

How Parkinson Disease Impacts Vision



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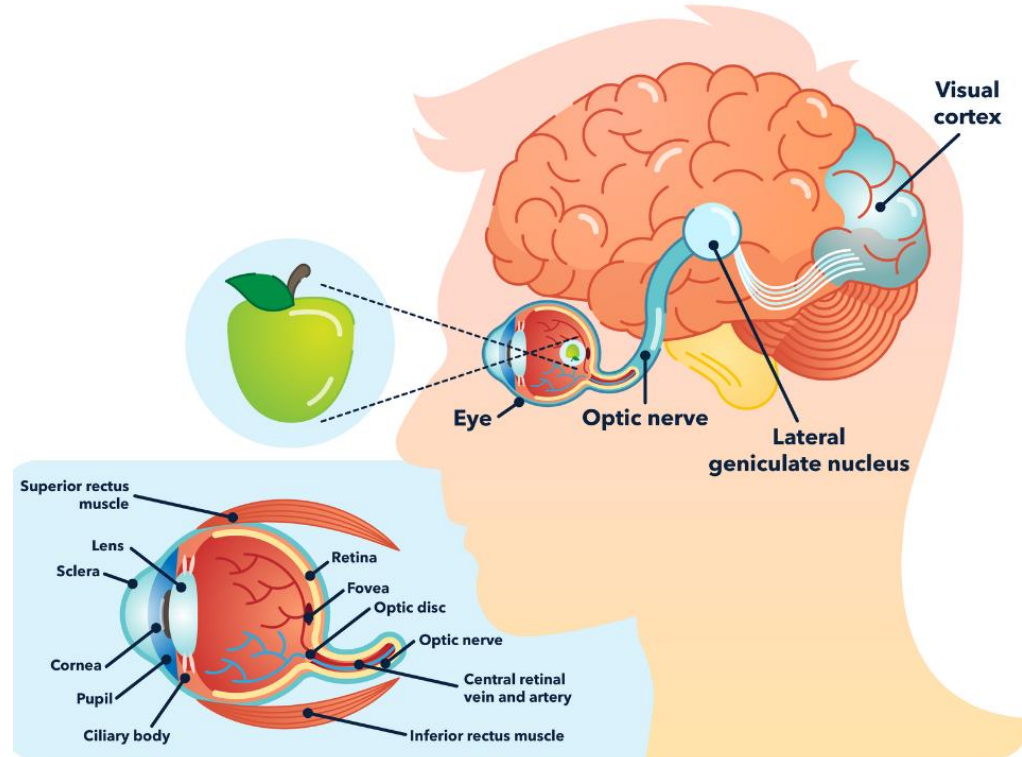


Disclosures

- I receive research support from Neuroderm, Neuraly, NIH



How does vision work?



Kind of Vision Problems in PD

Survey of 848 PD patients:

82% Had some visual complaint vs 48%

86% Dry eye

50% Eye misalignment versus 15%

41% Convergence insufficiency

Borm et al, Journal of Neurology 2022

Borm et al Neurology 2020

Hamedani et al Mov Disord. 2020



Eye Problems in PD: VIPD-Q

Neurology 2020 Carlijn et al

Table 1 Prevalence of ophthalmologic symptoms

Ophthalmologic symptoms reported weekly or daily	PD, n (%)	Controls, n (%)	p Value ^a
Ocular surface			
I have blurry vision when I read or work on a computer.	385 (46)	31 (12)	<0.001
I have a burning sensation or gritty feeling in my eyes.	231 (28)	20 (8)	<0.001
I have mucus/slime or particles in my eyes or eyelids.	167 (20)	14 (6)	<0.001
I have watery eyes.	261 (31)	38 (15)	<0.001
Intraocular			
When I read, some letters disappear.	168 (20)	13 (5)	
Lines that should be straight appear to be wavy or blurred.	140 (17)	12 (5)	
I won't go out alone in the evening or at night because my night vision is insufficient.	134 (16)	8 (3)	
When I drive at night, the oncoming headlights cause more glare than before.	347 (43)	54 (23)	



Eye Problems in PD

Neurology 2020 Carlijn et al

Oculomotor

Quick movements are hard to follow with my eyes.	205 (25)	9 (4)	<0.001
I have double vision.	186 (22)	6 (3)	<0.001
I can read better with one eye closed.	142 (17)	15 (6)	<0.001
I have trouble with depth perception. I find it hard to say which one of 2 objects is closer.	139 (17)	6 (2)	<0.001

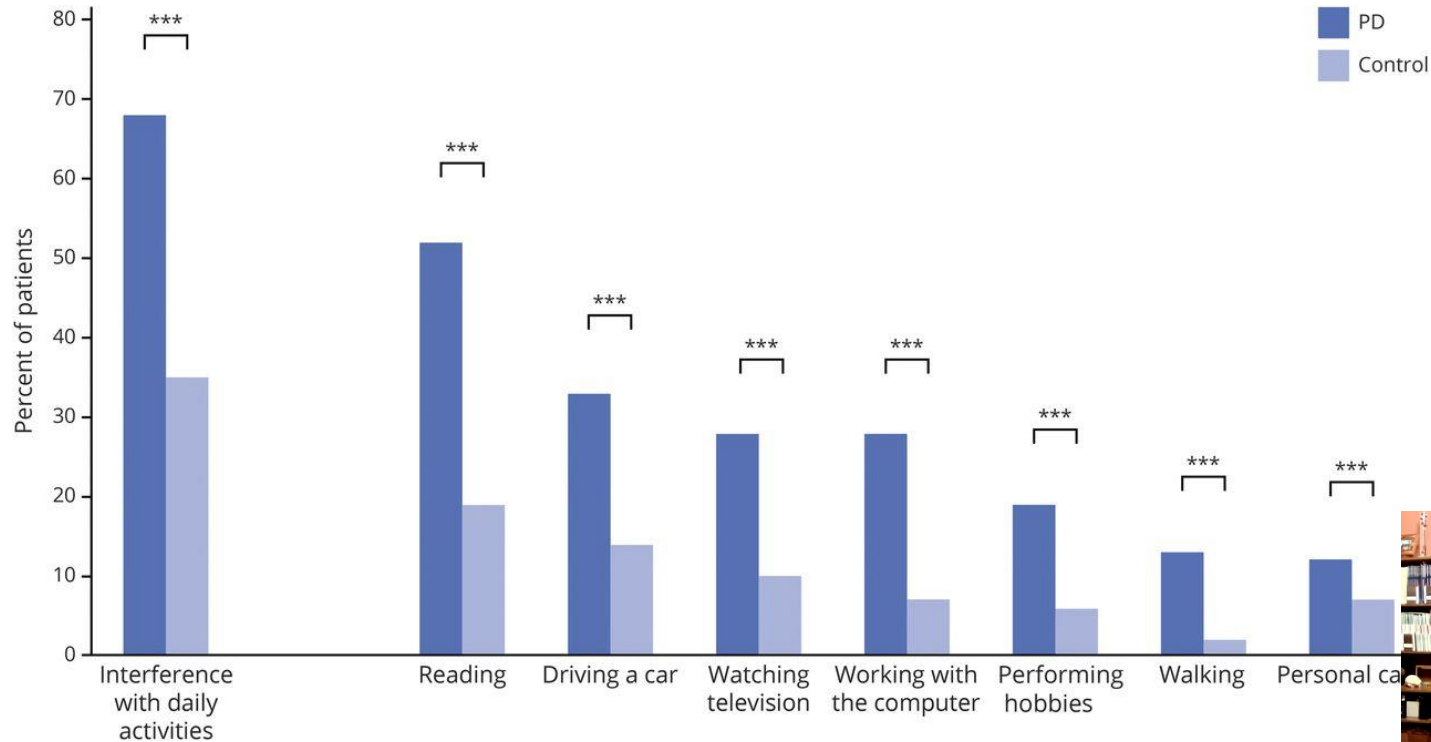
Optic nerve

Colors seem to be paler than before.	95 (11)	7 (3)	<0.001
I can't read plain text on a colored or gray background.	212 (26)	25 (10)	<0.001
I run into objects or people or feel that parts of my visual field are missing.	77 (9)	5 (2)	
I have problems with rapid changes of light intensity.	222 (27)	26 (11)	
I see things that other people do not see (hallucinations).	181 (22)	5 (2)	

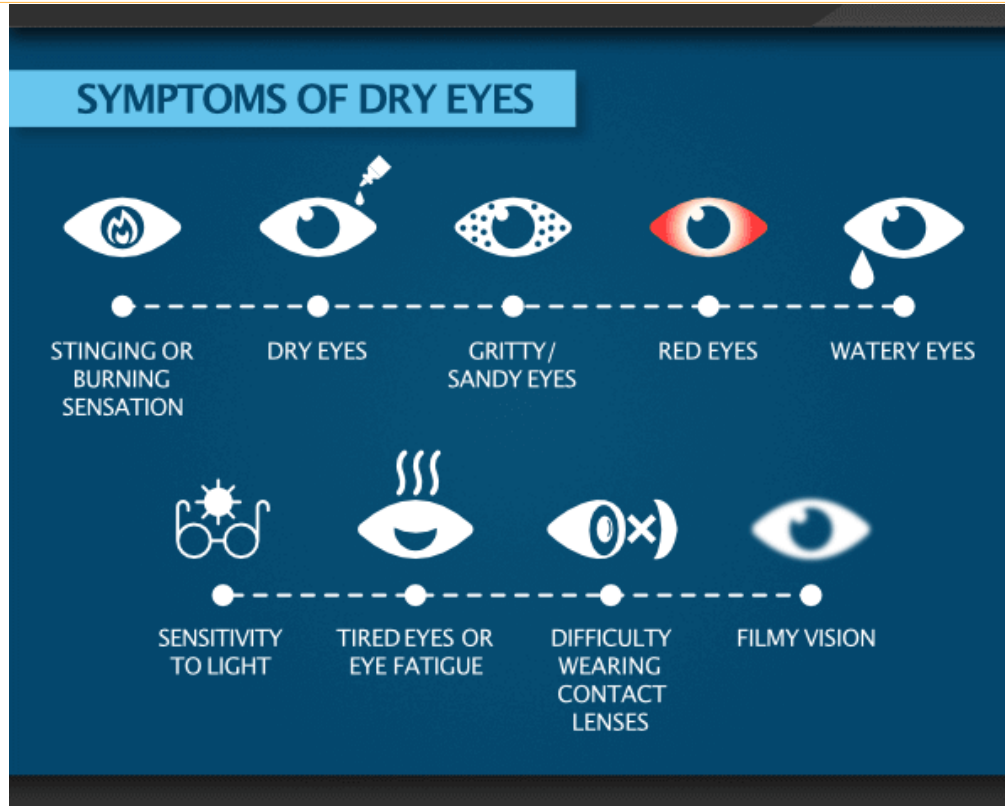


Eye Problems in PD

Neurology 2020 Carlijn et al

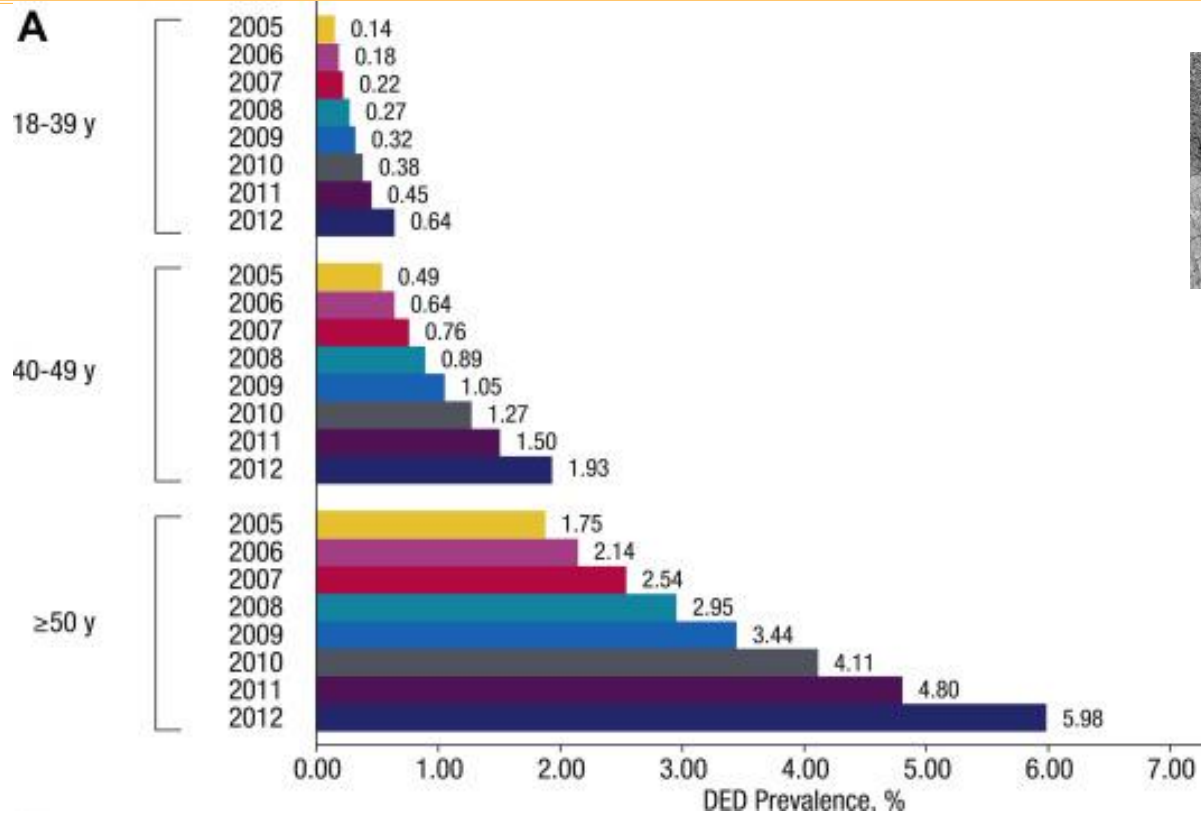


Dry Eye



Topic: Dry Eye

Amer. J. of Ophth, Dana et al 2019



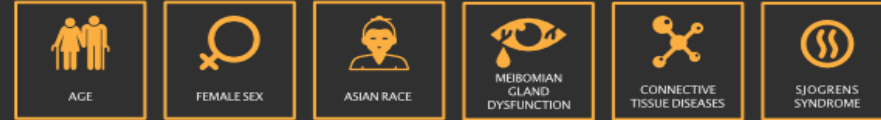
Topic: Dry Eye

Causes

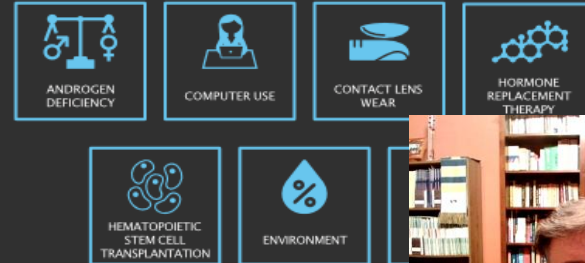
- Blink rate (10-18 per minute is normal). 5 /minute on computer. PD 1-2 per minute
- Tear production, meibomian glands narrow/blocked, autonomic dysfunction, blepharitis
- Meds: Trihexyphenidyl, amantadine, anti-depressants, sleep aids, water pills, antihistamines
- Other diseases

RISK FACTORS FOR DRY EYES

NON-MODIFIABLE



MODIFIABLE

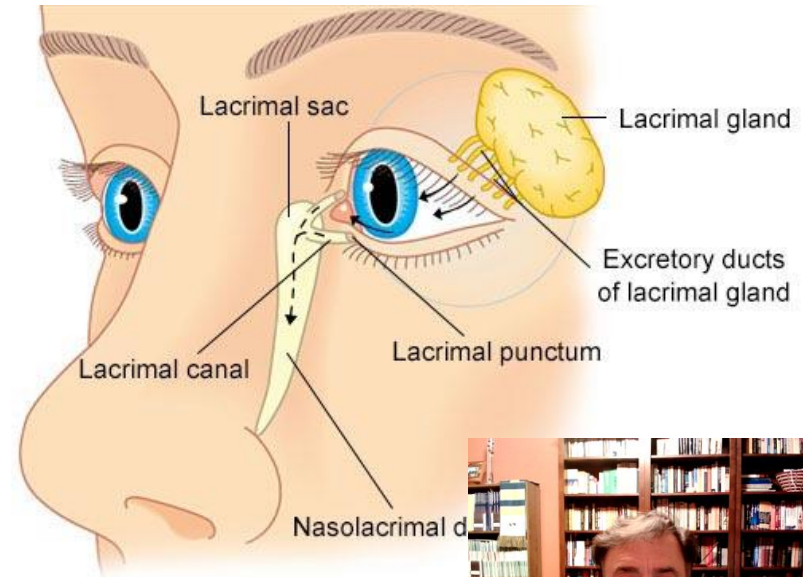


*Probable risk factors include low fatty acids and refractive surgery.

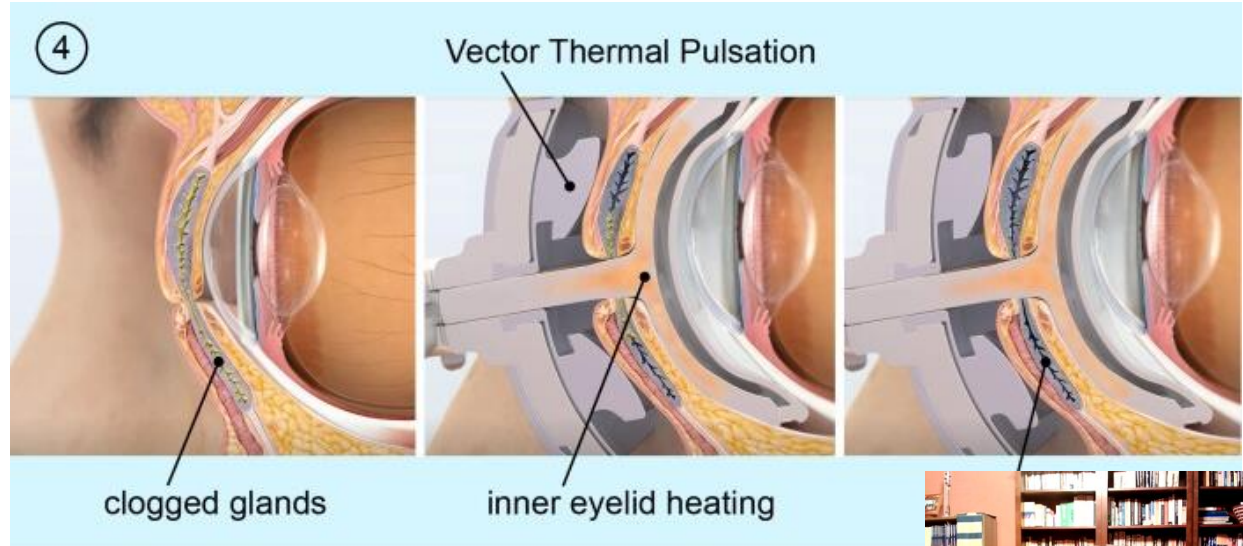
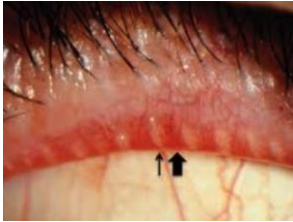


Treating dry eye

- Blink often and tightly, esp w/ screen time
- Stay well hydrated
- Avoid eye makeup, esp waterproof
- Artificial tears- single use tubes
- Overnight closure, esp with CPAP
- Prescription drops (Restasis, Xiidra)
- Lid hygiene, compresses w/ blepharitis
- Punctal blocking w/ plugs and sealing
- LipiFlow and pulsed light therapies

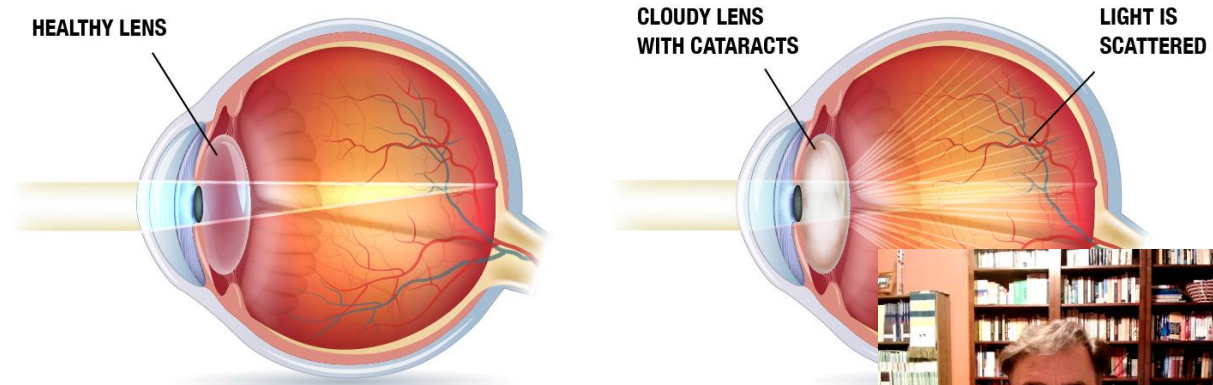


Treating dry eye-Open Meibomian glands



Cataracts

- Glare at night
- Halos around images
- Blurry/cloudy vision



<https://pgheyemds.com/our-services/cataracts>



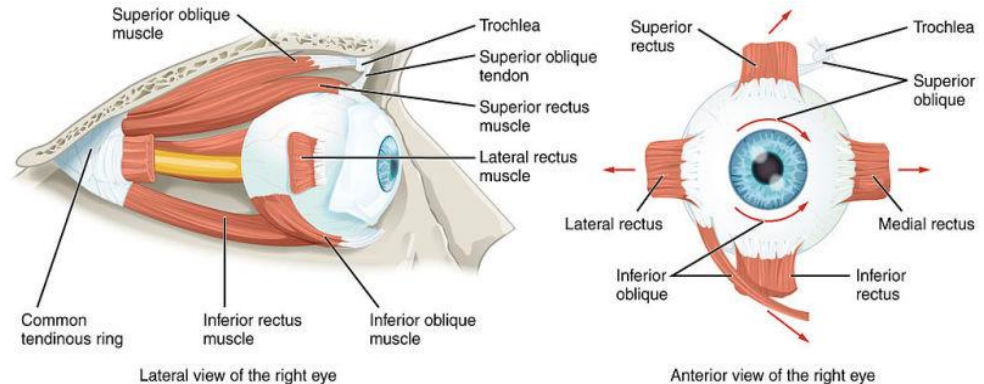
Abnormal Eye Movement and Double Vision

- 28% PD patients vs 9% w/ diplopia
- Binocular versus monocular

Convergence insufficiency

- Normal convergence to 6-10 cm
- Eye strain, headache
- Can occur with DBS
- Treat: eye patch, prisms, l-dopa
- Some medication can worsen

From: Anatomy, Head and Neck, Eye Extraocular Muscles StatPearls Publishing LLC



Topic: Abnormal Eye Movement: Reading

- Slow/delayed/short gaze movements, blink to help eyes move
- PD patients read 20% slower
- Linger on words, eye movements are short
- Mostly L-dopa independent
- MOCA and disease duration dependent
- Unclear if it is eye movement only or processing too

Waldthaler et al Mov Disord. 2018
Jehangir et al Plos One 2018



Topic: Abnormal Eye Movement: Reading

Fixation

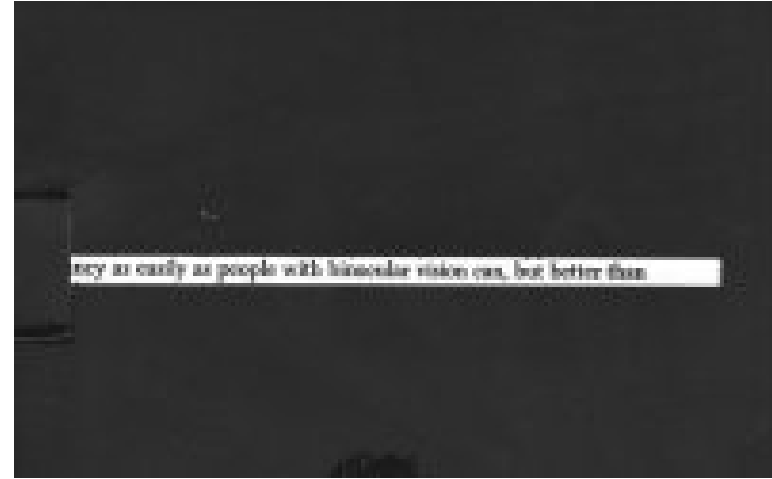
Saccade

the brown fox jumped over the lazy dog



Treatments for Trouble Reading

- Track lines with fingers or rulers
- Use separate glasses instead of bifocals and progressives
- Monocular patching
- Typoscopes, good lighting, E-tablets
- Optimize l-dopa (1 in 5)



Retina

Borm et al Journal of Neurology 2/2022

Retina thinning seen in PD by OCT

Suciu et al J of Personalized Medicine 2022

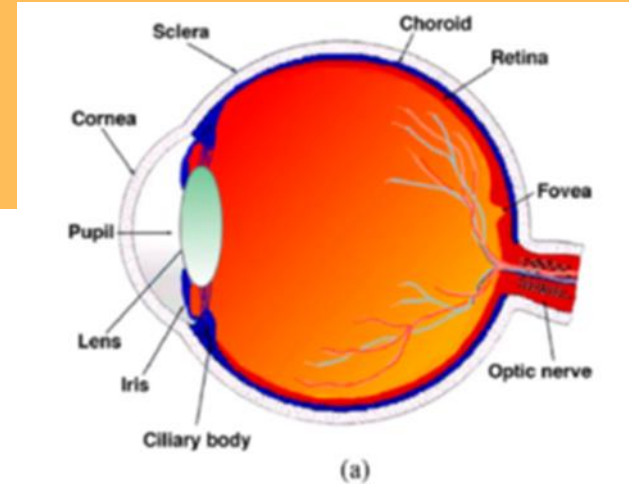
Retina alpha-synuclein

Glaucoma

- Pale and atrophied optic nerve in PD and glaucoma
- Similar visual disturbance seen in PD and glaucoma
- Possible normal-pressure glaucoma in 17% vs 3.5%
- Unclear if treatment helps (drops to lower pressure)

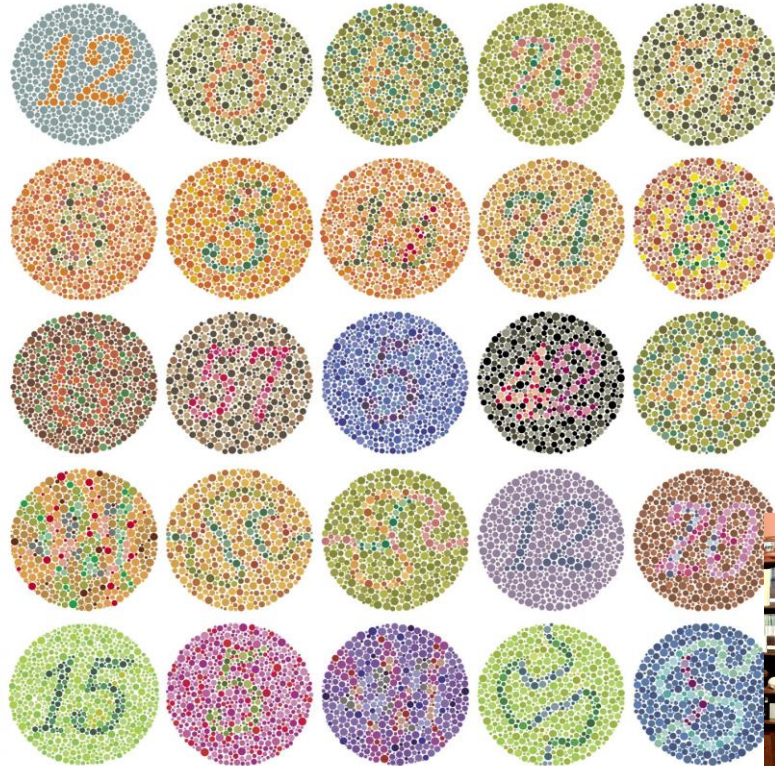
Macular Disease

- Seen in 25% of PD patients
- Problems with central vision
- Deposits in the retina
- Macular disease and PD increase with aging
- See a retina specialist, vitamins, UV protection

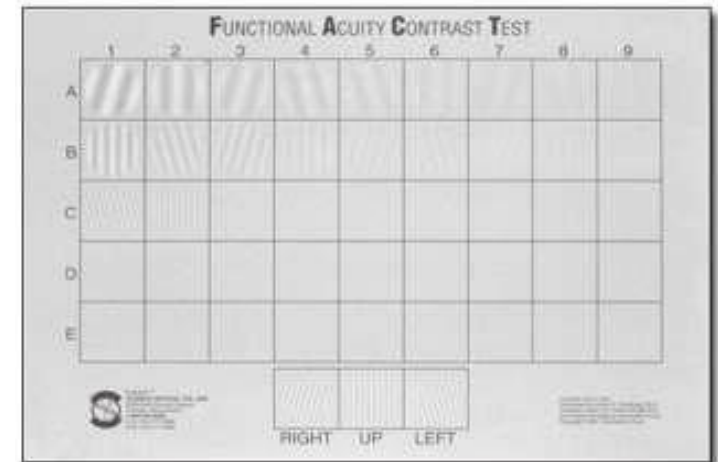
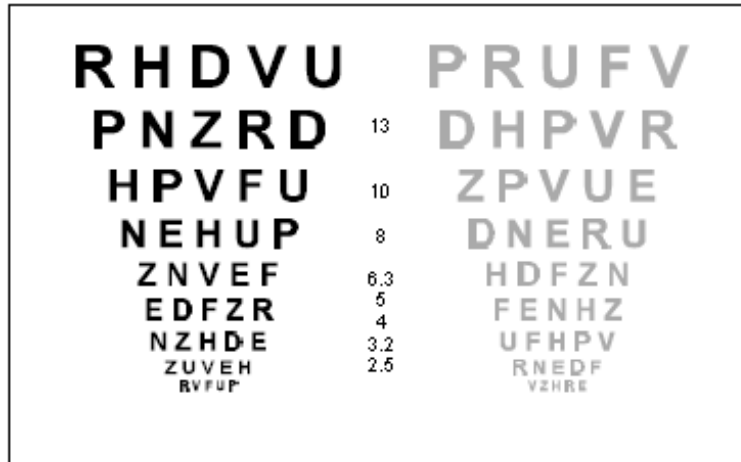


Color Vision

- 33% of PD patients have color vision disturbance



Contrast Sensitivity



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PD had worse contrast sensitivity to those without PD
PD patients with hallucinations had worse contrast detection than others with
fMRI studies suggest contrast problems are from connection issues in the brain

Diaz-Santos et al Movement Dis Clin. Prac. 2021, Bellot et al, Neuroimage: Clin 2022



Impaired Depth Perception: Clumsiness, impaired driving, freezing at doorways

- Visual measurements are impaired in PD
- Impaired depth perception
- Bumping into things, mis-reaching, impaired fine motor tasks

Treatment:

- Clear vision in each eye
- Good eye alignment
- Occupational therapy to compensate



Hallucinations

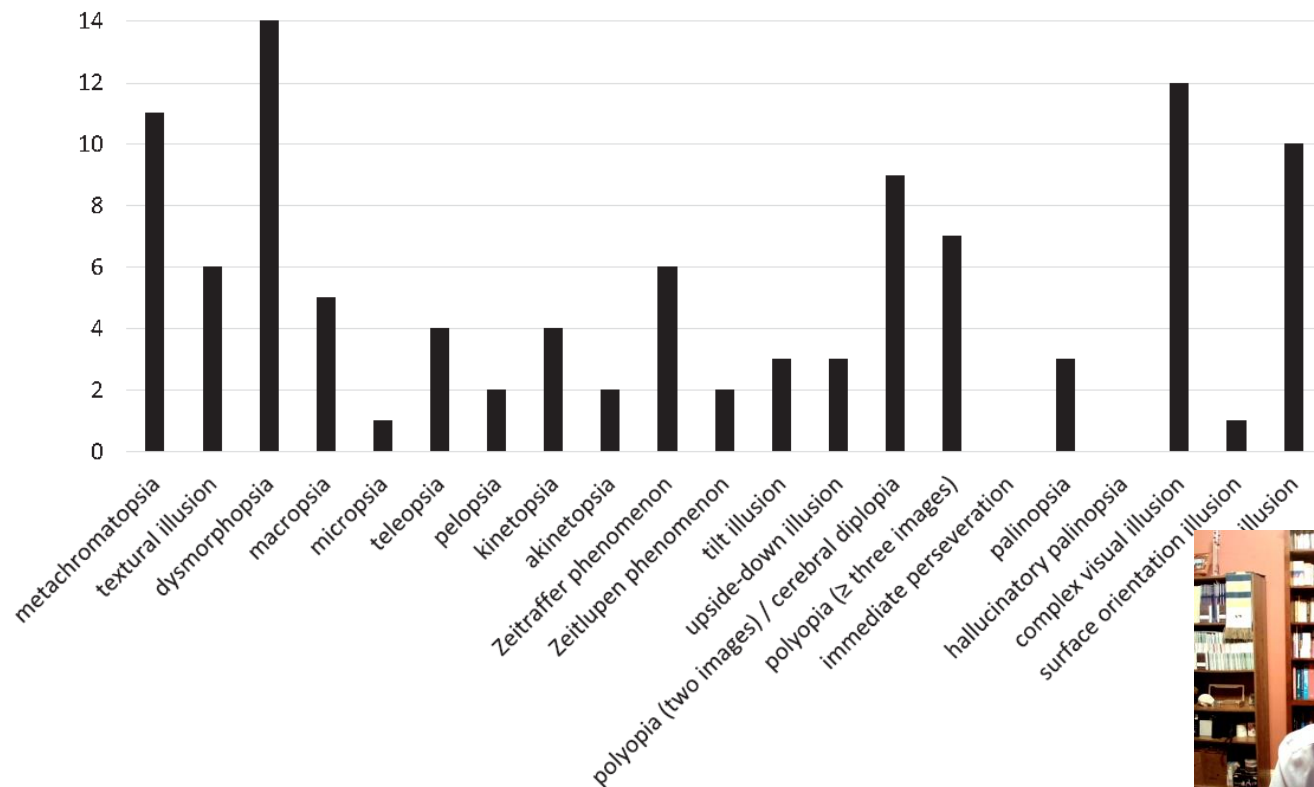
Sasaki et al Psychogeriatrics 2022

- 50%-60% of PD patients develop hallucinations, probably more. (22-38% due to PD)
- 3 of 4 PD patients had some type of visual illusion at least once
- May start as vivid dreams or illusions of passage/presence, unformed shapes, with insight, without insight.
- Impacted by low vision, cataracts, glaucoma, macular degeneration

Metachromatopsia:	Object colour appears different from that in reality ⁹
Textural illusion:	Object surface appears different from that in reality
Dysmorphopsia:	Object shape appears distorted ¹⁰
Macropsia:	Object appears larger than in reality ¹¹
Micropsia:	Object appears smaller than in reality ¹²
Teleopsia:	Object appears more distant than in reality ¹³
Pelopsia:	Object appears nearer than in reality ¹³
Kinetopsia:	Stationary object appears to be moving ^{14,15}
Akinetopsia:	Moving object appears to be stationary ¹⁶
Zeitraffer phenomenon:	Motion of object appears faster than in reality ^{17,18}
Zeitlupen phenomenon:	Motion of object appears slower than in reality ^{17,19}
Tilt illusion:	Orientation of the object appears tilted ²⁰
Upside-down illusion:	Orientation of the object appears inverted ²⁰



Visual Phenomena in 40 PD patients



Hallucinations

Hallucination risks:

- Genetics
- Cognitive impairment
- Age
- PD severity
- Medications
- Impaired vision
- Concurrent disease (infections)
- Poor sleep

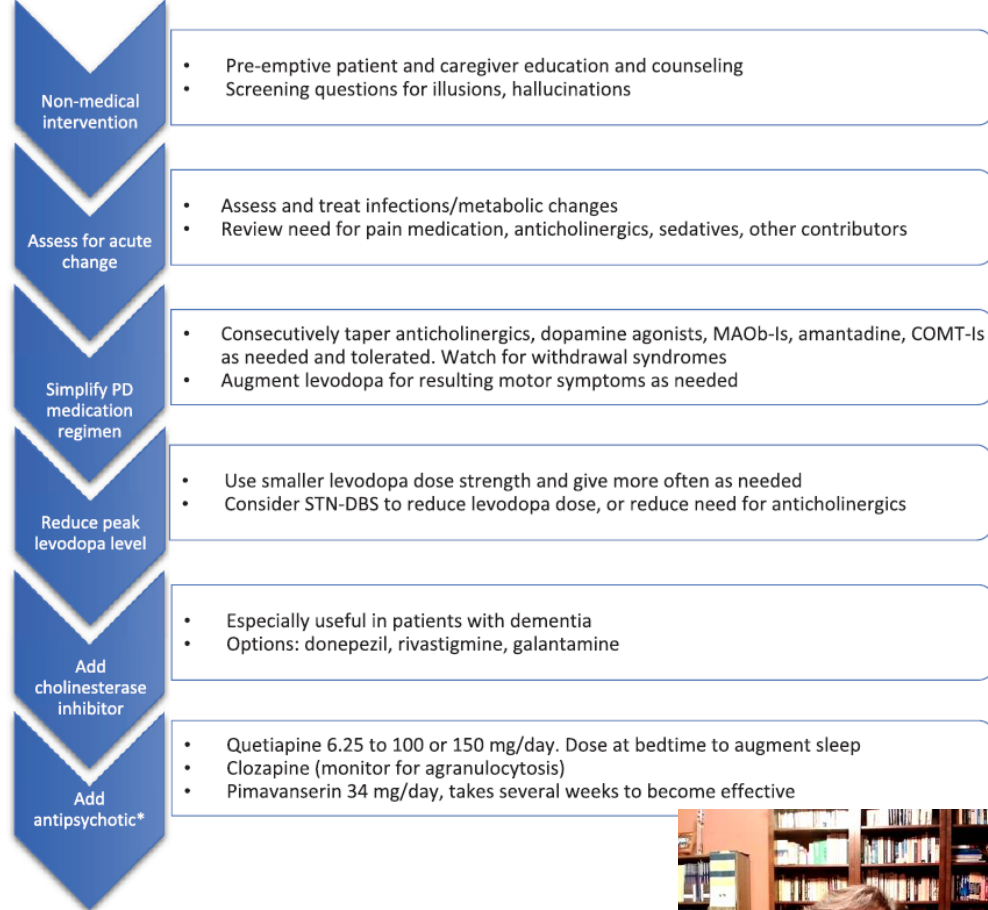


Treating Hallucinations

- Optimize vision: treat visual loss, cataracts, macular problems
- Look for infections, other diseases
- Stop non-PD medications that could contribute
- Aim for L-dopa monotherapy: wean off artane, amantadine, dopamine agonists, MAO-b-Is, istradefylline
- Use lowest tolerable l-dopa dose, small doses more often



Treating Hallucinations



Adequate Hallucination
Control

Savitt and Aouchic



What about driving?

- Impaired contrast: Limit night time and rainy driving
- Impaired depth perception: objects may appear further away or closer
- Slow sign reading
- Hallucinations



Summary

Ophthalmic pathology and management in Parkinson's disease. Treatment recommendations are often not PD-specific and are taken from general ophthalmologic practice, literature review and author's experience. See text for details

Eyelid/Ocular surface

- Decreased blink rate
- Dry eye syndrome
- Blepharitis
- Meibomian gland dysfunction
- Blepharospasm

Treatment

- Preservative-free artificial tears [7]
- Tear duct occlusion [7]
- Lid hygiene [7]
- Botox for blepharospasm [14]
- Increase in dopaminergic agents

Diplopia

Monocular

- Refractive error
- Corneal pathology
- Cataract formation
- Macular disease

Binocular

- Convergence insufficiency
 - Decompensated strabismus
- ## *Treatment*
- Refraction
 - Manage underlying pathology
 - Cataract surgery
 - Single vision reading glasses [7]
 - Base-in prisms
 - Typoscope [24]
 - Proper lighting [7] [24]
 - Reading stand (mitigates reading impairment from hand tremor) [7]
 - Monocular occlusion [7]

Visual loss and visuospatial impairment

Retina/optic nerve

- Decreased acuity and color vision
- Reduced contrast sensitivity
- Visual field defects

Cortical

- Visual hallucinations

Treatment

- Visual rehabilitation [24]
- Occupational therapy [24]
- Dopaminergic therapy [37]
- See Figure 1 for hallucination algorithm



Resources

- <https://www.apdaparkinson.org/what-is-parkinsons/symptoms/eye-vision-issues/>
- <https://www.parkinson.org/Understanding-Parkinsons/Symptoms/Non-Movement-Symptoms/Vision-Changes>
- <https://parkinsonsdisease.net/clinical/vision-issues-symptom>

