BRIEF SUMMARY

In certain embodiments, determining physical lengths of an eye includes determining an optical length of each segment of a plurality of segments of an axis of the eye, where each segment corresponds to a portion of the eye. A refractive index is determined for each segment. A physical length of each segment is determined according to the optical length and the refractive index of the segment.

According to a first aspect, there is provided a method for determining one or more physical lengths of an eye comprising: determining an optical length of each segment of a plurality of segments of an axis of the eye, each segment corresponding to a portion of the eye; determining a refractive index of each segment of the plurality of segments to yield a plurality of refractive indices; by: obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair; and calculating a physical length of each segment of the plurality of segments according to the optical length and the refractive index of the segment to yield a plurality of physical lengths.

According to a second aspect, there is provided a system for determining one or more physical lengths of an eye comprising: a memory configured to store location information; and one or more processors configured to: determine an optical length of each segment of a plurality of segments of an axis of the eye, each segment corresponding to a portion of the eye; determine a refractive index of each segment of the plurality of segments to yield a plurality of refractive indices; by: obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair; and calculate a physical length of each segment of the plurality of segments according to the optical length and the refractive index of the segment to yield a plurality of physical lengths.

According to a third aspect, there is provided one or more non-transitory computer-readable media storing logic for calculating intraocular lens (IOL) power, when executed by one or more processors the logic configured to: determine an optical length of each segment of a plurality of segments of an axis of the eye, each segment corresponding to a portion of the eye; determine a refractive index of each segment of the plurality of segments to yield a plurality of refractive indices~~;~~ by: obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair; and calculate a physical length of each segment of the plurality of segments according to the optical length and the refractive index of the segment to yield a plurality of physical lengths.

CLAIMS

What is claimed is:

1. A method for determining one or more physical lengths of an eye comprising:

determining an optical length of each segment of a plurality of segments of an axis of the eye, each segment corresponding to a portion of the eye;

determining a refractive index of each segment of the plurality of segments to yield a plurality of refractive indices~~;~~ by:

obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and

determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair; and

calculating a physical length of each segment of the plurality of segments according to the optical length and the refractive index of the segment to yield a plurality of physical lengths.

2. The method of Claim 1, the segments comprising at least one of the following segments: a corneal segment corresponding to a cornea, a crystalline lens segment corresponding to a crystalline lens, an aqueous humor segment corresponding to an aqueous humor portion, and a vitreous humor segment corresponding to a vitreous humor portion.

3. The method of Claim 1, the determining the optical length further comprising:

obtaining an estimated physical length for each segment;

obtaining one or more estimated refractive indices for the plurality of segments; and

calculating the optical length of each segment according to the estimated physical length of the segment and at least one of the estimated refractive indices.

~~4. The method of Claim 1, the determining the refractive index further comprising:~~

~~obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and~~

~~determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair.~~

~~5~~4. The method of Claim 1, the determining the refractive index further comprising:

obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis, the post-operative physical length comprising an IOL length corresponding to an IOL; and

determining the plurality of refractive indices using a directly determined physical IOL length for the IOL length.

~~6~~5. The method of Claim 1, further comprising calculating an IOL location of an IOL by:

determining a crystalline lens segment length of a crystalline lens segment of the plurality of segments;

determining a crystalline lens anterior location and a crystalline lens posterior location from the crystalline lens segment length; and

calculating the IOL location from the crystalline lens anterior location and the crystalline lens posterior location.

~~7~~6. The method of Claim 1, further comprising calculating an IOL power of an IOL by:

calculating a retinal location of a retina of the eye according to the physical lengths;

calculating an IOL location of an IOL from a crystalline lens segment of the plurality of segments;

determining a corneal power of a cornea of the eye; and

calculating the IOL power of the IOL according to the corneal power, the IOL location, and the retinal location.

87. A system for determining one or more physical lengths of an eye comprising:

a memory configured to store location information; and

one or more processors configured to:

determine an optical length of each segment of a plurality of segments of an axis of the eye, each segment corresponding to a portion of the eye;

determine a refractive index of each segment of the plurality of segments to yield a plurality of refractive indices; by:

obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and

determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair; and

calculate a physical length of each segment of the plurality of segments according to the optical length and the refractive index of the segment to yield a plurality of physical lengths.

98. The system of Claim 87, the segments comprising at least one of the following segments: a corneal segment corresponding to a cornea, a crystalline lens segment corresponding to a crystalline lens, an aqueous humor segment corresponding to an aqueous humor portion, and a vitreous humor segment corresponding to a vitreous humor portion.

109. The system of Claim 87, the determining the optical length further comprising:

obtaining an estimated physical length for each segment;

obtaining one or more estimated refractive indices for the plurality of segments; and

calculating the optical length of each segment according to the estimated physical length of the segment and at least one of the estimated refractive indices.

~~11. The system of Claim 8, the determining the refractive index further comprising:~~

~~obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and~~

~~determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair.~~

~~12~~10. The system of Claim ~~8~~7, the determining the refractive index further comprising:

obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis, the post-operative physical length comprising an IOL length corresponding to an IOL; and

determining the plurality of refractive indices using a directly determined physical IOL length for the IOL length.

~~13~~11. The system of Claim ~~8~~7, the one or more processors further configured to calculate an IOL location of an IOL by:

determining a crystalline lens segment length of a crystalline lens segment of the plurality of segments;

determining a crystalline lens anterior location and a crystalline lens posterior location from the crystalline lens segment length; and

calculating the IOL location from the crystalline lens anterior location and the crystalline lens posterior location.

1412. The system of Claim 87, the one or more processors further configured to calculate an IOL power of an IOL by:

calculating a retinal location of a retina of the eye according to the physical lengths;

calculating an IOL location of an IOL from a crystalline lens segment of the plurality of segments;

determining a corneal power of a cornea of the eye; and

calculating the IOL power of the IOL according to the corneal power, the IOL location, and the retinal location.

~~15~~13. One or more non-transitory computer-readable media storing logic for calculating intraocular lens (IOL) power, when executed by one or more processors the logic configured to:

determine an optical length of each segment of a plurality of segments of an axis of the eye, each segment corresponding to a portion of the eye;

determine a refractive index of each segment of the plurality of segments to yield a plurality of refractive indices~~;~~ by:

obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and

determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair; and

calculate a physical length of each segment of the plurality of segments according to the optical length and the refractive index of the segment to yield a plurality of physical lengths.

~~16~~14. The non-transitory computer-readable media of Claim ~~15~~13, the segments comprising at least one of the following segments: a corneal segment corresponding to a cornea, a crystalline lens segment corresponding to a crystalline lens, an aqueous humor segment corresponding to an aqueous humor portion, and a vitreous humor segment corresponding to a vitreous humor portion.

~~17~~15. The non-transitory computer-readable media of Claim ~~15~~13, the determining the optical length further comprising:

obtaining an estimated physical length for each segment;

obtaining one or more estimated refractive indices for the plurality of segments; and

calculating the optical length of each segment according to the estimated physical length of the segment and at least one of the estimated refractive indices.

~~18. The non-transitory computer-readable media of Claim 15, the determining the refractive index further comprising:~~

~~obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis; and~~

~~determining the plurality of refractive indices that yield the pre-operative physical length substantially equal to the post-operative physical length for each pair.~~

~~19~~16. The non-transitory computer-readable media of Claim ~~15~~13, the determining the refractive index further comprising:

obtaining a plurality of length pairs, each pair comprising a pre-operative physical length and a post-operative physical length, each pair estimating a physical length of at least a portion of the axis, the post-operative physical length comprising an IOL length corresponding to an IOL; and

determining the plurality of refractive indices using a directly determined physical IOL length for the IOL length.