IOLMaster 500 and the Haigis-L Formula in IOL Calculations for Post-Refractive Patients

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Modern cataract surgery has evolved significantly in terms of safety and accuracy of the procedure. Today's surgeon has an array of tools that can be applied before, during and after surgery to help patients achieve outcomes that just several years ago were hard to imagine.

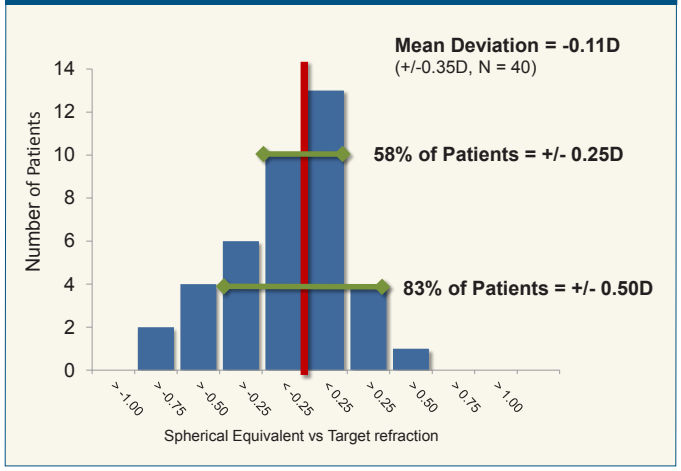
The demand for improvement in cataract outcomes has been fueled in part by what has been achieved in refractive surgery and laser vision correction (PRK and LASIK). Surgeons must contend with growing expectations by cataract patients, with a growing percentage of them having undergone laser vision correction at an earlier stage of life. Carl Zeiss Meditec (Dublin, CA) has made the Haigis-L formula available on its IOLMaster 500 and asked SM2 Strategic to interview and summarize the experience with Haigis-L of Mitchell Jackson, MD, a refractive cataract surgeon in Chicago, Illinois.

Solving a Problem

In the United States, 9-10 million people (17-19 million eyes) have undergone some form of laser vision correction since its approval as a commercial treatment in late 1995[1]. Worldwide estimates of procedure rates range from 2 to 4 times this amount. While formulas such as Holladay 2 for IOL calculation in cataract surgery have served to significantly increase precision and predict outcomes, none of these formulas were designed to take into account corneas that have been altered due to corneal refractive surgery. Because these formulas use corneal power as part of their calculations, they won't be accurate unless modified to account for the change.

Several alternatives have emerged to help surgeons. The Masket Regression method as published in JCRS in 2006 estimates a 1D adjustment in IOL power for every 3D of laser vision correction performed prior to cataract surgery. This method can be utilized on website calculators but still requires knowledge of the pre-LASIK refractive error.

Figure 1: Target Refraction vs. Post-Op Outcome



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The contact lens method, where the preoperative workup includes over-refraction of the patient with a contact lens (CL) placed on the cornea, has been deemed time-consuming as well as inconvenient for the patient. A third alternative is the clinical history method, which requires access to the patient's refractive data prior to having refractive surgery (and is not always available). With these data, a surgeon can use online calculators available at several websites.

Haigis-L

German Professor Wolfgang Haigis, author of the standard Haigis formula, helped overcome the limitations by creating a formula specifically designed for eyes that have had LASIK or PRK (note: the formula does not apply to RK, as post-RK eyes typically show an unchanged relationship between anterior and posterior corneal curvature, where both are flattened as a result of peripheral weakening). Known as the Haigis-L, this formula has been available since 2006[2] and is now included as standard (along with Holladay 2) within the IOLMaster 500 unit.

The Haigis-L formula removes the relationship between corneal power and postoperative effective lens position (ELP), instead using the measured anterior chamber depth to predict ELP. All necessary measurements are taken on the IOLMaster; no clinical history or CL over-refraction is required. The only other information needed is whether the patient had myopic or hyperopic LVC.

Haigis-L in Practice

Besides being an optimized formula for LASIK and PRK eyes, the advantage of Haigis-L is one of convenience in saving time both before surgery (reduced planning) and after surgery (dealing with refractive surprises)[1]. Mitchell Jackson's practice, located in suburban Chicago, is a com-

bined refractive and cataract practice where Dr. Jackson has performed laser vision correction since 1995. Approximately half of his current cataract surgical volume is comprised of patients who have had refractive surgery in the past, well above the typical 10-20% for most cataract surgeons. Hence, having tools in place that address the specific needs of post-refractive patients is paramount.

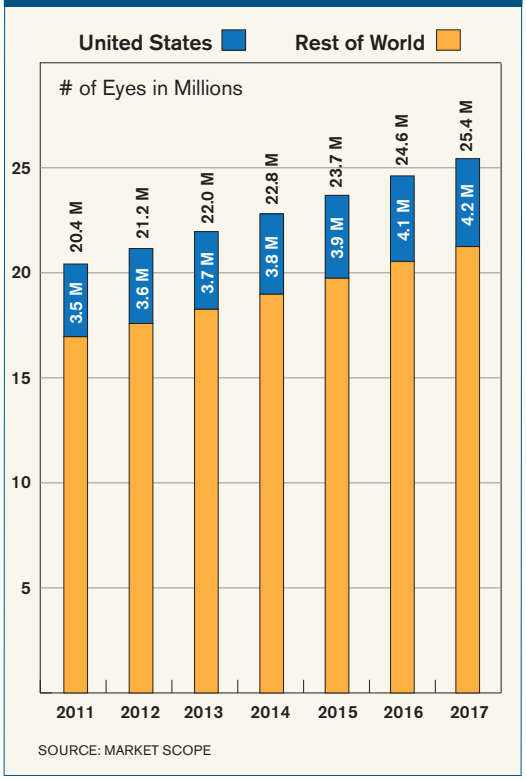
Dr. Jackson utilizes multiple diagnostic and therapeutic tools as part of his surgical armamentarium, including IOLMaster 500, OPDIII Scan (Nidek), ORA (WaveTec Vision), and MICS (Bausch & Lomb Surgical); later this year, he plans to add a femtosecond laser. He uses Haigis-L as his formula of choice for post-refractive patients. "Using Haigis-L for LASIK patients is no different in terms of effort than using Holladay 2 on (non-modified) corneas. All you need to know is whether the eye had a myopic or hyperopic laser vision treatment."

Dr. Jackson has conducted his own study to determine the value offered by the Haigis-L formula. In a retrospective analysis of 40 consecutive eyes, Dr. Jackson found that 58% of eyes were within 0.25 diopters of target refraction and 83% of eyes were within 0.5 diopters, with a mean deviation (target minus achieved) of 0.11 diopters. The distribution of results can be seen in *Figure 1*.

In terms of ability to reduce outliers, only 1 eye was hyperopic at 0.5D sphere; 22 eyes were myopic as part of the surgical plan intended to avoid hyperopic surprise. The myopia ranged from -0.25 to -0.75 diopters. In Dr. Jackson's estimation, these results are similar to what he achieves with a normal population of eyes undergoing surgery but not having had prior refractive surgery. "If Haigis-L was not available, there would have been more hyperopic surprises and a larger standard deviation."

Dr. Jackson also appreciates the fact that Haigis-L is a time saver. "The formula doesn't replace anything; it just makes life easier. Having it built in to the IOLMaster 500 makes using it as easy as the other available formulas on the device." This time savings extends to the reduced chair time eliminated from dissatisfaction resulting from refractive surprises.

Figure 2: Total IOLs Surgical Procedures



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Rising Expectations

The other key benefit of Haigis-L is that it helps surgeons meet expectations among today's patients, especially those that are paying directly for refractive services performed in conjunction with cataract surgery. "When patients are spending their own money on upgrading technology for their procedure, they expect it to be right the first time," noted Dr. Jackson. "Especially since they know what to expect – great vision – from LASIK."

As seen in *Figure 2*, data from Market Scope show both the US and Worldwide forecast for cataract surgery over the next five years. Much of this growing population of patients has expectations for their outcome, whether they pay directly for services or having their surgery covered by a third party.

Dr. Jackson has found Haigis-L to be a highly valuable tool for post-refractive patients. His advice to surgeons who have not yet upgraded to the IOLMaster 500 is simple: "You get two great formulas (Holladay 2 and Haigis-L) that cover a broad range of patients. You can still use contact lens or clinical history methods if you choose. It's all in a single box, and that makes the upgrade to the current platform well worth it." Cataract patients have long known of the vision outcomes achieved in refractive surgery and have come to expect their cataract outcome to be similar to refractive outcomes. As shown in Dr. Jackson's practice, the Haigis-L Formula and the IOLMaster500 are important tools in helping surgeons meet these expectations.

1 Market Scope Newsletter data, analyzed by SM2 Strategic

2 Haigis W. Intraocular lens calculation after refractive surgery for myopia: Haigis-L formula. Journal of Cataract and Refractive Surgery 2008; 34(10):1658-1663