Partial Coherence Interferometry as a Technique to Measure the Axial Length of the Eye

Archived Medical Policy

Archived medical policies are no longer subject to periodic review, are maintained for reference, and may be returned to active status if the need is identified.

Policy # 00093
Original Effective Date: 06/05/2002
Current Effective Date: 07/27/2012

Applies to all products administered or underwritten by Blue Cross and Blue Shield of Louisiana and its subsidiary, HMO Louisiana, Inc. (collectively referred to as the “Company”), unless otherwise provided in the applicable contract. Medical technology is constantly evolving, and we reserve the right to review and update Medical Policy periodically.

When Services Are Eligible for Coverage
Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:

- Benefits are available in the member’s contract/certificate, and
- Medical necessity criteria and guidelines are met.

Based on review of available data, the Company may consider measurement of the axial length of the eye using partial coherence interferometry as part of the preoperative workup of patients undergoing cataract removal to be eligible for coverage.

When Services Are Not Considered Medically Necessary
The use of both partial coherence interferometry and ultrasound measurements of the axial eye length is considered not medically necessary.**

Background/Overview
Placement of an artificial lens after cataract surgery requires an accurate calculation of the intraocular lens power necessary for attaining the optimal postoperative refraction. The intraocular lens power is calculated using standard formulas and is dependent on accurate measurements of the axial eye length, the corneal radius and the anterior chamber length. The corneal radius is typically measured using keratometry, while the anterior chamber length is measured by slit lamp illumination. Ultrasound, using either immersion techniques or applanation, where the ultrasound transducer is placed on the surface of the cornea, is used to assess the axial eye length. The applanation technique is most commonly used. Recently, partial coherence interferometry has been introduced as an alternative technique to measure the axial length of the eye. This technique relies on a laser Doppler technique to measure the echo delay and intensity of infrared light reflected back from tissue interfaces. This technique, which is thought to be more accurate and precise than ultrasound biometry, may ultimately contribute to improved postsurgical refraction. Partial coherence interferometry may also be referred to as optical (or ocular) coherence biometry or laser Doppler interferometry.

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FDA or Other Governmental Regulatory Approval

U.S. Food and Drug Administration (FDA)
The IOLMaster (Carl Zeiss) is a device approved by the U.S. FDA that performs measurement of the axial length of the eye using partial coherence interferometry, measurement of the corneal radius using traditional keratometry principles, and measurement of the anterior chamber depth by slit lamp illumination. The IOLMaster also includes software that uses the above measurements to calculate the intraocular lens power according to standard formulas.

Rationale/Source

Of the three parameters used to calculate the intraocular lens power preoperatively (axial length, corneal curvature, and anterior chamber length), errors in measurement of axial length are thought to be the largest contributor to postoperative refractive errors. The most commonly used technology for measuring the axial length is ultrasound using an applanation technique, i.e., the ultrasound transducer must be in contact with the corneal surface. The accuracy of standard ultrasound biometry techniques is estimated at 0.1 to 0.12 mm. In addition, errors in measurement may result if the placement of the transducer even slightly indents the surface of the eye. Based on the formulas used to calculate intraocular power, a 0.1-mm error in axial length will result in a 0.28-diopter refractive error. Refractive errors of two diopters or more may result in a second operation to exchange the intraocular lens with one of a different power.

A standard method of assessing the contributions to the refractive error is to perform biometric measurements preoperatively (which are used to calculate the intraocular lens power), and then to measure the postoperative refraction. Based on the refraction, one can calculate the axial eye length. Thus the axial eye length measured preoperatively can be compared with the axial eye length based on postoperative refraction. Drexler and colleagues evaluated 85 cataract eyes using both ultrasound and partial coherence interferometry. The intraocular lens power was then calculated based on both techniques, but the results from the ultrasound biometry were used to select the intraocular lens power inserted following cataract removal. The difference between the intraocular lens power calculated with partial coherence interferometry versus ultrasound biometry was then assessed as a function of the refractive outcome. There was a significant correlation between the two techniques. For example, if the intraocular lens power calculated with partial coherence interferometry was greater than that calculated with ultrasound biometry data, the patient tended to be myopic postoperatively. Essentially, the final refractive results based on ultrasound biometry were compared to the predicted results based on partial coherence interferometry. While this is an indirect measure of the value of partial coherence interferometry to calculate intraocular lens power, the other biometric measures used were the same (i.e., only the measurement of axial eye length was different in the two techniques). The same formulas were used to calculate intraocular power, and it is assumed that there is minimal refractive error introduced during the surgery itself. However, it should also be noted that in Drexler’s study the majority of refractive errors clustered between –0.5 and +1.5 diopters. It is not known what percentage of patients achieved 20/20 vision postoperatively, either aided or unaided, or what, if any, percentage of patients required placement of a new lens.
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Aside from improvement in calculation of intraocular lens power, proposed advantages of partial coherence interferometry include the increased comfort for the patient, and increased ease of measurement of axial eye length in patients with retinal detachment, silicone-filled eyes (e.g., after vitrectomy), and patients with abnormally shaped eyes.

2003 Update
A review of the peer-reviewed literature based on the MEDLINE database for the period of 2001 through February 2003 identified three clinical trial publications. In a prospective, randomized clinical trial of 100 patients, Rajan and colleagues reported partial coherence laser interferometry resulted in improved predictive value for postoperative refraction over applanation ultrasound technique and was reliable in calculating intraocular lens power. In two trials, Kiss and colleagues, reported no significant difference in refractive outcomes using commercial prototype versions of the IOLMaster partial coherence interferometry vs. immersion ultrasound. While finding the refractive outcomes with the IOLMaster were as good as immersion ultrasound, the authors also noted the improved comfort for patients, reduced risk of infection, and practicality for clinical use of partial coherence interferometry. Therefore, the policy statement is unchanged.

References

Coding
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Codes used to identify services associated with this policy may include (but may not be limited to) the following:

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Policy History
Original Effective Date: 06/05/2002
04/18/2002 Medical Policy Committee review
06/05/2002 Managed Care Advisory Council approval
06/24/2002 Format revision. No change to coverage eligibility.
06/01/2004 Medical Director review
07/20/2004 Medical Policy Committee review. Format revision. No substance change to policy.
07/14/2005 Medical Director review
07/19/2005 Medical Policy Committee review
08/24/2005 Quality Care Advisory Council
09/06/2006 Medical Director review
09/20/2006 Medical Policy Committee approval. No changes to policy guidelines.
09/05/2007 Medical Director review
09/19/2007 Medical Policy Committee approval. No change to coverage eligibility.
07/02/2009 Medical Director review
07/22/2009 Medical Policy Committee approval. No change to coverage eligibility.
07/01/2010 Medical Policy Committee approval
07/07/2011 Medical Policy Committee review
06/28/2012 Medical Policy Committee review. Recommend archiving policy.
07/27/2012 Medical Policy Implementation Committee approval. Archived.

Next Scheduled Review Date: Archived medical policy.

**Medically Necessary (or “Medical Necessity”) - Health care services, treatment, procedures, equipment, drugs, devices, items or supplies that a Provider, exercising prudent clinical judgment, would provide to a patient for the purpose of preventing, evaluating, diagnosing or treating an illness, injury, disease or its symptoms, and that are:

A. in accordance with nationally accepted standards of medical practice;
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B. clinically appropriate, in terms of type, frequency, extent, level of care, site and duration, and considered effective for the patient's illness, injury or disease; and
C. not primarily for the personal comfort or convenience of the patient, physician or other health care provider, and not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of that patient's illness, injury or disease.

For these purposes, “nationally accepted standards of medical practice” means standards that are based on credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community, Physician Specialty Society recommendations and the views of Physicians practicing in relevant clinical areas and any other relevant factors.

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