THE SHAMMAS-PL AND -PHL FORMULAS FOR IOL POWER CALCULATION AFTER LASIK

THE “NO HISTORY” METHOD

By

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FINANCIAL DISCLOSURE

The Shammas post-LASIK formulas are licensed to Haag-Streit, Nidek, Visia and Tomey

AFTER MYOPIC LASIK

AFTER LASIK, TWO ERRORS ARE INTRODUCED WHEN WE DO IOL POWER CALCULATIONS

1. Error when we measure the Ks
   The K readings measured after LASIK do not represent the true corneal power

2. Error in the ELP prediction
   This error is only produced by the formulas where ELP is a function of the K readings:
   SRK/T, HOLLADAY1, HOFFER Q

AFTER MYOPIC LASIK

Correcting the “K readings” is necessary no matter what formula you are using
**CLINICAL HISTORY METHOD**

**WHEN THE REFRACTIVE DATA IS AVAILABLE**

The Ks can be corrected where: \( K_c = K_{\text{pre}} - CR_c \)

The amount of LASIK correction is subtracted from the pre-LASIK Ks

**PROBLEM**

This method often becomes less accurate because of additional refractive changes that happen with time. These can be due to corneal changes, multiple refractive surgeries or cataract progression

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**AFTER MYOPIC LASIK**

How to correct the “K readings”

**WHEN**

The pre-LASIK Ks are not available or when we can not rely on the Clinical History Method

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**THE SHAMMAS-PL FORMULA**

Few years ago, we presented a method to correct the “K readings” when the pre-LASIK Ks and the amount of myopic correction are not available

(SHAMMAS, SHAMMAS et al. AJO 2003;136:426-432)

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**THE SHAMMAS-PL FORMULA**

200 randomly selected eyes from 200 patients that had LASIK surgery

Group I: To derive the formula
Group II: To validate the results
THE SHAMMAS-PL FORMULA

FOR EACH EYE, WE CALCULATED THE AMOUNT OF LASIK CORRECTION (CRc) AT THE CORNEAL PLANE

\[ CRc = Rc.post - Rc.pre \]

Rc.post = Post-LASIK refraction at the cornea
Rc.pre = Pre-LASIK refraction at the cornea

THE SHAMMAS-PL FORMULA

CORRECTED “K” (Kc)
What the “K readings” should have been after LASIK

\[ Kc = Kpre - CRc \]

MEASURED “K” AFTER LASIK (Kpost)

THE SHAMMAS-PL FORMULA

The corrected K (Kc) to be used in the IOL Power Formula is calculated:

\[ Kc = 1.14 \cdot K_{post} - 6.8 \]

Utilizes only data available at the time of cataract surgery
“The measured post-LASIK K readings (Kpost)”

(SHAMMAS, SHAMMAS et al. AJO 2003;136:426-432)
**THE SHAMMAS-PL FORMULA**

\[
\text{IOL}_{\text{mm}} = \frac{1336}{L - 0.1(L - 23) - (C+0.05)} - \frac{1}{Kc} \cdot \frac{10.125}{C + 0.05 - \frac{1336}{Kc}}
\]

Where:
- \( L \) = Axial length in mm
- \( C \) = pACD in mm
- \( Kc = 1.14K_{\text{post}} - 6.8 \)

*(SHAMMAS and SHAMMAS. J Cataract Refract Surg 2007;33:31-36)*

**THE SHAMMAS-PL FORMULA**

**PROSPECTIVE STUDY**

We used the SHAMMAS-PL formula in 15 eyes of 15 patients that had previous myopic LASIK and scheduled for cataract surgery.

**THE SHAMMAS-PL FORMULA**

**THE MEAN IOL PREDICTION ERROR**

Mean Arithmetic Error: -0.003 ± 0.63 D
Median Absolute error: 0.55 D
Range of errors: -0.89 to +1.05 D
Number of eyes within ± 1 D: 14 / 15 (93.3%)

**THE SHAMMAS-PL FORMULA**

**CASE PRESENTATION**

- 59 year-old with cataract OD
- Vision OD with -4.50 = 20/80
- Prior LASIK = No information
- Lenstar A.L. = 26.15 mm
- \( Ks = 41.50 / 42.00 \) D
THE SHAMMAS-PL FORMULA

CASE PRESENTATION

- SRK/T calculates 13.82 D for emmetropia
- Shammas-PL formula: 15.53 D
- Haigis-L : 15.47 D
- I implanted a 16.0 D IOL
- Refraction : Plano - 0.50 x 180 = 20/20

THE FORMULA IS AVAILABLE

- On the Haag-Streit Lenstar-LS900 Biometer
- On many recently manufactured biometry units
- On Hoffer’s computer programs
- On the ASCRS web site IOL calculator

THE SHAMMAS-PL FORMULA

PDF File

No-History IOL power calculator
created by Dr. Elliot Perlman, Rhode Island Eye Institute

JShammas@shammaseye.com

THE SHAMMAS-PL FORMULA

Mean absolute IOL prediction errors
A STUDY BY WANG, HILL AND KOCH, JCRS 2010
Mc CARthy’S STUDY:

**IOL Power Calculations**

*After Myopic Laser Refractive Surgery:*

A comparison of methods on 173 eyes

25 different combinations of:
- 9 corneal power adjustment formulas
- And 6 optical vergence formulas


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**THE SHAMMAS-PL FORMULA**

**Mc CARthy’S STUDY:**

**TOP 5 COMBINATIONS WITH THE LEAST PREDICTION ERRORS**

<table>
<thead>
<tr>
<th>Formula</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shammas-PL formula</td>
<td>-0.10 ± 1.02 D</td>
</tr>
<tr>
<td>Masket + Hoffer Q formula</td>
<td>-0.18 ± 0.87 D</td>
</tr>
<tr>
<td>Haigis-L formula</td>
<td>-0.26 ± 1.13 D</td>
</tr>
<tr>
<td>CHM + Hoffer Q formula</td>
<td>-0.27 ± 1.04 D</td>
</tr>
<tr>
<td>Latkany flat-K + SRK/T</td>
<td>-0.37 ± 0.91 D</td>
</tr>
</tbody>
</table>

IOL POWER CALCULATION IN EYES WITH PRIOR HYPEROPIC LASIK

Fact

AFTER MYOPIC LASIK
If a conventional formula is used (SRK/T, Holladay 1, Hoffer Q or Haigis), the patient will end up with post-operative hyperopia

AFTER HYPEROPIC LASIK
If a conventional formula is used (SRK/T, Holladay 1, Hoffer Q or Haigis), theoretically, the opposite will happen and the patient will end up with post-operative myopia

IOL POWER CALCULATION IN EYES WITH PRIOR HYPEROPIC LASIK

Correcting the errors when the LASIK data is not available

AFTER MYOPIC LASIK
Two most popular formulas: Haigis-L and the Shammas-PL. Both formulas use a corneal correction equation to correct for the measurement errors induced by the LASIK procedure

AFTER HYPEROPIC LASIK
A different corneal correction equation is required

IOL POWER CALCULATION IN EYES WITH PRIOR HYPEROPIC LASIK

Study design

42 EYES WITH PRIOR HYPEROPIC LASIK THAT UNDERWENT CATARACT SURGERY
18 eyes with previous LASIK data
And
24 eyes with NO previous LASIK data

Establishing the corneal correction equation
18 eyes with previous LASIK data

\[ y = 1.0457x - 1.9538 \]
\[ R^2 = 0.8897 \]
IOL POWER CALCULATION IN EYES WITH PRIOR HYPEROPIC LASIK

Establishing the corneal correction equation

The correct K (Kc) to be used in the IOL Power Formula is calculated:

\[ Kc = 1.0457 \times K_{post} - 1.9538 \]

Utilizes only data available at the time of cataract surgery

"The measured post-LASIK K readings (Kpost)"

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IOL POWER CALCULATION IN EYES WITH PRIOR HYPEROPIC LASIK

The corneal correction equation is combined with the Shammas original formula to establish

**THE SHAMMAS-PHL FORMULA**

\[
IOL_{em} = \frac{1336}{L - 0.1(L - 23) - (C + 0.05)} \times \frac{1}{1.0125 - \frac{C + 0.05}{Kc}}
\]

Where \( L \) = Axial length in mm, \( C \) = pACD in mm,
And where the corrected K readings \( Kc = 1.0457 \times K_{post} - 1.9538 \)

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THE SHAMMAS-PHL FORMULA

Evaluating the formula’s accuracy in all 42 eyes (with or without prior LASIK data)

<table>
<thead>
<tr>
<th>FORMULA</th>
<th>MAE ± SD</th>
<th>MedAE</th>
<th>RANGE</th>
<th>WITHIN ± 1D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shammas-PHL</td>
<td>0.01 ± 0.65</td>
<td>0.42</td>
<td>-1.79 to 1.54</td>
<td>90.4%</td>
</tr>
<tr>
<td>Haigis-L</td>
<td>0.22 ± 0.48</td>
<td>0.38</td>
<td>-1.71 to 1.67</td>
<td>88.1%</td>
</tr>
</tbody>
</table>

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THE SHAMMAS-PHL FORMULA

Median Absolute Errors With and Without the Corneal Correction Equation

<table>
<thead>
<tr>
<th>18 CASES WITH KNOWN HYPEROPIC LASIK CORRECTION AMOUNT</th>
<th>SHAMMAS FORMULA WITHOUT CORNEAL CORRECTION</th>
<th>SHAMMAS FORMULA WITH CORNEAL CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1.50 D (11 cases)</td>
<td>0.37 D</td>
<td>0.35 D</td>
</tr>
<tr>
<td>More than 1.50 D (7 cases)</td>
<td>0.57 D</td>
<td>0.49 D</td>
</tr>
</tbody>
</table>
IN CONCLUSION

The SHAMMAS-PL formula (after myopic LASIK)
And
The SHAMMAS-PHL formula (after hyperopic LASIK)
can be very helpful and are highly recommended

WHETHER OR NOT

The LASIK data is available

THANK YOU
FOR YOUR ATTENTION