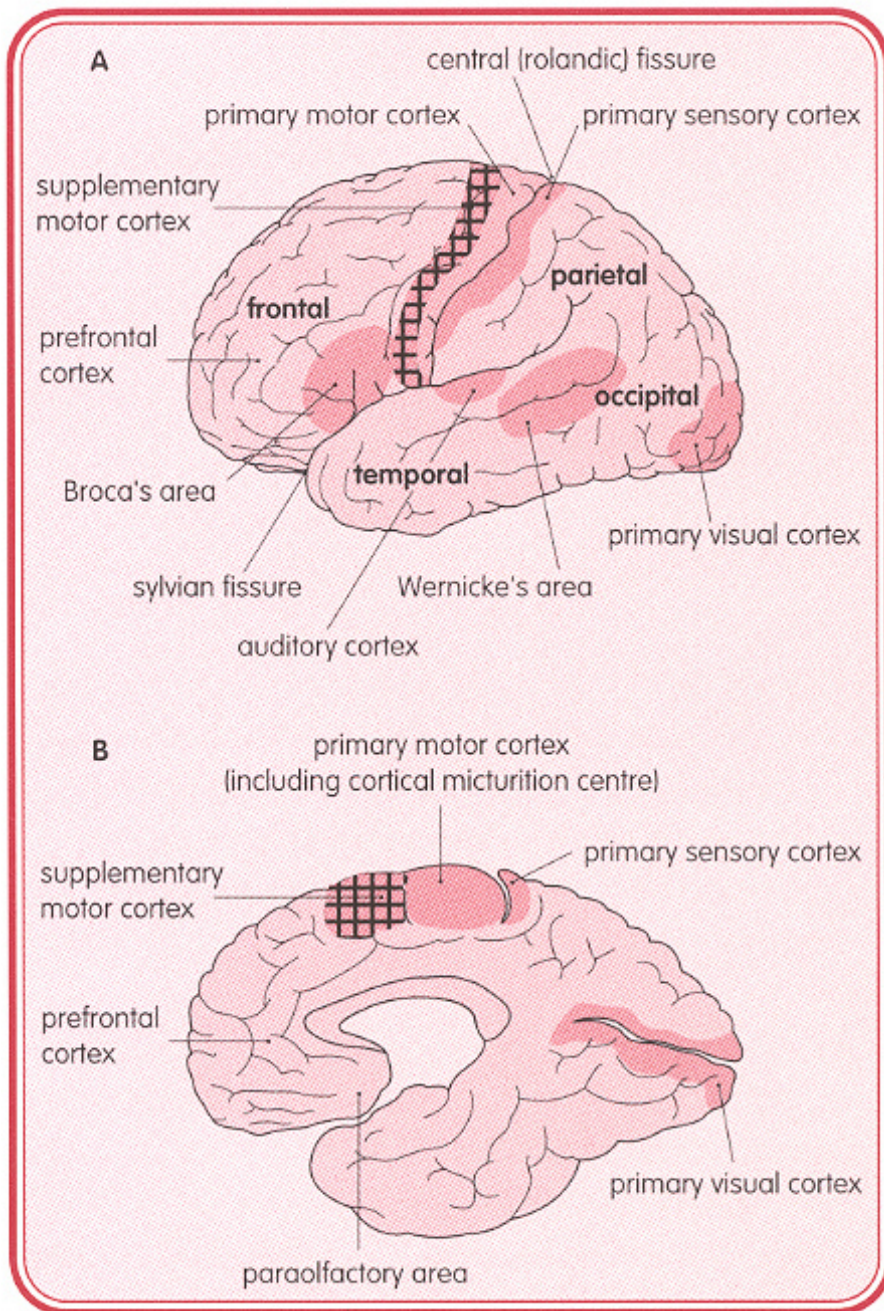
CILIOSPINAL: Reflex

Procedure: The production of painful stimulation of the skin of the neck such as sharp pinching, pin prick, etc., dilate the pupil (Figs. 35 A & B).

Significance: This reflex is dependent upon the integrity of the cervical sympathetics and is lost with their interruption (Horner's Syndrome).

Synonym: Cutaneous Pupillary Reflex

Brain



frontal lobe

contralateral mono-/hemiparesis, facial weakness

Broca's dysphasia: motor, expressive dysphasia (dominant)

behavioural change: social disinhibition, loss of abstract thought, apathy, mutism

primitive reflexes: grasp and sucking

apraxic gait

incontinence

parietal lobe

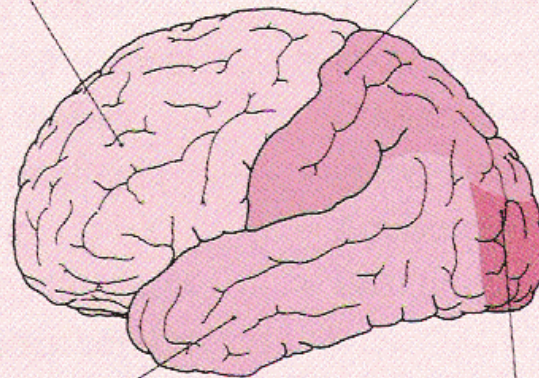
contralateral discriminatory sensory impairment

Wernicke's dysphasia: sensory, receptive dysphasia (dominant)

visual field deficit: contralateral lower homonymous quadrantanopia

dominant syndromes: Gerstmann's syndrome, bilateral ideomotor and ideational apraxia

non-dominant syndromes: constructional apraxia, dressing apraxia, contralateral sensory inattention



temporal lobe

Wernicke's dysphasia: sensory receptive dysphasia (dominant)

auditory agnosia: inability to recognize sounds (non-dominant)

visual field deficit: contralateral upper homonymous quadrantanopia

learning difficulties: auditory (dominant) and visual (non-dominant) information

memory impairment

emotional disturbances: aggression, rage, hypersexuality

olfactory and gustatory hallucinations

occipital lobe

visual field deficit: contralateral homonymous hemianopia
lesions of posterior cerebral artery — spare the macula
lesions of the middle cerebral artery/occipital pole —
contralateral macular homonymous hemianopic field defect

visual agnosia: impaired recognition of faces and objects

visual illusions: disturbance of size, shape, colour and number of objects

visual hallucinations: unformed and formed