

DAMIEN MD, PhD

GATINEL

Dr. Gatinel, the head of anterior segment and refractive surgery at the Rothschild Foundation in Paris, is a researcher and innovator with an interest in ophthalmic optics. His most recent investigative forays include taking another look at Zernike analysis to try to make it more clinically useful. In this interview, Dr. Gatinel talks about his research projects, why he is so curious, and his love for photography.

INTERVIEWED BY LAURA STRAUB, EDITOR-IN-CHIEF,
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BMC: Who or what drew you to ophthalmology?

DAMIEN GATINEL, MD, PHD: I always wanted to be a doctor, but my heart was also drawn to the basic sciences, especially the hard sciences like math, physics, optics, and astronomy. It seemed logical to me that the perfect combination of these interests would be ophthalmology. When I was really young, however, I honestly thought that ophthalmology mainly dealt with optics and refractive surgery, and I had no idea that you could also do vitreoretinal procedures, for instance. Part of this perception, in France at least, is because we don't have independent optometrists per se; instead, patients go to their ophthalmologist for refractions. There are many medical ophthalmologists who do mostly refractions and routine checks, in comparison to a few ophthalmic surgeons. Naturally, I thought ophthalmology would mainly be a specialty dealing with refractive issues—that's essentially why I chose it.

BMC: Once you learned more about ophthalmology, did it influence how you found your niche?

GATINEL: Long before I was a medical student, I was devouring magazines about lasers and technological inventions like that. I believed that ophthalmology was going to be cool because I could do research in an engineering environment, work with lasers and other fancy technology, and also be a doctor. So even before I had to formally choose a medical specialty, I knew I wanted to be an ophthalmologist and I knew I wanted to do what I'm doing today in terms of refractive surgery and optics research.

In some ways, it was fortuitous that I had little appreciation of the breadth of subspecialties one can undertake as an ophthalmologist. As a result, I had a precise idea of what I wanted to do, and I never deviated from this goal. I stuck with refractive surgery and issues related to ocular optics because it's what most fascinates me.

BMC: What is the focus of your current research?

GATINEL: Currently I'm working on a new model for more accurately describing the optical aberrations of the eye using an approach combining mathematics and physiological optics. Second, I am working on keratoconus detection and characterization. Third, I am working on optical designs for the next generation of trifocal diffractive optics. Additionally, we recently published a paper on an objective cataract grading method, based on lens densitometry measurements on swept-source OCT scans with the IOLMaster 700 (Carl Zeiss Meditec).¹ This method utilizes the cross-sectional image from the swept-source OCT, from which we can calculate an index of cataract opacity. This is a research project we've been working on for a long time, and I think it will be an important milestone, both clinically and from a research standpoint. We've also undertaken some research with the HD Analyzer (Visiometrics) in

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the past. The idea is to define new objective measures for distinguishing between surgery for dysfunctional lens syndrome and true cataract surgery. We have experimented with other metrics in the past and are now investigating swept-source OCT.

Last but not least, we are working on using deep learning processes and big data to improve IOL power calculations. We are just getting started but think we can do something great with this.

BMC: You recently won Best Paper at the Wavefront & Presbyopic Refractive Corrections Congress for your new Zernike formula.² Can you talk about that paper and research?

GATINEL: This research was the core of my PhD work, which I did somewhat late in my career for various reasons. But this project was a long one. It's aimed at providing clinicians with numbers that make more sense when they analyze ocular wavefronts. The Zernike system was designed by Frits Zernike to describe instrumental wavefront errors, such as what occurs in the optics of microscopes or telescopes, but for many reasons it's not really suited for human eye analysis. For example, if you try to predict an eye's refraction from the wavefront Zernike analysis, you will encounter some systematic errors. Similarly, the titration and prediction of the impact of higher-order aberrations may not be clinically as accurate.

I tried to provide a basis of functions that are more directly related to the clinical aberrations that we see in our patients. Now I'm at the stage where I'm comparing the Zernike measurements to this new class of operation—trying, for example, to see if we can predict refractions with greater accuracy. The numbers we are generating match the clinical situation more closely than the Zernike. So far, it's been encouraging.

BMC: From your Instagram account (@madeingelatin), it's clear you enjoy photography. How does that fit with your love of ophthalmology?

GATINEL: Ophthalmology is an exciting profession. It combines many aspects from science to medicine, discipline, and proficiency with microsurgery. But one aspect that might not come to mind at first is the artistic dimension. Photography, because it's a visual art like painting, is something that I feel complements ophthalmology well.

If you are fascinated by optics and vision, you're likely to be interested in the visual arts, and photography is made easily accessible today with digital cameras and smartphones. I adore painting, but I must admit that I'm a poor painter! So with photography, I try to take a picture of something I would like to paint if I could, as some sort of compensation for my lack of painting finesse. I also like playing with light. I try to take a subject that may be somewhat mundane and pay attention to the lighting and framing in particular to create something artistic with it.

I like to take pictures of luminous reflections, which form inverted images on reflective surfaces, and play with the orientation of the photo, to present it upside down. This refers to the laws of the propagation of light, which are intangible and obey universal laws, whereas our perception of the surrounding world is eminently subjective. What makes me happiest is when I take a picture of something that should be unremarkable but I am able to turn it into something interesting. It doesn't have to be sophisticated. (Editor's note: Displayed on this page is one of Dr. Gatinel's photographs.)

BMC: If you had to characterize yourself in one word or phrase, what would it be, and why?

GATINEL: I would say *curious*. But also I love challenges, and I don't like dogmas in my field. I hate preconceived ideas, especially things that are accepted but not really proven. I have this strong



need to make my own understanding, evaluation, and objective judgment before accepting new ideas or concepts. I believe that curiosity fuels creativity.

BMC: If you had to nominate one creative mind in ophthalmology, whom would it be and why?

GATINEL: Gerrit Melles, MD, PhD, because of his inventiveness and creativity—he has developed many new techniques for corneal surgery. I have had the honor of meeting him, and he has a fascinating personality. Of all the ideas he has contributed, for instance with Descemet membrane endothelial keratoplasty, he is an innovative creator in the realm of corneal surgery. ■

Editor's Note: This is an abridged version of Dr. Gatinel's interview. To read the entire interview, log onto www.glaucomatoday.com/issues/ and click on the May/June issue.

1. Panthier C, Burgos J, Rouger H, Saad A, Gatinel D. New objective lens density quantification method using swept-source optical coherence tomography technology: Comparison with existing methods. *J Cataract Refract Surg*. 2017;43(12):1575-1581.

2. Gatinel D. A new aberration basis for better ocular wavefront analysis. Paper presented at: Wavefront & Presbyopic Refractive Corrections Congress; February 23-24, 2018; Denver, CO.

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