

Action of Autonomic drugs on the eye

The eye presents a special advantage that drugs applied to the conjunctiva pass directly through lymph canals into the eye ball to produce local effects.

Both the Iris & the ciliary muscle are under the control of the autonomic nervous system.

The Iris contains two layers of smooth muscle:-

1-(the sphincter M. Circular smooth M.) ,

2- (dilator M. Radial smooth M.)

-the sphincter M. receives only parasympathetic (ACH)released from the postganglionic neuron cause contraction of the muscle fiber , the pupil thus contracts(myosis)

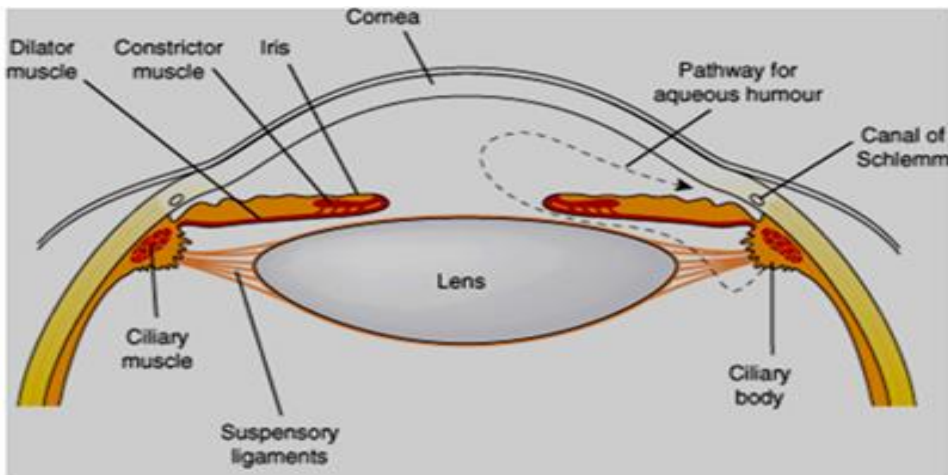
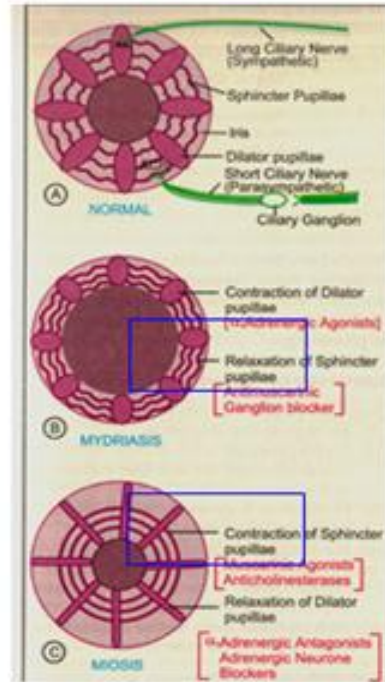
-the dilator pupils received only a sympathetic (NE)released from the postganglionic neuron

Cause contraction of the muscle fibers the pupil dilates (mydriasis).

Ciliary muscle received only parasympathetic ACH evokes ciliary m, contraction and the eye is accommodation for near vision .

Interference with ciliary m. control my thus not only paralysis (cyclopegia),my predispose to an elevation of intraocular pressure.(glucacuoma).

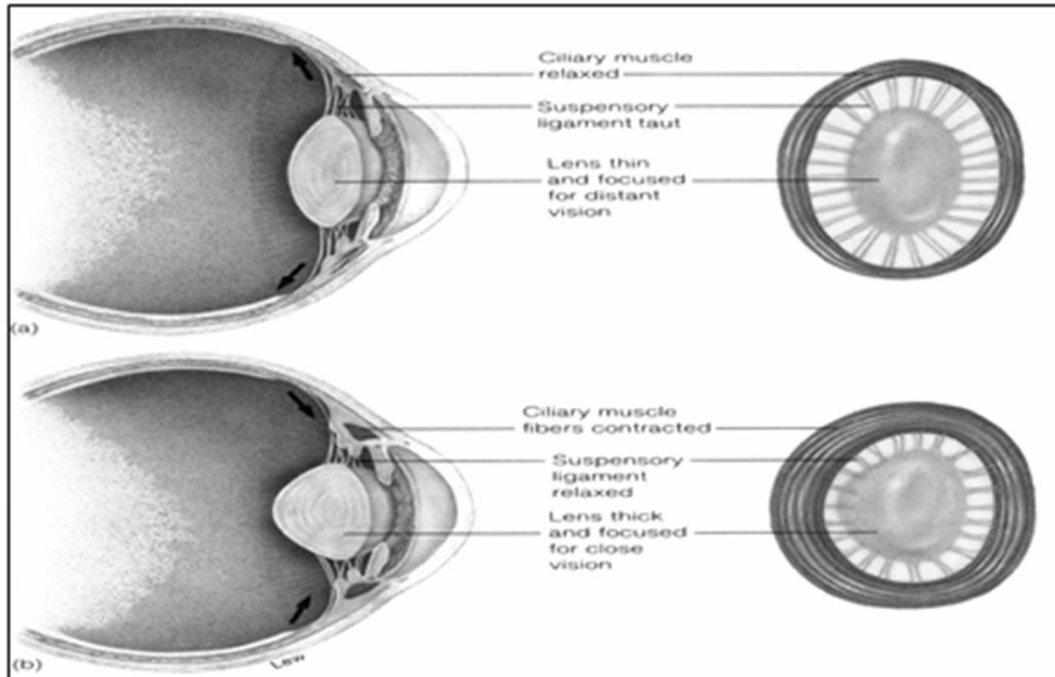
Autonomic control of pupil (A) and site of action of mydriatics (B) and miotics (C)



Accommodation:-the elasticity of the lens enable it to change shape and focused power and facilitated by ciliary body

Paralysis of accommodation is called cycloplegia

Accomodation



TREATMENT RATIONALE

LOWER IOP BY:

- (1) Decreasing Production of Aqueous Humor
- (2) Increasing Outflow of Aqueous Humor

Autonomic Nerve supply of the Eye

1-Parasympathetic N.S.

- Constriction of the pupillary sphincter muscle (**miosis**)
- Contraction of the ciliary muscle (**accommodation for near vision**).
- Decrease in intraocular pressure **↓ IOP.**
 - increases aqueous outflow through the trabecular meshwork into canal of Schlemm by ciliary muscle contraction
- Increased lacrimation
- Conjunctival Vasodilatation

Atropine cause :-

-dilate pupil

-light reflex is abolished

-accommodation is paralysis & the lenes fixed for far vision

-rise IOP.

Cholinergic drugs

Drugs	Ocular uses
Acetylcholine	
Carbachol	Induction of miosis in surgery
Methacholine	Glaucoma
Pilocarpine	In open angle glaucoma
Physostigmine	Glaucoma, accommodative esotropia
Ecothiophate	Glaucoma, accommodative esotropia

2-Sympathetic N.S.

- Contraction of dilator Pupillae (Mydriasis) α_1
- Relaxation of ciliary muscles (accommodation for far vision) β receptors
- Lacrimation α_1
- Vasoconstriction of conjunctival blood vessels α_1

- β receptors in the blood vessels of the ciliary processes
→production of aqueous humour.
- β antagonists reduces the production of aqueous humor
- α agonists increase outflow of aqueous humor and ↓ IOP

Drugs acting on sympathetic system

Adrenergic agonists

Non-selective agonists (α_1 , α_2 , β_1 , β_2), eye drops

- e.g. epinephrine, depevefrin (pro-drug of epinephrine)
- Uses: open angle glaucoma
- **Mechanism:** ↑ outflow of aqueous humor
- **Side Effects:** cardiovascular arrhythmia, tachycardia
- C/I in closed angle glaucoma in patients with narrow angles

α_1 agonists e.g. phenylephrine

- mydriasis (without cycloplegia), decongestant

Uses:

- Funduscopy examination of the eye
- Decongestant in minor allergic hyperemia of eye

α_2 agonists

e.g. apraclonidine (eye drops)

Uses: glaucoma treatment, prophylaxis against IOP spiking after glaucoma laser procedures

Mechanism: ↓ production of aqueous humor

Side Effects: fatigue, dry mouth

β blockers

- non-selective: timolol, carteolol
- Given topically as eye drops

Uses: open angle glaucoma

Mechanism: Act on ciliary body to ↓ production of aqueous humor

Advantages can be used in patients with hypertension/ischemic heart disease

Contraindications

- Bronchospasm
- Cardiovascular (bradycardia, hypotension,)
- Depression

Eye	Parasympathetic N.S.	Sympathetic N.S.
Iris radial muscle	No effect	Contraction (Mydriasis) α1
circular muscle	Contraction (miosis) M3	No effect
Ciliary muscle	Contraction M3	Relaxation β2
Accommodation	for near vision	accommodation for far vision
Conjunctival blood vessels	Conjunctival Vasodilatation	Conjunctival Vasoconstriction
Intraocular pressure(IOP)	Decrease	Narrow filtration angle

-Ciliary M.:-the circular M. between the anterior and posterior chambers behind the iris .its acts to change the

shape of the lens in visual accommodation control by parasympathetic.

Cycloplegia:-paralysis of the ciliary M. which prevent the accommodation of the lens to variation distance

Dilator M.:-that contract iris of the eye and dilate the pupil.
Radial smooth M.

Sphincter M.:-

A circular band of muscle fiber that constrict a passage or close a natural opening in the body .in the eye narrowing the diameter of the pupil of the eye (control by PSNS)circular smooth M.

Aqueous humor :- the clear watery fluid circulating in the anterior and posterior chamber.