

## **Pilates for Glaucoma Patients**

Bianca Beach

BASI Pilates Comprehensive Teacher Training

9/18/21

## **Table of Contents**

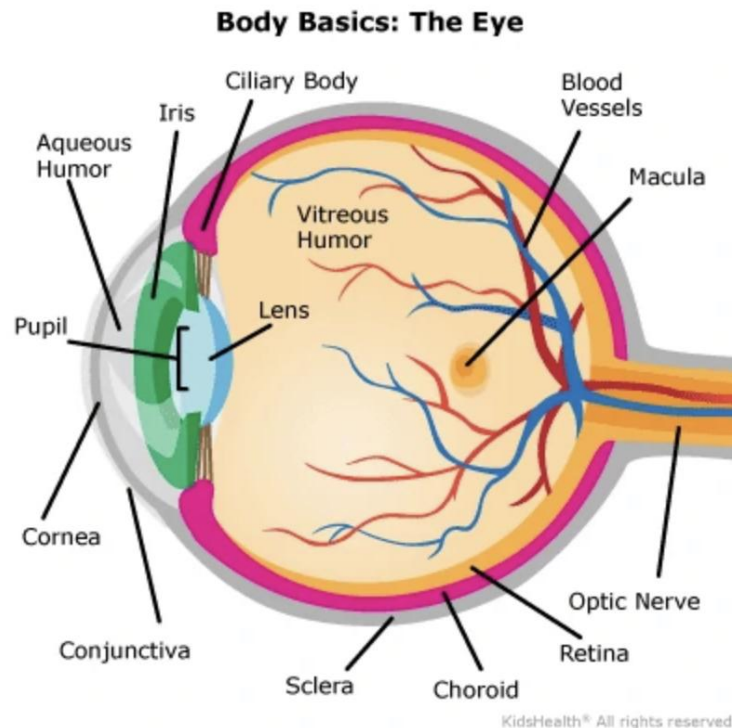
Introduction.....	3
Analysis of Glaucoma.....	4
Client Overview.....	6
Medical Risks/Limitations Involved.....	8
Creating Solutions.....	12
Client Program.....	15
Bibliography.....	19

## **Introduction**

The purpose of this paper is to analyze the limitations of Pilates clients who have Glaucoma, a medical condition in which increased pressure within the eye causes gradual vision loss over time, and create a program to reap the same or similar benefits without including the potentially harmful repertoire. This paper will also address key modifications for notable exercises.

Pilates is an incredibly low-impact form of exercise that is safe for Glaucoma patients if planned accordingly; with hundreds of exercises to choose from, clients can improve their physical strength, alignment and body awareness. Of particular interest is the latter, since most if not all Glaucoma patients struggle with restricted vision and have difficulty with depth perception. Currently, Glaucoma affects 2.3 million people in the United States alone (Glaucoma Research Foundation).

## Analysis of Glaucoma



Above is a basic diagram of the human eye. Glaucoma occurs primarily as a result of ocular hypertension, or high pressure inside the eye, medically referred to as intraocular pressure or IOP. Common causes include excessive aqueous production (a fluid produced by the ciliary body), inadequate drainage of aqueous fluid, steroid medications, eye trauma and genetics. If this is prolonged, optic nerve fibers begin to die, and the body is unable to re-generate them.

A normal IOP measurement should be roughly between 9-13, and is considered high once it reaches about 20. Some pressure readings for Glaucoma patients can start around 22, while more extreme cases can measure in the 50s or higher. When a person blinks, their eye pressure spikes instantly to roughly 100, then regulates itself; when we sleep, pressure against the pillow increases IOP for

the duration of the night. This is completely normal, but for Glaucoma patients whose eyes are not regulating IOP efficiently, it adds fuel to the fire.

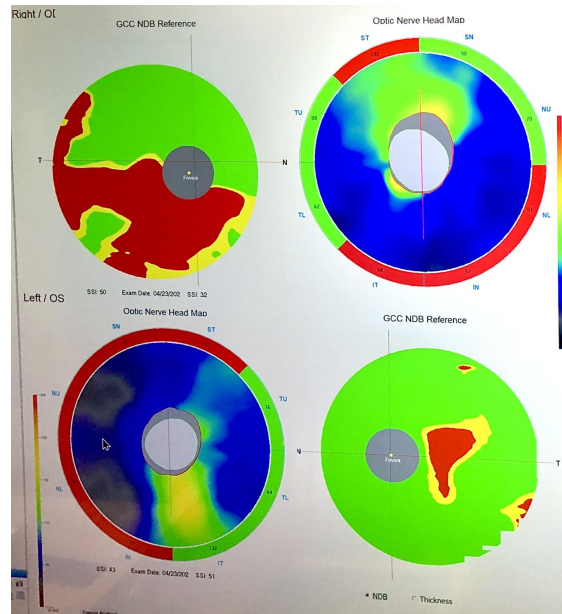
Glaucoma patients can be treated with eye drops, in-office procedures and surgery in extreme cases.

## **Client Overview**

Bianca Beach has had a long medical journey with her eyes leading into her current struggles with Glaucoma, beginning at age 11 with her first complete retina detachment (macula off). Rushed into surgery, she began her journey of five additional surgeries within the space of a year and a half. By 13, Bianca had suffered three retina detachments, a cataract replacement, formation of prominent scleral thinning, strabismus correction, and finally Glaucoma; she has been seen and treated by specialists all along the coast of California, as her case is extremely rare and unique. Banned from sports and physical exercise for years, Bianca eventually landed in physical therapy with Sciatica as a result of inactivity. At 19 with more stable eyes, her physical therapist recommended she try Pilates for rehabilitation; the studio had a BASI-trained instructor - Brittany Herber - working in tandem with the physical therapists for client care. The discovery of a low-impact form of exercise revolutionized Bianca's life and health, and at age 22 in 2021 she is able to manage her Sciatica and overall health safely through practicing Pilates - and she is excited to continue her fitness journey modeled around protecting her eyes.

Bianca is currently on five eye drops in an effort to maintain low IOP: Alphagan, Timoptic, Zioptan, Rhopressa and Cosopt. In the last year she has had four in-office procedures, which were successful at lowering her IOP from mid-20s to mid-teens with the combination of her eye drops. "Selective laser trabeculoplasty (SLT) is an in-office procedure that reduces intraocular pressure in patients with glaucoma. The laser is applied through a special contact lens to the drainage system of the eye where it stimulates a biochemical change that improves the

outflow of fluid from the eye” (Glaucoma Research Foundation). She has also slept with clear plastic “patches” taped over her eyes since her first surgery at 11 to prevent elevated IOP from the pressure of her face against the pillow each night. Below are her most recent visual field scans:



In a healthy eye, the optic nerve would be thick, but these scans show how thin Bianca's are and how some areas have been completely lost. The optic nerve is indicated in the center of the top right/bottom left images by a light gray circle surrounded by a thin, uneven dark gray circle. The dark gray circle is supposed to be significantly thicker all the way around. Bianca has lost over 50% of her nerve fibers.

## **Medical Risks/Limitations Involved**

### **Bianca's Limitations**

There are two key limitations and one consideration to be aware of when looking at Pilates for Glaucoma. The limitations include not doing anything too strenuous which would increase pressure in the head (lifting heavy weights, running, etc.) and not being upside down/having the head below the heart. Of the two, not being upside down is of particular interest when looking at the Pilates repertoire. An additional consideration for Bianca and other Glaucoma patients is the lack of depth perception, throwing off balance. Bianca also has a smaller range of vision due to scar tissue after her surgeries, resulting in a range of vision similar to that of a race horse wearing blinders.

A gray area of being upside down is the period of time the head stays below the heart. A few short seconds in motion is not a great concern, however, more than 3-4 seconds turns from active movement to holding a position which can be exponentially harmful to the eye. Further, each individual Glaucoma patient should discuss the degree of strictness to adhere to with their doctor when practicing Pilates. Some medical professionals will allow their patients to be upside down for the short 3-4 second period, some may allow longer periods, and some may ban the position completely; it all depends on the severity of the patient's case, if their Glaucoma is successfully regulated, and abstract components such as the patient's quality of life. The program outlined in this paper reflects a balance of all considerations and is tailored to Bianca's specific case; some Glaucoma patients are able to do more, and some may need to remove exercises entirely. No two clients are the same, and Pilates instructors should recommend clients discuss their



specific boundaries with their doctor before attempting potentially dangerous repertoire.

## **Medical Risks**

An important piece of information is that Glaucoma patients - or anyone for that matter - cannot feel the pressure inside their eyes increasing; therefore, patients and Pilates instructors alike must be informed of the risks involved during a session since damage can occur "silently." "Most episodes of IOP elevation appear likely to remain undetected due to difficulties in monitoring IOP during many activities. Studies of IOP fluctuation with physical exercise have typically measured IOP with an insufficient sampling rate to truly measure IOP variability. For example, head movement during dynamic exercise necessitates that tonometry be performed during a break in an exercise sequence or after the sequence has been completed" (McMonnies).

If repertoire is attempted from the following list of exercises, Bianca risks further loss of vision that is currently irreversible. There is no cure for Glaucoma, only treatments to manage it (prescription eye drops and/or surgery). Since vision loss from Glaucoma is incremental and happens over a period of time, it is likely Bianca would not notice in real-time; rather, one day she would notice a significant change in her vision that had resulted from damage to nerve fibers weeks, months, or years ago. If Bianca's eye pressure does not stay low consistently, it is possible she would go fully blind as early as age 40. Therefore, every day counts towards preserving her vision and repertoire limitations are taken seriously. Below is a list of prohibited exercises categorized by apparatus; an asterisk indicates the exercise

can be performed with modifications, and “(L#)” indicates the exercise can be performed in a limited number, typically 2-3 repetitions.

## **Prohibited Exercises**

### **Mat Work**

- Shoulder Bridge Prep\*
- Shoulder Bridge\*
- Jack Knife (L#)
- Control Balance
- Scissors
- Bicycles

### **Reformer**

- Teaser Prep\*
- Teaser\*
- Bottom Lift w/Extensions (L#)
- Short Spine (L#)
- Long Spine (L#)
- Up Stretch 1 (L#)
- Elephant (L#)
- Tendon Stretch (L#)

### **Cadillac**

- Tower Prep (L#)
- Tower (L#)
- Hanging Back (L#)
- Roll Up Bottom Loaded\*

- Bottom Lift w/Roll Up Bar (L#)

### **Wunda Chair**

- Standing Pike (L#)
- Cat Stretch Kneeling
- Jack Knife (L#)
- Tendon Stretch (L#)
- Side Pike (L#)

### **Spine Corrector & F2**

- Spine Twist Supine
- Roll Over (& F2)
- Corkscrew
- Supine Leg Series
- Hip Work Series

### **Ladder Barrel**

- Basic Back Extension\*/(L#)
- Swan\*/(L#)

### **F2 Chair**

- Roll Up\*

## **Creating Solutions**

All aspects of life come with obstacles, and Pilates for Glaucoma is no exception - fortunately, most of the potentially dangerous repertoire can be modified to coexist with Glaucoma. Let's take Teaser Prep/Teaser on the Reformer, for example: the harmful component of these exercises is the beginning/end where the client's head drops below parallel to the floor and extends back and down. This creates an immense spike in blood rushing to the head, immediately elevating eye pressure. The force of then having to pull the head back up creates excess strain on the eyes, elevating eye pressure even more in that moment. To modify this exercise for Glaucoma, Pilates instructors should cue their client's head to hover in parallel, or even with the chin tucked and lifted slightly if the client is hesitant or not yet strong enough to hold the head parallel without support for multiple repetitions. This simple modification turns a classic Pilates exercise from dangerous to doable with the knowledge of Glaucoma risks.

In looking at the exercises that cannot be performed at all, it is interesting to notice what blocks they fall under and how a client can reap these same benefits in other exercises. At first glance it appears as though a lot is eliminated from the Comprehensive Program, but digging deeper reveals Pilates has much crossover between exercises. The majority of the listed exercises above are from the Spinal Articulation and Hip Work blocks, with exceptions being Corkscrew in the Lateral Flexion/Rotation block and Cat Stretch Kneeling in the Full Body Integration block. Fortunately, there are many other options for hip work on the Reformer and Cadillac which would give a client the same physical benefits (hip joint mobility and stability). Additionally, the Spinal Articulation exercise eliminated - Roll Over on the

F2 Spine Corrector - simply places the client at a different angle before attempting the original Mat Work exercise. Although holding onto the F2 handles allows for increased scapular stabilization, the same objectives - spinal articulation, hip extensor stretch, lower back stretch - can be obtained through the traditional Mat Work Roll Over, taking away the harmful head-below-heart angle of the body. If a client cannot maintain scapular stability performing the Mat equivalent, an instructor should select an alternate fundamental level exercise and strengthen the client's scapula with other exercises - primarily arm work - in preparation for Roll Over.

Notable modifications for allowed repertoire include exercises where great balance is needed. Since Bianca - and many Glaucoma patients - have issues with depth perception, balance can become very difficult and dangerous for some exercises without modification or aid from an instructor. Examples include Leg Press Standing, Pike Forward, Side Pike and Lunge Forward. These exercises either involve lifting the body up onto the Wunda Chair or dipping the head down, both of which throw off the body's center of gravity and balance. Luckily, modifications can be made! Since Bianca does not have peripheral vision, she cannot use her arms for additional balance for Leg Press Standing because they are so far out of her field of vision. To help her body feel more grounded, she can move her arms to reach out in front of her versus out to the sides. For Pike Forward and Side Pike, not lifting the body into deep flexion will minimize the head movement and ground her more; she can also keep her head relatively still, with eye line at the edge of the chair between her hands to keep her balance and not risk falling. These exercises, plus

Lunge Forward - especially this one - require careful spotting from the instructor to ensure safety.

### **Importance of Breath**

Each Pilates exercise has a specific breath pattern, and many of them encourage exhalation on the main “work” of the exercise, or the contraction of the targeted muscle(s). Chest Lift, for example, instructs to exhale while lifting the trunk, inhale to pause, and exhale to lower the trunk. This not only benefits the correct engagement of muscles, but alleviates strain on the head; attempting to inhale while lifting the trunk would cause the body to work against itself - contracting the abdominals while the diaphragm drops and the lungs expand is counterintuitive, and creates excess strain on the upper body and head, causing elevated eye pressure. McMonnies writes, “breath control is a significant factor in the generation of intra-abdominal pressure magnitude during lifting tasks. IOP increases significantly during a bench press exercise and to a greater extent with breath holding.” He refers to traditional weight-lifting in this study, but the concept remains the same: excess force and holding breath increases eye pressure, while the release of breath lowers it. Therefore, the proper use and control of breath patterns for Pilates repertoire is essential for a Glaucoma patient’s safety during a session. Even a Glaucoma-safe exercise like Chest Lift can turn dangerous with improper breath, but the awareness of this can become an advantageous tool in sessions.

## Client Program

Using the BASI Block System

\*\*\*indicates additional Glaucoma modification notes

Block	Apparatus & Level	Exercise	Notes
Warm Up	Mat - Fundamental	Roll Down  ***modification: using the long box on the Reformer, springs unattached, legs against the foot bar and holding onto the box, push the carriage out and then articulate the spine back up like a regular Roll Down; this keeps the head from lowering as far down	The Pilates roll down is at the beginning and end of each session, and is fantastic for the client to see the change in their body's mobility.  ***to minimize lowering Bianca's head to the floor, she will do 1-2 at the beginning of the session and 1-2 at the end
Warm Up	Cadillac - intermediate series	Roll Up w/Roll Up Bar Mini Roll Ups Mini Roll Ups Oblique Roll Up Top Loaded	This series provides an extra challenge of maintaining scapular and pelvic stability/neutrality while the shoulder flexors are working; additionally, the neck must work harder to support the head, building up strength for future exercises like Teaser on the Reformer.
Footwork	Cadillac - fundamental	Parallel Heels Parallel Toes V Position Toes Open V Heels Open V Toes	Keeping proper breath (inhale to bend, exhale to straighten) is key to maintaining low IOP in this series; hips should

		Calf Raises Single Leg Heels Single Leg Toes	line up directly underneath feet, but to enhance low back stretch and relieve sciatic pain, move the body down slightly so the hips are slightly past the feet
Abdominal Work	Cadillac - intermediate	Breathing w/Push Through Bar	fluid movements are key to this exercise; great way to build strength for Teasers  ***once up in the V position, exhale and articulate back down immediately to keep IOP from spiking
Hip Work - Single Leg Supine Series	Cadillac - intermediate	Frog Extensions Circles (Down, Up) Bicycles Bicycles Reverse	a challenging intermediate series, hip work on the Cadillac requires much more pelvic stability than the Reformer series, and can always be made more challenging by lifting the crossbar  ***keeping the upper body relaxed with shoulder girdles down will prevent pressure from building in the head
Spinal Articulation	Reformer - intermediate	Short Spine	***3-4, keeping constant motion when curling up/down and deeply exhaling as the spine articulates down
Stretches	Reformer - intermediate	Lunge Kneeling	a difficult exercise with Sciatica since the pelvis goes into a posterior tilt, but is high-reward for the nerves when



			stretched properly
Full Body Integration 1	Reformer - advanced	Up Stretch 3 Balance Control Back Prep	<p>***2-3 in both directions of Up Stretch 3; safest of all the Up Stretches since the head spends the least amount of time below the heart</p> <p>Combining these two exercises is inspired by the Mat work Front Support and Back Support - if you do one side, you have to do the other!</p>
Arm Work - Arms Sitting Series	Reformer - intermediate	Chest Expansion Biceps Rhomboids Hug-A-Tree Salute	maintaining an upright trunk position and keeping the wrists straight throughout is challenging in addition to working the isolated muscles in the arms
Leg Work	Wunda Chair - intermediate	Step Down Back	this exercise tests balance while maintaining a stable trunk, isolating the leg movement as it presses the pedal down and up
Full Body Integration 2	Wunda Chair - advanced	Tendon Stretch	***safe for Bianca as long as she does not go into deep, lifted flexion; exercise can be repeated 5-8 times using proper breathing and keeping the head from lowering all the way down
Lateral Flexion/Rotation	Wunda Chair - intermediate	Side Kneeling Stretch	wonderful way to stretch and work obliques while practicing co-contraction of back

			extensors
Back Extension	Wunda Chair - intermediate	Swan on Floor	<p>***keeping the weight light until arm/shoulder strength builds up to press pedal down will prevent excess pressure in the head when articulating up</p> <p>Bias towards a posterior pelvic tilt will protect the lumbar spine from causing sciatic irritation, engaging abdominals</p>
N/A	Roll Down	N/A	***1-2 to finish

## **Bibliography**

Basi Portal, portal.basipilates.com

"Body Basics: The Eye." KidsHealth.

"Exercise for Glaucoma Patients." Cascadia Eye, 28 Sept. 2021,  
<https://www.ncascade.com/exercise-for-glaucoma-patients/>.

Gary Heiting, OD. "5 Causes of High Eye Pressure (Ocular Hypertension)." All About Vision, All About Vision, 7 Sept. 2021,  
<https://www.allaboutvision.com/conditions/hypertension.htm>.

Isacowitz, Rael, and Karen S. Clippinger. Pilates Anatomy: Your Illustrated Guide to Mat Work for Core Stability and Balance. Human Kinetics, 2020.

McMonnies, Charles William. "Intraocular Pressure and Glaucoma: Is Physical Exercise Beneficial or a Risk?" Journal of Optometry, Elsevier, 2016,  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4911456/>.

"Understand Your Glaucoma Diagnosis." Glaucoma Research Foundation,  
[www.glaucoma.org/treatment/understand-your-glaucoma-diagnosis.php](http://www.glaucoma.org/treatment/understand-your-glaucoma-diagnosis.php).