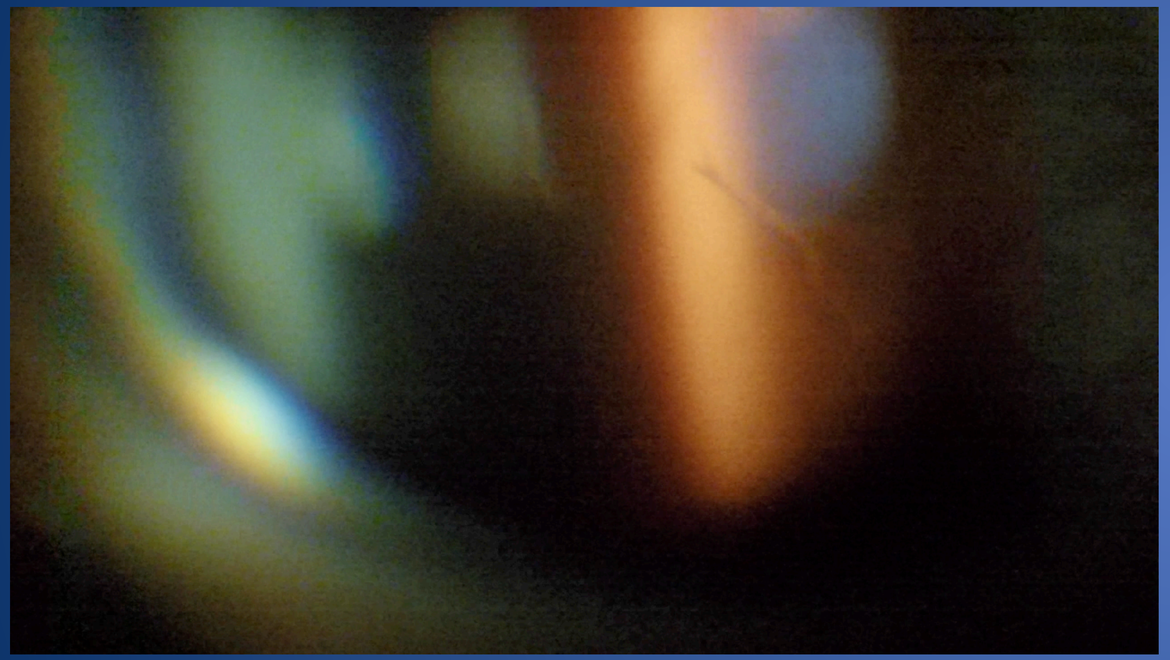
DOC 2023 Nürnberg

YAG Vitreolysis

Feike Gerbrandy
Amsterdam Eye Clinic



About the author:

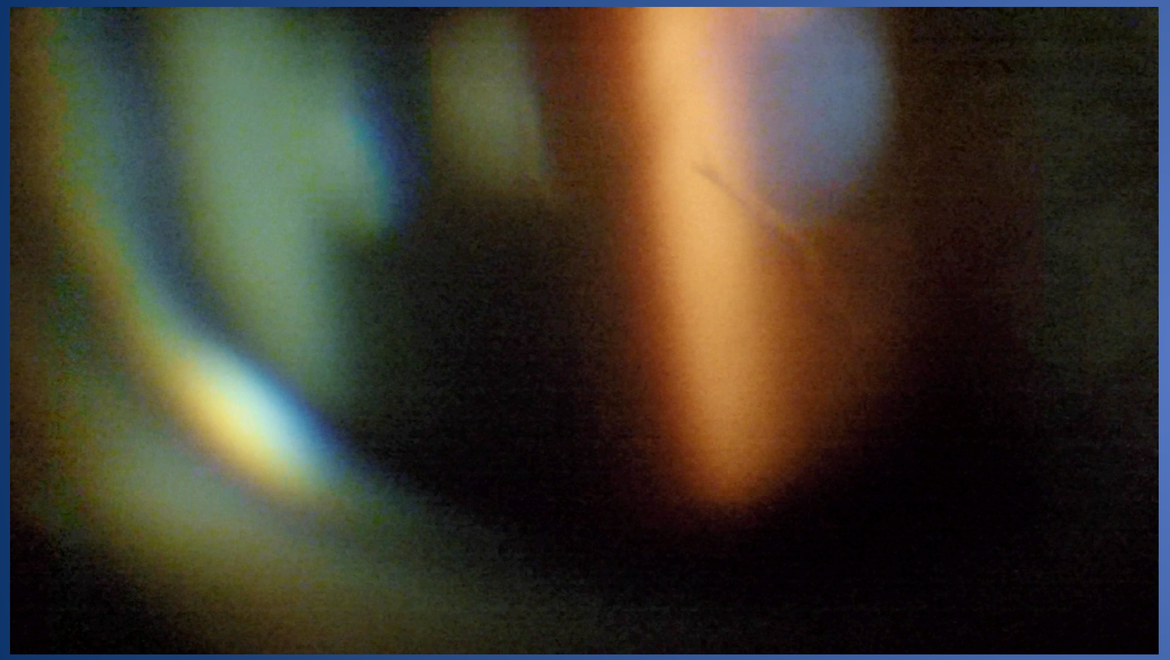
Started performing Floaterlaser Treatment (FLT) in 2009
Performed > 12.000 treatments
Referrals from all over Europe
info@floaterlaser.nl

OMC Oogheelkundig Medisch Centrum Amstelland
Amsterdam Eye Hospital

www.floaterlaser.com

Floaterlaser
www.floaterlaser.nl

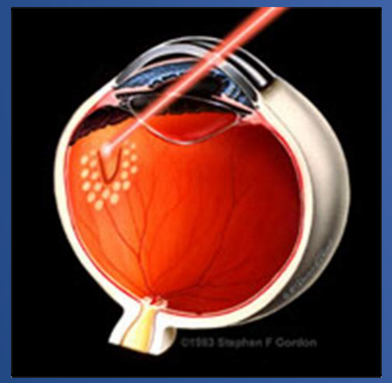
Grundlagen und Funktionsweise des Lasers
Basics and operation of the laser



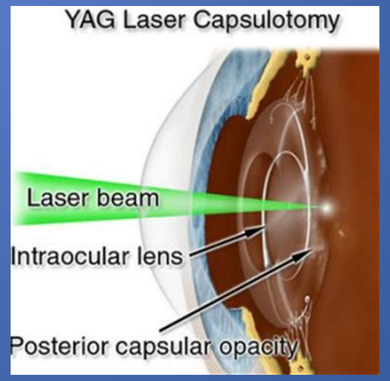
Wie Functioniert die YAG Laser Vitreolyse

Effects of ophthalmic lasers:

Green laser	Burning, coagulation *
→ Nd:YAG laser	Disruption of tissue



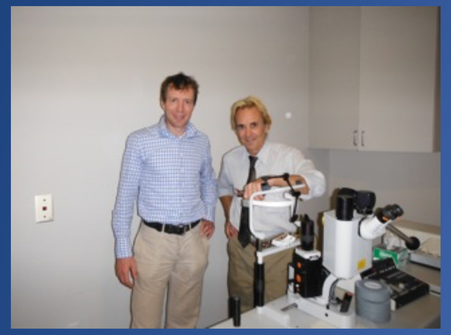
Green laser



Nd:YAG laser

** Green laser = 'Argon' Laser*

Wie Functioniert die YAG Laser Vitreolyse



Intermezzo 1

Dr Scott Geller was the first ophthalmologist treating floaters with a YAG laser

He started doing this in 1986

Laser used: Meridian Microruptor 2

Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

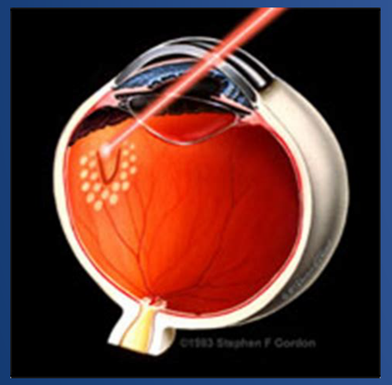
Physics of Green laser: retinal tear

Settings: 200mW 0.1 sec 200 µm

$$Power = \frac{Energy}{Time} \qquad W = \frac{J}{s}$$

Power x Time = Energy *Watt x s = Joule*

→ ***200mW x 0.1s = 20mJ***



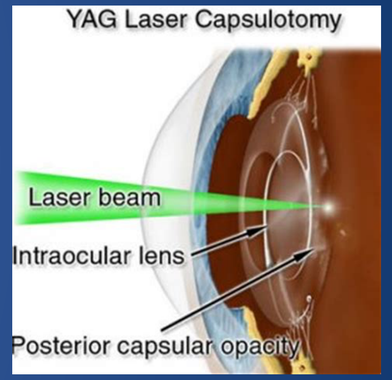
Wie Functioniert die YAG Laser Vitreolyse

Physics of YAG laser:

Energy= Power x Time

Nd: YAG pulse = 4 nano seconds = 4×10^{-9} s

Question:
How do we get 2.0mJ of energy with this pulse duration?



Answer:
Increase Power!

Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

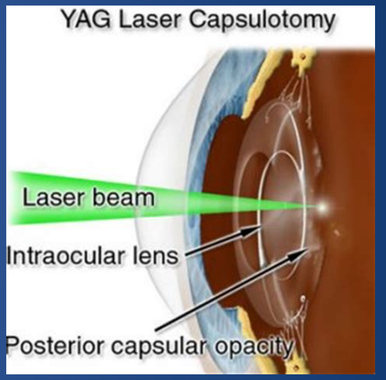
Physics of YAG laser:

How much more power for a YAG laser then Green?
(2 mJ of YAG vs 20mJ of Green)

A) 10.000 times

B) 100.000 times

C) > 1.000.000 times



Wie Functioniert die YAG Laser Vitreolyse

Physics of YAG laser:

2mJ delivered in 4 nano seconds

$$\text{Power} = \frac{\text{Energy}}{\text{Time}}$$

$$\text{Power} = \frac{2\text{mJ}}{4.0 \times 10\text{-}9 \text{ seconds}}$$

Power = 500.000.000 mW = 500.000 W = 0.5 MW

(energy for 5000 lightbulbs of 100Watt)

$$\frac{500.000.000}{200} = 2.500.000$$

→ *2.500.000 times stronger than 200mW of green laser*

Wie Functioniert die YAG Laser Vitreolyse

Physics of YAG laser:

2mJ = 500.000.000 mW

That’s why a YAG laser indicates mJ instead of mW….

Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

Spotsize:

Green laser: 300mW x 0,1 s spot size 200 µm (31.500 µm²)

20 mJ / 31.500 µm² = 0,0006 mJ / µm²

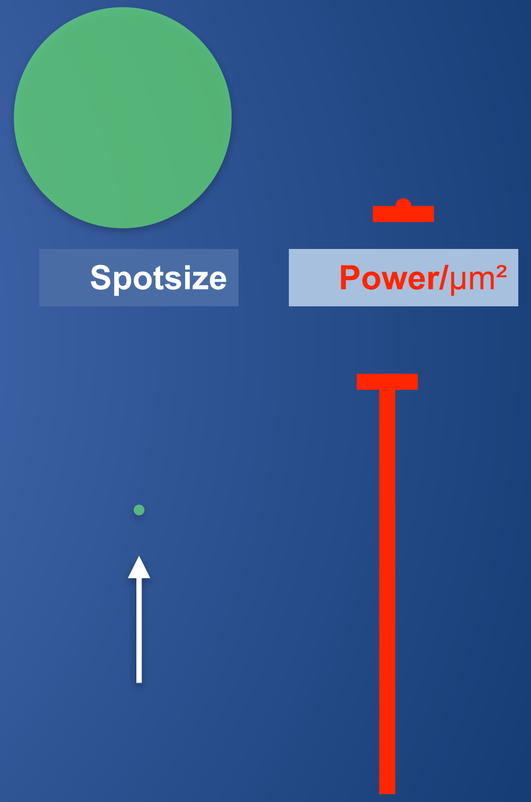
low power “large” area

Nd:YAG laser: 2mJ 8 µm (50.3 µm²)

2 mJ / 50.3 µm² = 0,04mJ / µm²

high power on small surface (626 times smaller)

$$\frac{0,04}{0,0006} = 66 \text{ times more power per } \mu m^2$$



Wie Functioniert die YAG Laser Vitreolyse

Spotsize:

Green laser: 300mW x 0,1 s spot size 200 µm

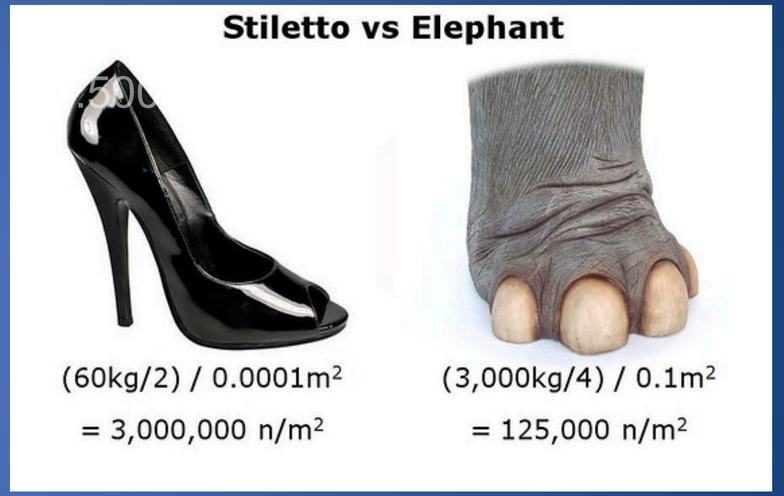
20 mJ / 31.500 µm² = 0,0006 mJ / µm²

low power “large” area

Nd:YAG laser: 2mJ 8 µm (50.3 µm²)

2 mJ / 50.3 µm² = 0,04mJ / µm²

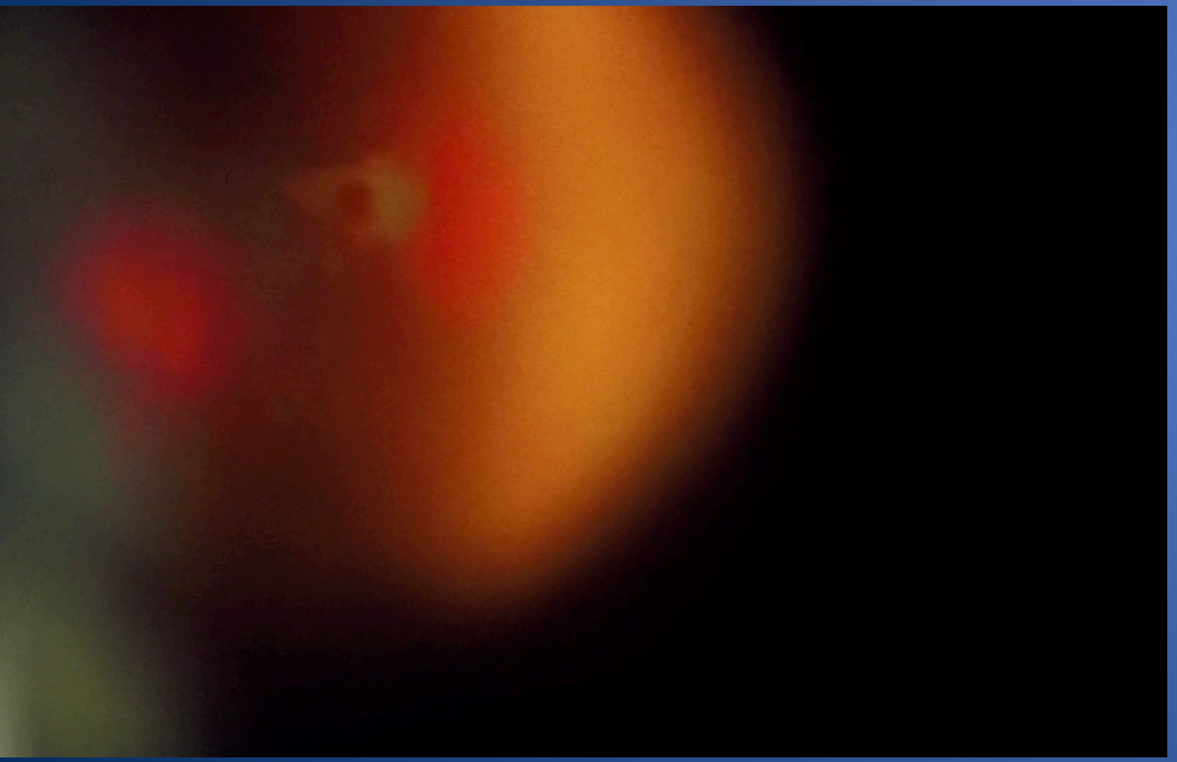
high power on small surface (626 times smaller)



$$\frac{0,04}{0,0006} = 66 \text{ times more power per } \mu m^2$$

Wie Functioniert die YAG Laser Vitreolyse

Intermezzo 2 : succes rate of a Weiss Ring



Succes rate of FLT for Weiss ring is:

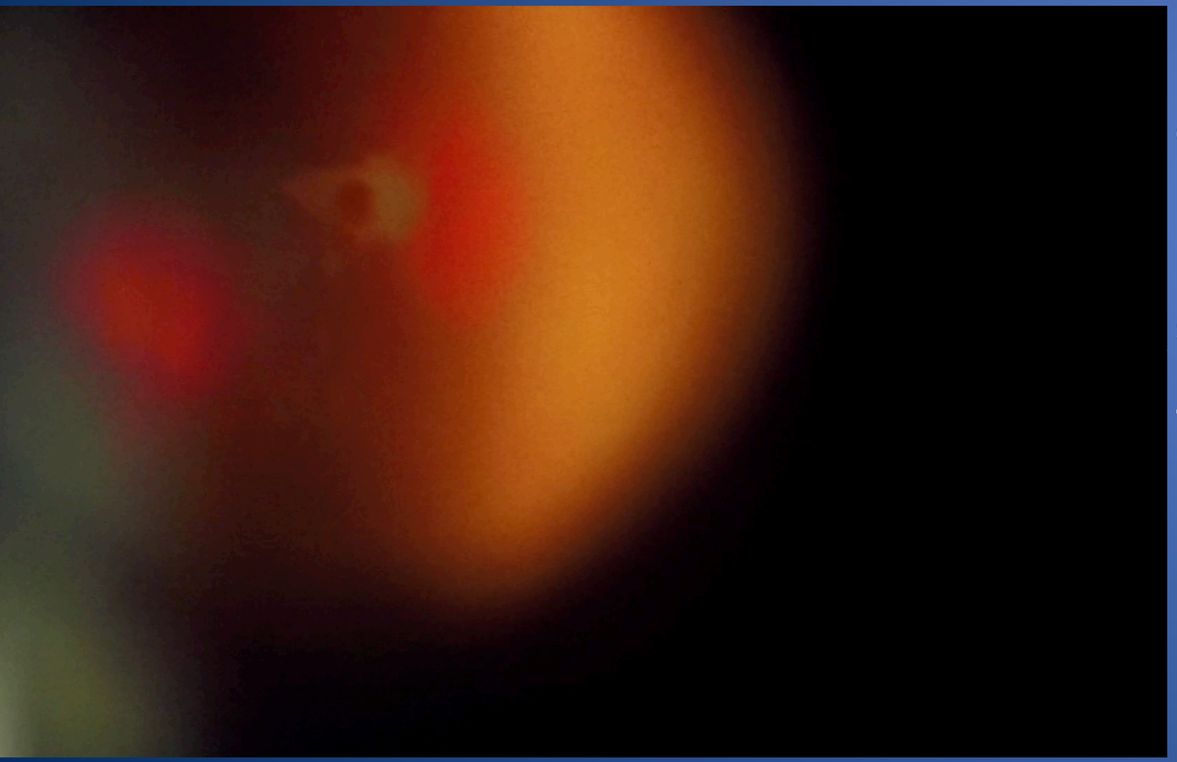
A) 45-55%

B) 60-70%

C) 85-95%

Wie Functioniert die YAG Laser Vitreolyse

Intermezzo 2 : succes rate of a Weiss Ring



dr Shah reported a rate of 53% after 1 treatment session. *

Experienced doctors:

succes rate for Weiss rings of about 95%

This requires several treatments

* *JAMA Ophthalmol. 2017 Sep; 135(9): 918–923.*

Nan
ID:
DOI
Age: **67**

Exam date: 16-11-2017
Gender: Female
Eye: Both

Comments:

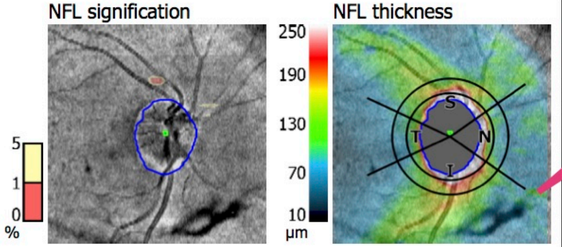
Laserviosion Instruments BV
De Grift 20
7711EJ NIEUWLEUSEN

R 16-11-2017 10:53:04
3D 6 x 6 mm

DISC | BOTH EYES

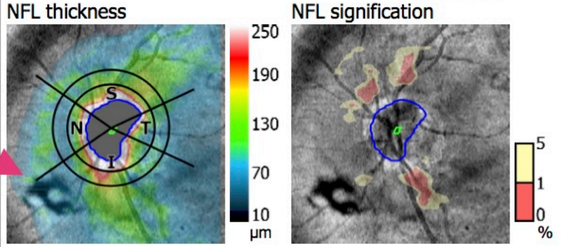
16-11-2017 10:52:13
3D 6 x 6 mm **L**

NFL signification | NFL thickness



weiss ring floaters

			Normal
			- 2,05
			,00 - 0,90
Rim V			0,16 - 0,55
Cup V ne [mm]		0,00	,00 - 0,23
Me Cup depth [mm]	0,01	0,01	0,00 - 0,29
ax Cup depth [mm]	0,02	0,03	0,00 - 0,59
C/D Area	0,01	0,02	0,00 - 0,42
C/D vertical	0,08	0,13	
C/D horizontal	0,08	0,15	
Cup V/H	1,22	0,98	
R/D minimum	0,41	0,28	
Rim Absence [°]	-	-	
DDLS	2	3	



Nan
ID:
DOI
Age: **67**

Exam date: 16-1-2018
Gender: Female
Eye: Both

Comments:

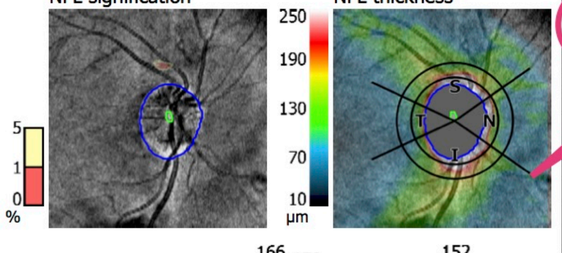
OMC Amstelland
Muiderstraatweg 58-b
1111 PT DIEMEN
Tel: +31 (0)202612590

R 16-1-2018 10:27:03
3D 6 x 6 mm

DISC | BOTH EYES

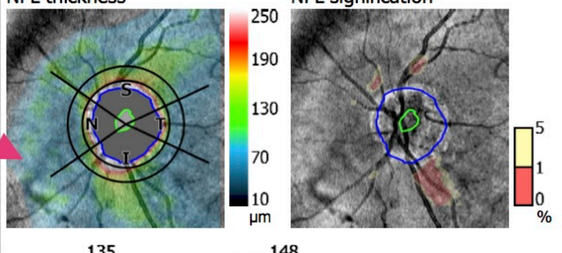
16-1-2018 10:27:33
3D 6 x 6 mm **L**

NFL signification | NFL thickness



weiss ring floaters are gone

			Normal
			06 - 2,05
			,00 - 0,90
Rim V			0,16 - 0,55
Cup V ne [mm]		0,01	,00 - 0,23
M Cup depth [mm]	0,01	0,04	0,00 - 0,29
ax Cup depth [mm]	0,03	0,09	0,00 - 0,59
C/D Area	0,02	0,07	0,00 - 0,42
C/D vertical	0,15	0,31	
C/D horizontal	0,10	0,26	
Cup V/H	1,83	1,27	
R/D minimum	0,37	0,28	
Rim Absence [°]	-	-	
DDLS	2	2	

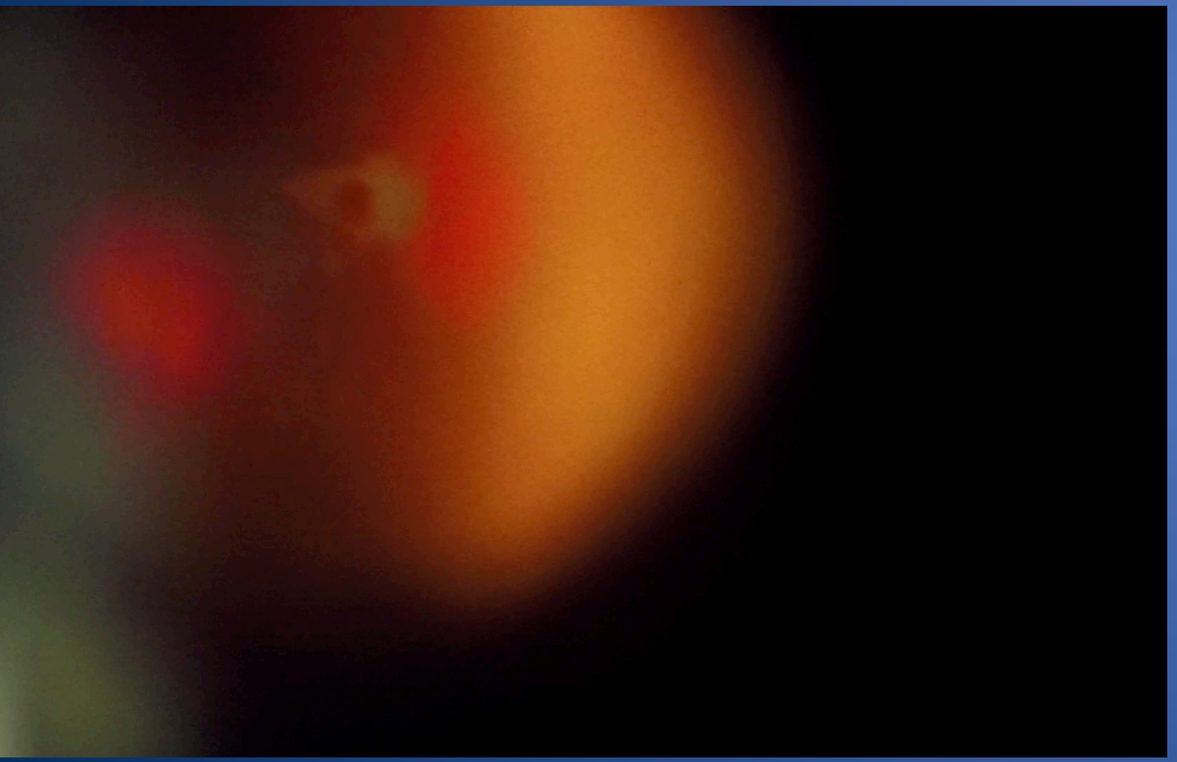


Ring diameter 2,40 mm. Ring thickness 0,40 mm.

Ring diameter 2,40 mm. Ring thickness 0,40 mm.

Wie Functioniert die YAG Laser Vitreolyse

Intermezzo 2 : succes rate of a Weiss Ring



95% succes
What happens to the other 5% ?

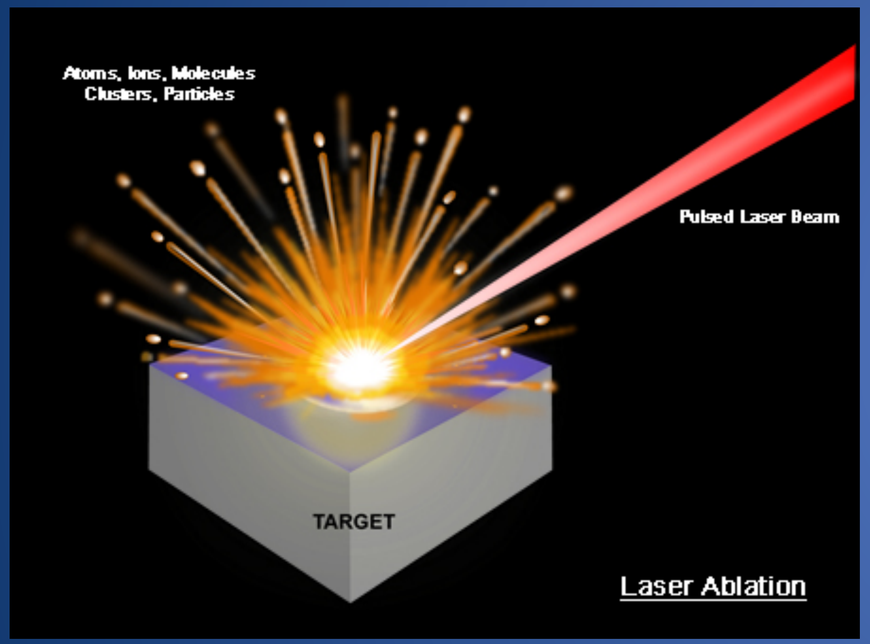
Posterior vitreous membrane

→ Membranotomy

- Membranotomy

Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse



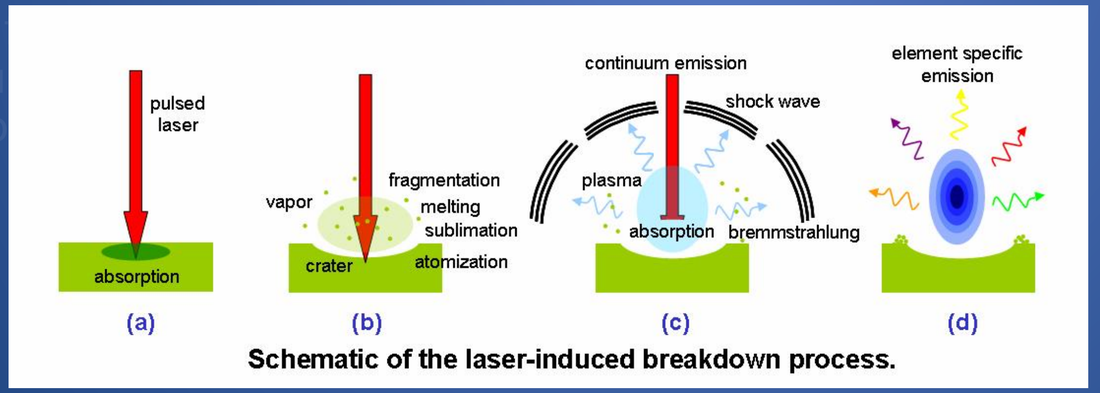
Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

Physics of YAG laser:

Effect of 1MW on 8 microns for 4 nanoseconds:

Temperature up to 20.000 celcius
Plasma formation
Evaporation of molecules and tissues
Fragmentation



Schematic of the laser-induced breakdown process.

Wie Functioniert die YAG Laser Vitreolyse

Physics of YAG laser:

Effect of 1MW on 8 microns for 4 nanoseconds:

Temperature up to 20.000 celcius
Plasma formation
Evaporation of molecules and tissues
Fragmentation

Safe for the eye due to:
- pulse duration
- Focus and defocus

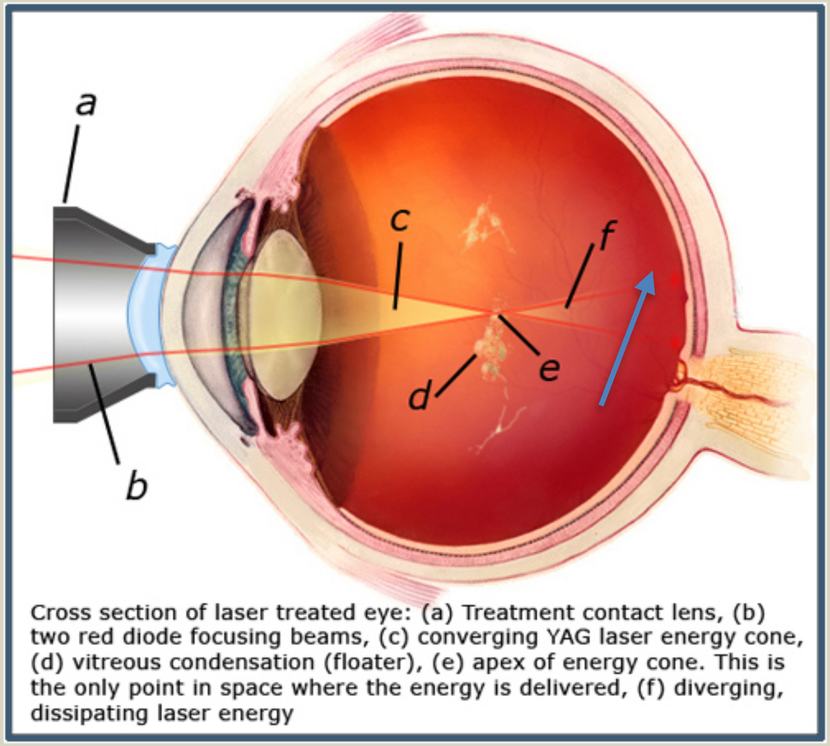
Wie Functioniert die YAG Laser Vitreolyse

Physics of YAG laser:

Effect of 1MW on 8 microns for 4 nanoseconds:

Temperature up to 20.000 celcius
Plasma formation
Evaporation of molecules and tissues
Fragmentation

Safe for the eye due to:
- pulse duration
- Focus and defocus



Cross section of laser treated eye: (a) Treatment contact lens, (b) two red diode focusing beams, (c) converging YAG laser energy cone, (d) vitreous condensation (floater), (e) apex of energy cone. This is the only point in space where the energy is delivered, (f) diverging, dissipating laser energy

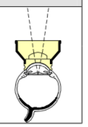
Cross Section of YAG Laser Energy Profile in Eye

Image used with permission of James Johnson

Focus and defocus

Ocular Abraham Capsulotomy YAG Laser Lens

Product Code	Image Mag	Laser Spot Mag	Contact OD	Lens Height	
OAYA CE	1.8x	.56x	15mm	16.5mm	*Designed with:* *Robert K. Abraham, M.D., Encino, CA* Reference: Ocular Surgery News Vol. 14, No. 17, p. 36, September 1, 1996



Design

- The Abraham Capsulotomy YAG Laser Lens features a 10.0mm diameter HeNE YAG coated plano-convex 1.8x magnification button positioned at the center of the lens.
- The spherical button provides high image quality and beam control when treating the region from the anterior to the posterior capsule by mode-locked or Q-switched YAG laser systems.

Comparison of Beam Diameters		
When the YAG laser cone angle Equals 16°	**With Abraham Iridectomy Lens**	**No Contact Lens**
Convergence Angle	24°	16°
Focus Spot Size at Posterior Capsule (um)	14	21
Beam Diameter at Cornea	3.4mm	2.2mm
Beam Diameter at Retina	7.2mm	4.7mm

Cleaning

Rinse:	Immediately upon removal from patient's eye, thoroughly rinse in cool or tepid water.
Wash:	Place a few drops of mild soap on a moistened cotton ball. Gently clean with a circular motion.
Rinse:	Thoroughly rinse in cool or tepid water, then dry carefully with a *non-linting* tissue.
Then:	Proceed with either disinfection or sterilization instructions.

Disinfection

	GLUTARALDEHYDE	*OR*	BLEACH
Soak In:	2% or 3.4% aqueous solution		10% solution mixed at: 1 part bleach to 9 parts cool tepid water
	Temperature per manufacturer instructions		
	Minimum exposure time = 20 minutes		Recommended exposure time = 10 minutes
	Caution *To avoid damage to the lens,* do not *exceed recommended exposure time.*		
Then:	Rinse lens *thoroughly* to remove disinfection solution. 3 cycles of 1 minute, with cool or tepid water is recommended.		
	Dry carefully and place in a dry storage case.		
NOTE	This lens is known to be compatible with: Asepti-Wipe, Cavi-cide, Cidex OPA, DisCide Wipe, Enviro-cide, H_2O_2 - 3%, and Opti-Cide		
Caution	***If used on an ulcerated cornea, lens must be STERILIZED before next procedure.***		

Sterilization

AUTOCLAVE	STERRAD	STERIS SYSTEM 1	ETO	ETO Parameters		
		YES	YES	Minimum Time	Temperature	Aeration Time
No	No	Per manufacturer instructions	See Right	1 hour	130°F (54°C)	12 hours
WARNING	***Never Steam Autoclave or Boil listed lenses.*** ***Never soak in Alcohol, Acetone or Other Solvents.***					

For information on compatibility with alternative product care methods, contact Customer Service.

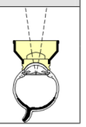
Ocular® Instruments, inc.

2255 116th Ave NE, Bellevue, Washington 98004-3039 USA
T: 425-455-5200 or 800-888-6616 F: 425-462-6669
E: ocular@ocular-instruments.com I: www.ocular-instruments.com

Focus and defocus

Ocular Abraham Capsulotomy YAG Laser Lens

Product Code	Image Mag	Laser Spot Mag	Contact OD	Lens Height	
OAYA CE	1.8x	.56x	15mm	16.5mm	*Designed with:* *Robert K. Abraham, M.D., Encino, CA* Reference: Ocular Surgery News Vol. 14, No. 17, p. 36, September 1, 1996



Design

- The Abraham Capsulotomy YAG Laser Lens features a 10.0mm diameter HeNE YAG coated plano-convex 1.8x magnification button positioned at the center of the lens.
- The spherical button provides high image quality and beam control when treating the region from the anterior to the posterior capsule by mode-locked or Q-switched YAG laser systems.

Comparison of Beam Diameters

When the YAG laser cone angle Equals 16°	With Abraham Iridectomy Lens	No Contact Lens
Convergence Angle	24°	16°
Focus Spot Size at Posterior Capsule (um)	14	21
Beam Diameter at Cornea	3.4mm	2.2mm
Beam Diameter at Retina	7.2mm	4.7mm

Cleaning

Rinse:	Immediately upon removal from patient's eye, thoroughly rinse in cool or tepid water.
Wash:	Place a few drops of mild soap on a moistened cotton ball. Gently clean with a circular motion.
Rinse:	Thoroughly rinse in cool or tepid water, then dry carefully with a *non-linting* tissue.
Then:	Proceed with either disinfection or sterilization instructions.

Disinfection

Soak In:	GLUTARALDEHYDE	*OR*	BLEACH
	2% or 3.4% aqueous solution		10% solution mixed at: 1 part bleach to 9 parts cool tepid water
	Temperature per manufacturer instructions		
	Minimum exposure time = 20 minutes		Recommended exposure time = 10 minutes
	Caution *To avoid damage to the lens,* do not *exceed recommended exposure time.*		
Then:	Rinse lens *thoroughly* to remove disinfection solution. 3 cycles of 1 minute, with cool or tepid water is recommended.		
	Dry carefully and place in a dry storage case.		
NOTE	This lens is known to be compatible with: Asepti-Wipe, Cavi-cide, Cidex OPA, DisCide Wipe, Enviro-cide, H_2O_2 - 3%, and Opti-Cide		
Caution	***If used on an ulcerated cornea, lens must be STERILIZED before next procedure.***		

Sterilization

AUTOCLAVE	STERRAD	STERIS SYSTEM 1	ETO	ETO Parameters		
		YES	YES	Minimum Time	Temperature	Aeration Time
No	No	Per manufacturer instructions	See Right	1 hour	130°F (54°C)	12 hours
WARNING	***Never Steam Autoclave or Boil listed lenses.*** ***Never soak in Alcohol, Acetone or Other Solvents.***					

For information on compatibility with alternative product care methods, contact Customer Service.

Ocular® Instruments, inc.

2255 116th Ave NE, Bellevue, Washington 98004-3039 USA
T: 425-455-5200 or 800-888-6616 F: 425-462-6669
E: ocular@ocular-instruments.com I: www.ocular-instruments.com

Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus

Comparison of Beam Diameters		
When the YAG laser cone angle Equals 16°	**With Abraham Iridectomy Lens**	**No Contact Lens**
Convergence Angle	24°	16°
Focus Spot Size at Posterior Capsule (um)	14	21
Beam Diameter at Cornea	3.4mm	2.2mm
Beam Diameter at Retina	7.2mm	4.7mm

Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus

Comparison of Beam Diameters		
When the YAG laser cone angle Equals 16°	**With Abraham Iridectomy Lens**	**No Contact Lens**
Convergence Angle	24°	16°
Focus Spot Size at Posterior Capsule (um)	14	21
Beam Diameter at Cornea	3.4mm	2.2mm
Beam Diameter at Retina	7.2mm	4.7mm

With Lens 24°

Beam diameter retina 7.2 mm

Area = π r 2

π x 3.6 x 3.6 = 40.7mm2

2mJ / 40.7 = 0,05 mJ/ mm²

No Lens 16°

Beam diameter retina 4.7mm

Area = π r 2

π x 2.35x2.35 = 17.35 mm2

2mJ / 17.35 = 0,12 mJ/ mm²

→ 0,12/0,05 = 2,4 → With lens 2,4 times less energy at retina level

Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus

Comparison of Beam Diameters		
When the YAG laser cone angle Equals 16°	**With Abraham Iridectomy Lens**	**No Contact Lens**
Convergence Angle	24°	16°
Focus Spot Size at Posterior Capsule (um)	14	21
Beam Diameter at Cornea	3.4mm	2.2mm
Beam Diameter at Retina	7.2mm	4.7mm

With Lens 24°

Focus Spot size 14

Area = 154 µm²

2mJ / 154 = 0,013 mJ/ µm²

No Lens 16°

Focus Spot size 21

Area = 346µm²

2mJ / 346 = 0,0057 mJ/ µm²

0,0013 / 0,0057 = 2,3
Difference with lens 2,3 times higher energy in focal point

Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus

Comparison of Beam Diameters		
When the YAG laser cone angle Equals 16°	**With Abraham Iridectomy Lens**	**No Contact Lens**
Convergence Angle	24°	16°
Focus Spot Size at Posterior Capsule (um)	14	21
Beam Diameter at Cornea	3.4mm	2.2mm
Beam Diameter at Retina	7.2mm	4.7mm

With Lens 24°

→ 2.3 times less energy needed
And 2.4 times less energy at retina leve

1/2.3 = 0,43
0,43/2.4 = 0,18

→ With lens only 18% of the energy at retina level!

Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus

Comparison of Beam Diameters		
When the YAG laser cone angle Equals 16°	**With Abraham Iridectomy Lens**	**No Contact Lens**
Convergence Angle	24°	16°
Focus Spot Size at Posterior Capsule (um)	14	21
Beam Diameter at Cornea	3.4mm	2.2mm
Beam Diameter at Retina	7.2mm	4.7mm

With Lens 24°

Clinical effect:

- Higher magnification
- Spotsize small
- Lens pits +/-
- Laser settings: 1.2 mJ
- Higher safety

No Lens 16°

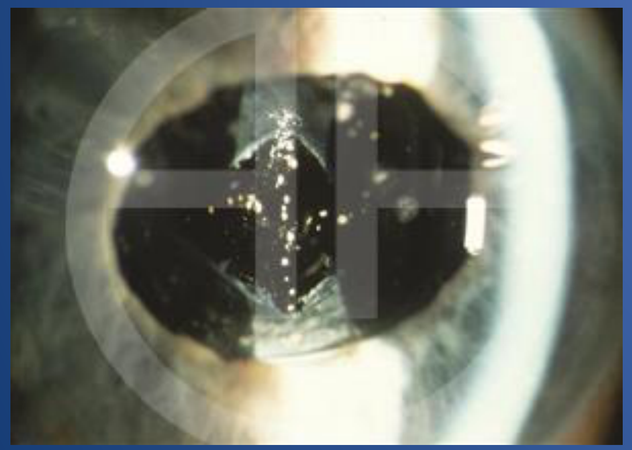
Clinical effect:

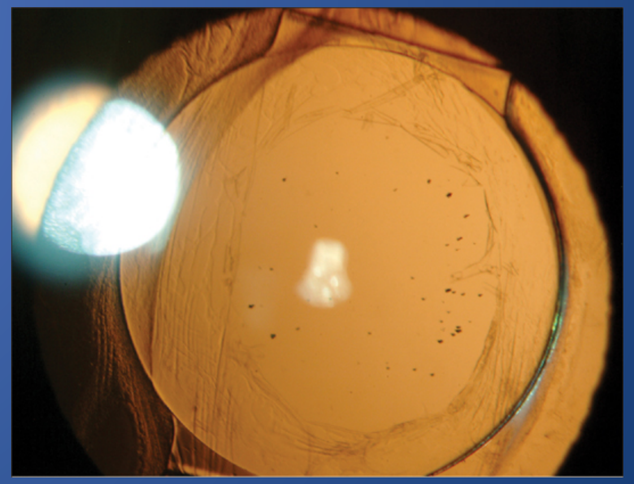
- Lower magnification
- Spotsize large
- Lens pits +
- Laser setings: 2.5 mJ
- Lower safety

Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus

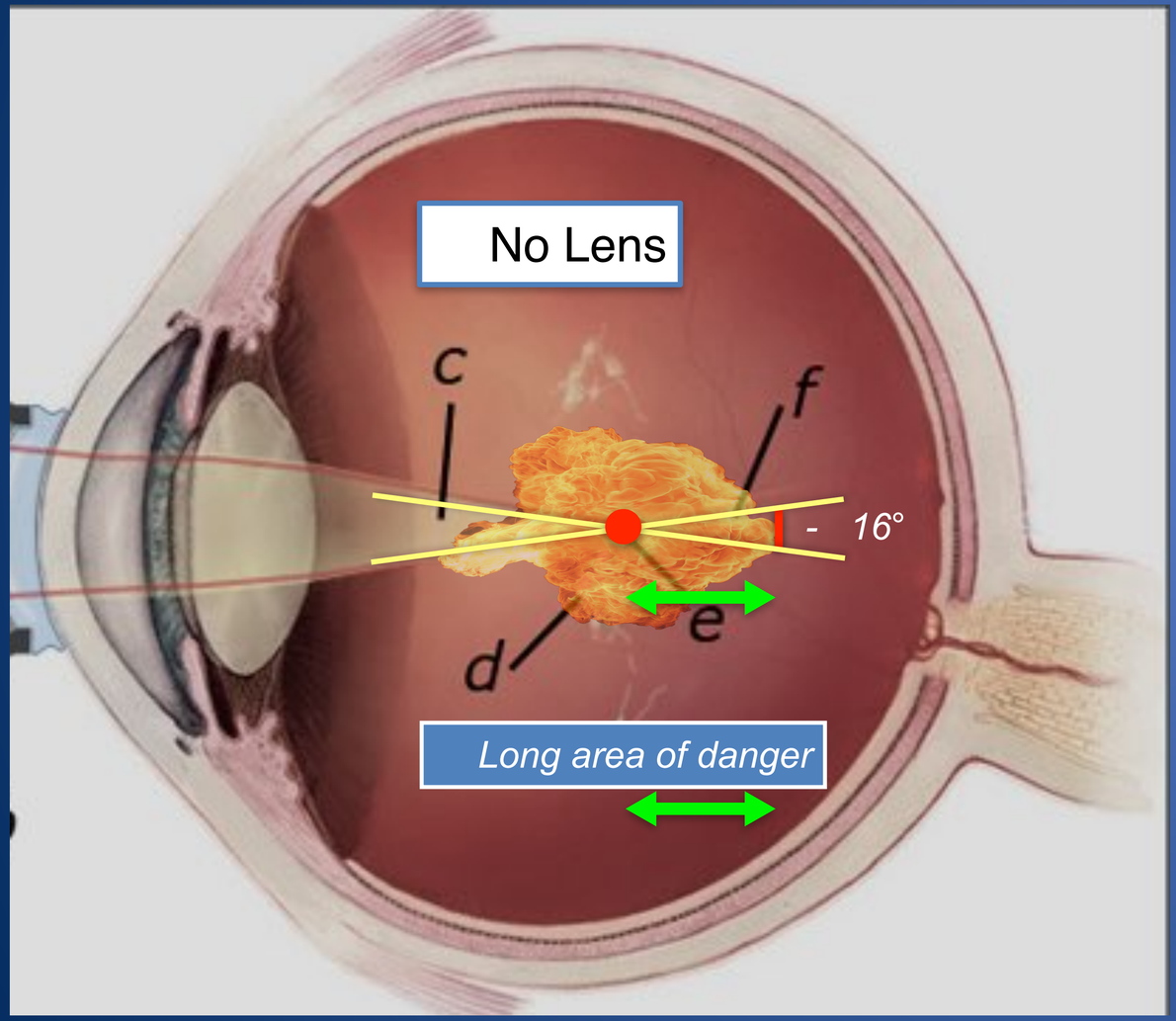
Capsulotomy is safer with contact glass than without !
Forget that extra minute
Don’t teach your residents to do without

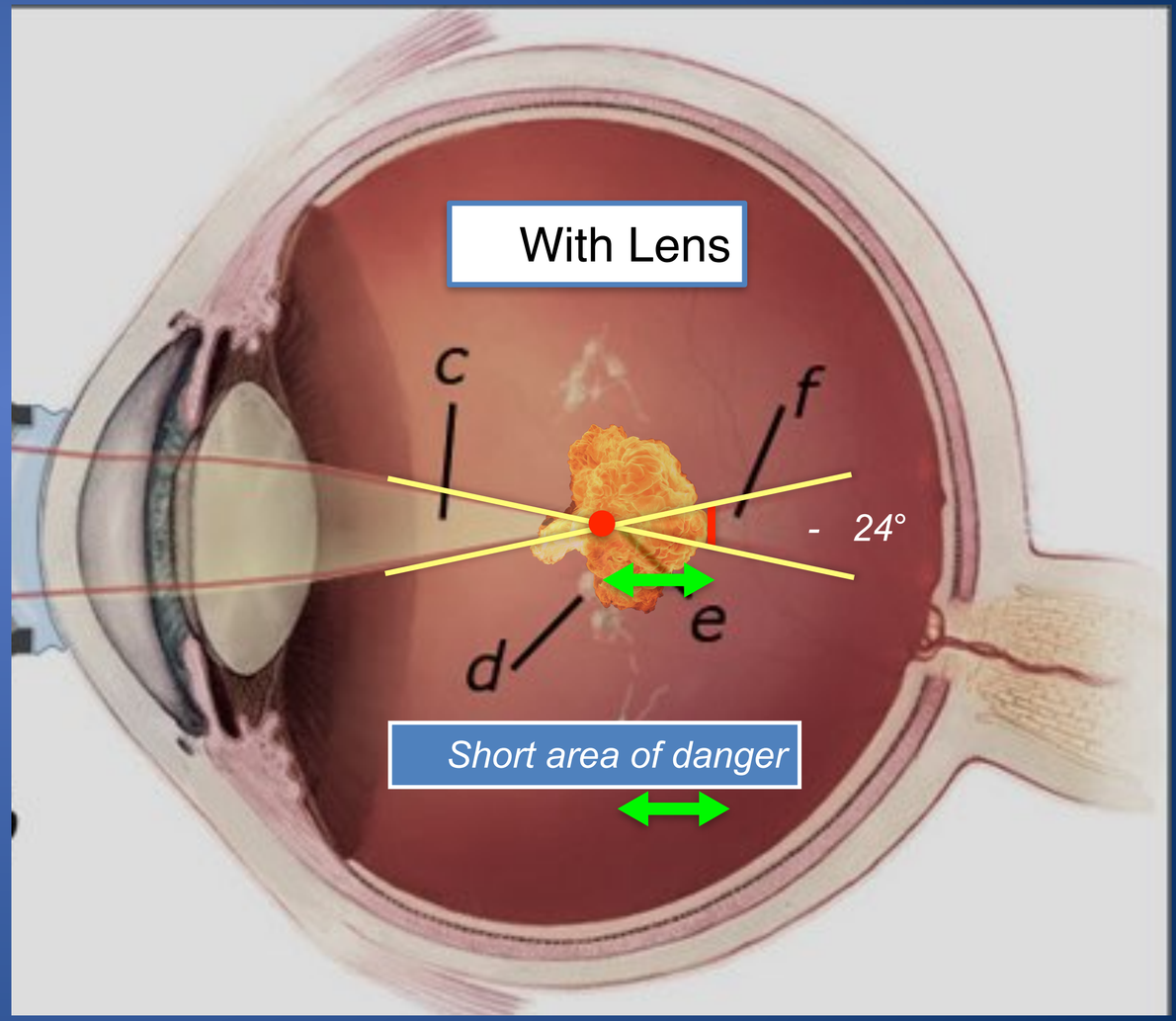




Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus

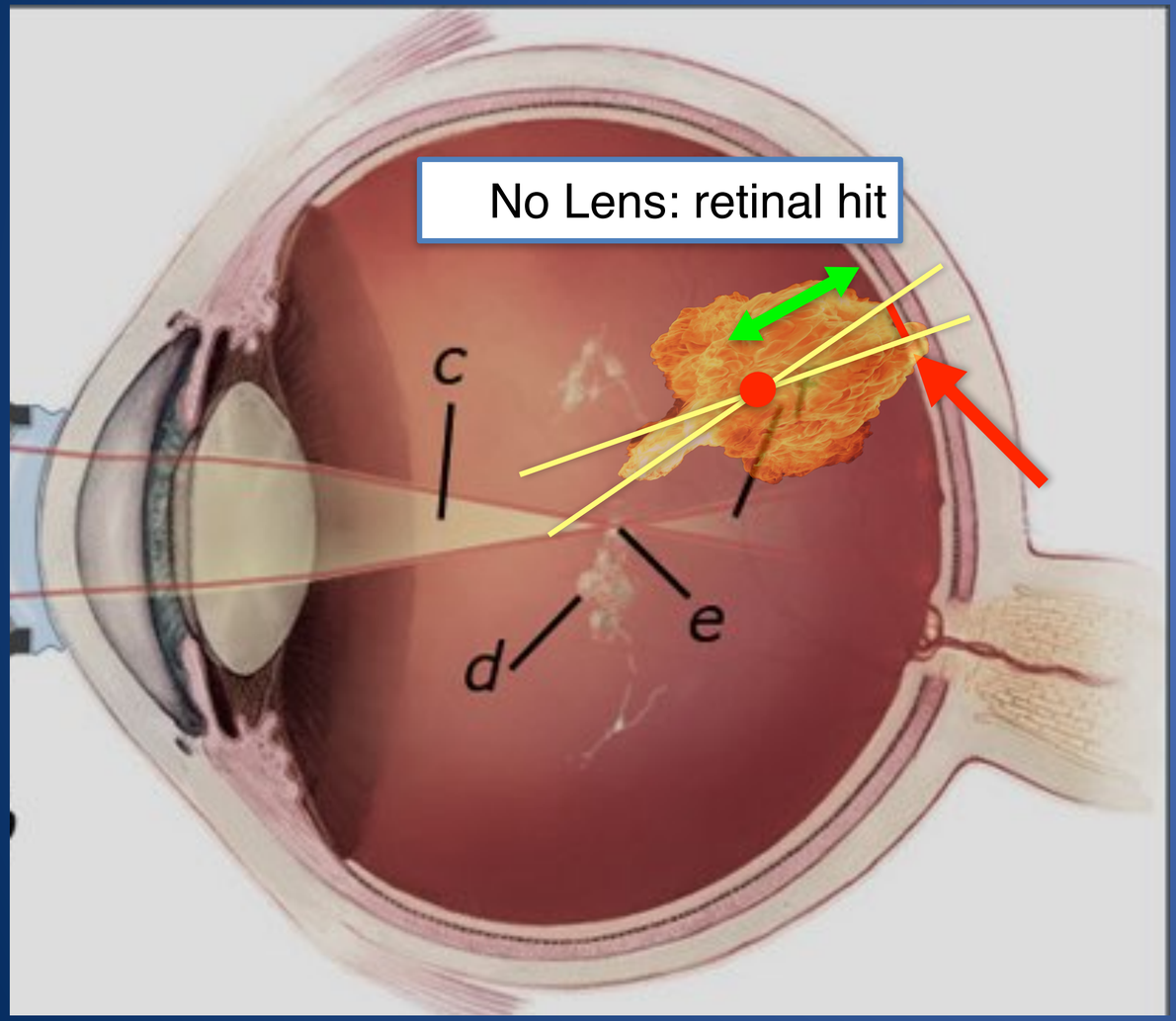


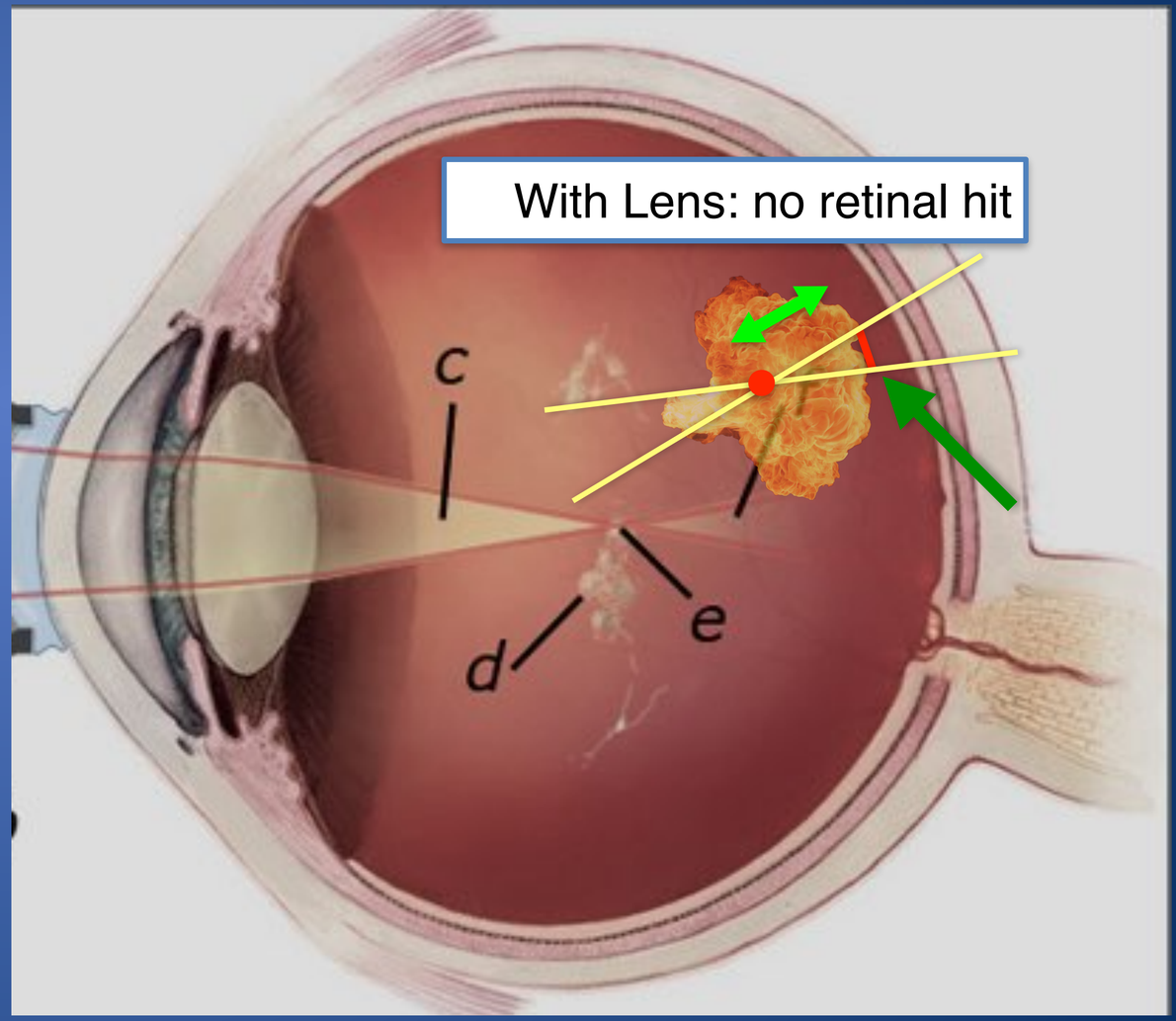


Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

Focus and defocus



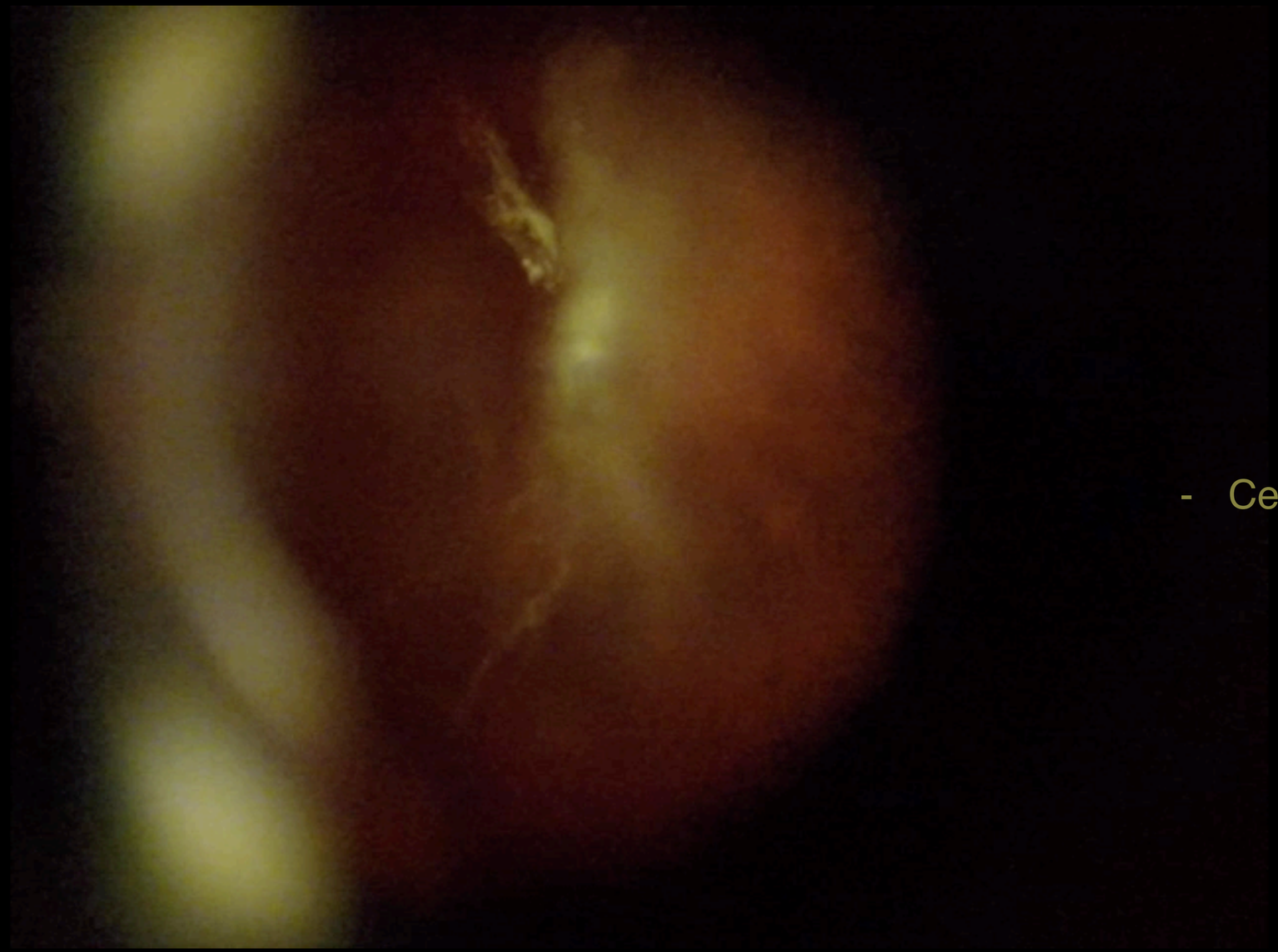


Feike Gerbrandy, Amsterdam

Feike Gerbrandy, Amsterdam

Wie Functioniert die YAG Laser Vitreolyse

Intermezzo 3 : treatment video’s



- Central cloud floater

Feike Gerbrandy, Amsterdam

YAG Vitreolysis

Feike Gerbrandy
Amsterdam Eye Clinic

Thank you

OMC Oogheelkundig Medisch Centrum Amstelland
Amsterdam Eye Hospital

www.floaterlaser.com

Floaterlaser
www.floaterlaser.nl

Feike Gerbrandy, Amsterdam

- Bottlebrush floater

Feike Gerbrandy, Amsterdam

- Central cloud high myopia

Feike Gerbrandy, Amsterdam

- Treatable preretinal floater

Feike Gerbrandy, Amsterdam