

## Unhappy Patients

Historically, ophthalmologists and optometrists have encountered patients that could not be corrected to a satisfactory level of BCVA. The cause of this vision problem is unique to each patient and may be attributed to a number of pathologies. Quite often, the physician invests a great deal of time working with patients using all available diagnostic techniques to no effect. Ultimately, the conclusion is that the patients have unrealistic expectations or the cause is “irregular astigmatism,” and the doctor tells the patients that they achieved the best vision currently possible.

To the patients, the result of the multiple visits is frustration and dissatisfaction because they still cannot see well. The patients question the capabilities of the doctor and wonder whether they should invest in obtaining a second opinion from another doctor to achieve the goal of better vision.

To the doctor, these patients have taken up a great deal of “chair-time”, sometimes 5-10 visits, have not generated additional revenue, and are now a very real risk to the reputation of the practice as they complain about their dissatisfaction. In addition, the physician is frustrated because he or she lacks the tools to achieve a better result for the patients.

COAS™ provides the physician with a way to quantify the existence and the magnitude of “irregular astigmatism”. These distortions of the optical path of the eye are now known as “higher-order aberrations” and are measured by COAS™. By measuring the optical path of the eye, COAS™ follows the same path the light travels when it enters the patient’s eye. In the event the patient has quantifiable amounts of coma, trefoil astigmatism, spherical aberration, or one of the other aberrations, COAS™ will show the answer immediately.

## Physician Benefits

**Diagnostic Benchmark** – The doctor knows he or she has established the most comprehensive “Diagnostic Benchmark” available to follow patients' BCVA. This will provide critically important treatment information as future therapeutic alternatives become available to the physician.

**Revenue** – Every doctor knows the direct correlation of return visits by a patient and revenue. Assuming \$100/hour chair time, resolving a problem patient with “irregular astigmatism” on the first visit can mean \$500-1000 of available time for other patients. Most busy practices have 30-50 patients of this type at any given time, representing a potential savings of \$50,000/year.

**Reputation** – Happy patients are likely to tell five of their friends how good their physician is. Unhappy patients are likely to tell ten of their friends that they should avoid the physician they are unhappy with. Wavefront aberrometry provides the doctor with a way to diagnose and discuss his or her patients’ vision problems in ways not possible in the past.

**Marketing** – Medical science is ever advancing and patients like to know their physician is up to date with the latest in medical knowledge and technology. Successful practices earn more business by differentiating their service with the latest diagnostic capabilities.

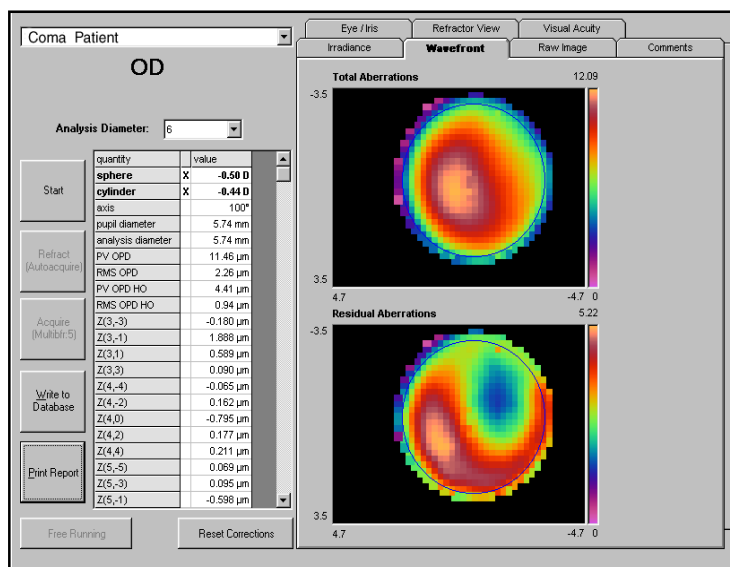


Figure 1 - Patient with large coma term

## Patient Benefits

Although in many cases the diagnosis of large magnitude higher-order aberrations will mean the patient will not immediately obtain a higher quality of vision, there are several very real benefits to the patient:

**Finally, an Answer** – There are tremendous psychological benefits to patients who have a definitive diagnosis for their vision problem. They do not have to wonder if they gave the wrong answer at the phoropter and their confidence in their physician is dramatically increased. In the patients' mind, knowing that the problem has been identified and that they cannot do anything further is far better than continuing to try different lenses and guessing about what is wrong.

## Customized Refractive Surgery

– Some patients may be good candidates for wavefront customized refractive surgery. In this case, they may be informed about the possibility and, depending on the availability of the procedure in the area, they may seek the treatment or look to future availability.

## Customized Contact Lenses

– Several major contact lens manufacturers have announced that they are developing wavefront customized lenses. If the patient prefers not to have surgery, these lenses may provide a viable alternative as they become available.

## Examples

Figure 1 provides the test report from a patient with a significant aberration known as coma. Reading directly from the table of aberration magnitudes, the  $Z(3,-1)$  term shows 1.888 microns of error. While each aberration affects vision differently and requires a different magnitude to be perceived as significant, a magnitude of 0.5 microns or more is generally found to be significant to a patient. Distortions greater than 1 micron are almost certainly an issue.

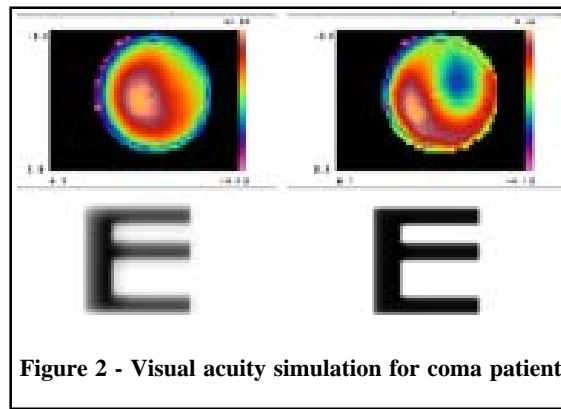


Figure 2 - Visual acuity simulation for coma patient

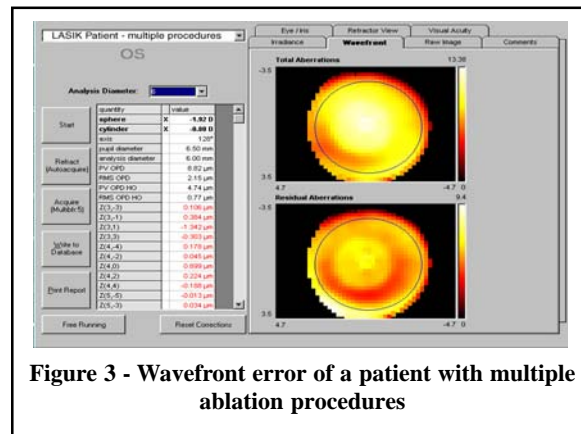


Figure 3 - Wavefront error of a patient with multiple ablation procedures

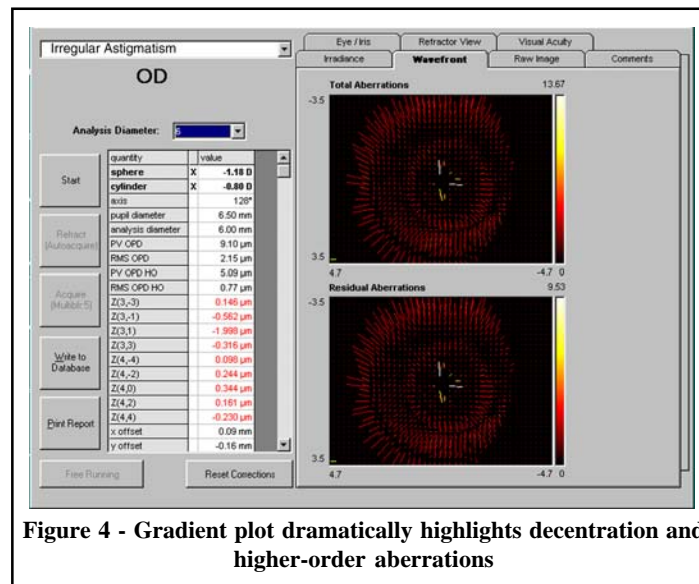


Figure 4 - Gradient plot dramatically highlights decentration and higher-order aberrations

Using the visual acuity simulator, this patient's vision can be simulated directly by removing the sphere and cylinder terms. Showing the patient this simulation after removing the sphere and cylinder terms simulates the vision at BCVA. Next, clicking on the larger magnitude term to remove the effects on the vision would demonstrate the improvement the patient would see IF that aberration could be corrected. As a result, the patient's vision problem is identified and the physician demonstrated to the patient its effect, satisfying the patient that further exploration is not necessary.

The second example is that of a patient with multiple LASIK procedures. Examination of the wavefront map does not initially indicate a specific problem. However, examination of the  $Z(3,1)$  term shows 1.1 microns of wavefront error. In addition, examination of the gradient plot screen in Figure 4 dramatically illustrates multiple ablation zones and decentration.

## COAS™

The COAS™ aberrometer provides the highest resolution wavefront measurement of the eye available. High resolution is essential for accurately measuring the more complex distortions classified as "higher-order aberrations". Other instruments provide similar measurements but of much lower quality. This is like listening to the AM radio on an old car speaker

compared to digital audio from a CD player. With the AM radio (low quality), you miss the highs and lows. With the high quality instrument, you get the whole range.