THE OPPORTUNITIES FOR

Digital Surfacing

PART 2

Once a new customized lens design has been ordered—What's happening behind the scenes? What are the critical lab issues and that will ensure the professional's confidence? What are the different lens designs that are available?

By Mark Mattison-Shupnick

You've ordered a new customized lens design i.e., one that will be created at the time of production the new design can be optimized based on the patient's prescription, a specific visual need or individualized based on visual behavior and position of wear. Lens design drives performance, digital surfacing delivers it. These lenses available from Essilor of America (Varilux Physio360, Varilux Ipseo, Definity and Definity, Accolade Freedom) Carl Zeiss Vision (Zeiss Gradal Individual, SOLAOne HD, Compact Ultra HD and AO Easy HD) and others push the mathematical limits of progressive lens design to further improve patient attributes. How does the digital or direct surfacing process make this happen?

Digital or direct surfacing is the simultaneous control of multiple axes (3 or more planes) while cutting and polishing the lens surface. The major differences to standard surfacing are that complex curves are being created rather than spheres or torics. These curves can be cut in the lab on a new type of CNC generator. A milling tool reduces process time and diamond tool smooths the surface for a minimum of polishing. Flexible and/or deformable polishing tools rather than hard laps with fixed curves are used to polish the surface and engravings are often applied after the cutting process to designate the position of the optics.

Lab Challenge or Opportunity?

While not completely plug and play yet, technology and equipment are catching up as fast as awareness and an increasing number of orders are hitting the lab. The future and the decisions that lab owners and managers must make regarding digital surfacing are now more immediate.

Only a year ago the scene was different. The lab owner was asking "Will it work?" Those that have bought have proved it is possible to cut, buff and create lenses using this new technology and most others are now convinced that it is the method by which a majority of progressives will be manufactured. For those labs that had implemented direct or digital surfacing, it was a stand alone unit and outside the normal efficiency of the lab, but now they can be interfaced with the lab's software management system given the cooperation between equipment, lens and technology vendors with great assistance from the Vision Council of America. VCA's members of the Lens and Lens Processing Technology Divisions established standards for the data transfer required for direct surfacing. This has sped development of direct surfacing technology by standardizing communication between lens surfacing equipment, lens design sources and laboratory management software.

While systems are still very expensive consider the cost vs. volume, throughput and cost/surface. The result is that any variety of volume labs can now consider digital surfacing equipment as an option.

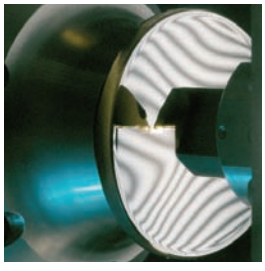
Also, in the past, the issue of a patent conflict clouded the decision of many lab owners' implementation. Today, with licenses being signed, agreements being talked about and a variety of designs that are not patent-threatened, interest is high for equipment purchases.

Lastly, what will probably become a major driver for increased interest and implementation by all will be the introduction of customized progressives through chain retail. Once the chains begin to merchandise this new progressive availability, many more consumers will be asking their professional whether these types of lenses are good for them. In response, every lab and their ECP customers should be prepared and, if possible, already experienced with a variety of lenses to meet these requests.

How Can the Lab Get Ready?

Like traditional progressives, customized progressives are affected by each of the processes in the manufacturing process i.e., anything that will affect surface construction. The critical components of surface generating are the mathematical data file that will control fast and accurate cutting, and polishing that doesn't alter the surface cut, while the lab also considers the challenges of blocking stresses, accurate lens marking and hard and AR coating that adds to the design attributes.

Surface descriptions – The translation of the design file to machine language is not easy because the goal is to get the surface geometry correct on the real lens in a minimum amount of time. Therefore, the generator's computer needs to know the input geometry and lens material, the motor stroke, acceleration



and jerk behavior in order to calculate the optimal feed rate for each individual lens. Once the designs are available to labs, the assumption must be made that the designer has confirmed that the design corrects eyesight in the way intended.

Manufacturers have begun to license their design files through programs where they will assist in the correct transfer of the design through the lab for delivery to the ECP.

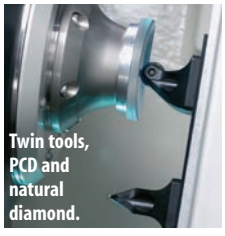
For example, Essilor has begun Digital Surfacing Extended Offering (DEO). Beginning third quarter, the first independent laboratory will offer Varilux 360° as part of a turnkey package. With equipment specified by Essilor and with software to download instructions from an Essilor server, the designs will be transferred to the lab for manufacture. To ensure accuracy of design and patient satisfaction, sample control lenses are sent daily to Essilor for analysis and verification. Adjustments can be made in real time. To complete the delivery of premium vision in design, Crizal Alizé is also available to these labs.

Process Integration – Like the doctor's office that purchases a variety of instruments and then needs to add the test data to the patient's record as part of an electronic medical record, instrument software is required to "talk" to practice management systems to increase office efficiency. Why enter patient name and data multiple times in an electronic record when an integration of the systems can do it? The same is now possible for the lab so that electronic data systems transfer machine-operating instructions for the Rx needed by any bar coded tray.

Who's on board? Visionstar, CC Systems and Digital Vision lab management systems support "connectivity" with some of the generator companies. Be sure to review system capability and implementation of the VCA communication protocol.

Implementation – Each lab should expect the same learning curve when installing new equipment and new software digital surfacing with one major difference. When installing direct or digital surfacing, one should expect a higher level of support from the lens design source, lab management software company and equipment supplier since the integration of these tools is essential for success. In fact, it is the responsibility of the lens design source to initially ensure that the design is correct since that's the license being secured.

Milling Characteristics – In the past, the lab had to determine the materials that were most often ordered when choosing equipment. Today, the digital surfacing generator is capable of cutting all materials and polishing requires adjustment depending on material. For example, the high utilization of polycarbonate in the U.S. affects machine efficiency. The Schneider HSC generator series incorporates three major changes for polycarbonate. First, the milling tool cuts short chips which are easier to clear from the chamber. Next, the cutting tool is positioned upside down to take advantage of gravity. And last, the work space is inclined to enhance swarf removal.



Twin tools, PCD and natural diamond.

Standard sphere and toric curves are cut by polycrystalline diamond (PCD), complex curves (progressives) require natural diamond for the smoothest surface.

Surface Protection and Blocking – Blocking and surface protection is the same as it is for standard surfacing i.e., there are material stresses created by pressure and temperature, specific to lens material. For example, a lens whose front surface is spherical to start, after blocking and generating may be correct in design after cutting but once removed from the block, incorrect in design. This has been the same for standard progressives when blocking alloy has been too hot, lenses weren't allowed to cool sufficiently before generating or too small a diameter block used. The surface "warps" and the corridor may have become unusable yet the distance and near values were correct. In addition, the blocking tolerances for digital surfacing are tighter.

Centering of the Optic - For lenses with engravings on the front, exact centering is required without blocking errors that might make the optics drift in position. Some believe that engraving after the lens is manufactured is better, it marks what you have done, not what you would like to have done. The other opportunity is to use digitally surfaced lenses that have front and back optics where a majority of the progressive surface is already on the front and the engravings have been applied to the mold prior to the casting process.

Cutter Position and Data Feed – The maximum speed achieved for cutting with the precision required depends on the complexity of the surface. For complex surfaces, the maximum stroke, acccelleration and jerk of the motor sets minimum processing time limits.

Polishing-conformable tools, variable paths.

Polishing – How has the more difficult polishing process been developed and what are the attributes of well-polished lenses? The surface has been prepared to be as smooth and near transparent as possible, however, the fineness of cut is not yet possible to just allow a coating to complete the lens. As a result, a slight buffing or polish is required. The use of hard laps are not possible because those will destroy the surface shape, therefore soft and conformable tools have been developed to buff the surface. They adjust to the shape of the surface. In addition, different tool radii are used to best match the surface curves generated.

Special oscillation and polishing paths help ensure that the surface created is well polished. As a result, the software developed to guide lens path over the tool and the tools chosen are different for each lens surface. The equipment software and lab management software work together to understand which lens is being worked on so the correct polishing is completed.

What Are the Economics?

For small labs, purchase is difficult. There is the high capital outlay, from $500 thousand to $1 million dollars. Since the overall volume of digitally

surfaced lenses is still low, for many it is difficult to justify the expense. As a result, many small labs are waiting until there is more trial, use and increased demand by ECPs before they purchase their own equipment. In the meantime, however, many already provide digitally surfaced lenses through larger labs with which they have relationships or special digitally equipped labs that act as labs' labs. Regardless, ECPs can get a variety of lenses from a good number of their suppliers.

Digitally surfaced lenses are available from many of the large and/or vertically integrated labs owned by lens manufacturers or large chains. For many of these companies, they have labs that are digitally capable in Europe and/or Asia and therefore have quite a bit of experience over the last 6-7 years. And, as we reported previously, customized progressives already account for 25 percent of the European progressive market in some sectors. Therefore, this application is well defined in Europe but as yet not in the US market.

What Happens to Standard Sphere And Toric Production?

Any lab can cut standard spheres and toric backs on fixed design, front surface progressives, whether or not they have been created using digital surfacing. However, customized designs will have the lenses with specially cut backs. For lenses like Physio360, the back surface creates sphere or cylinder power, axis and the optimization of front peripheral stigmatism. So the surface is no longer a traditional sphere or toric back.

The same is true of Definity which incorporates a portion of the add power on the back surface of the lens along with the necessary sphere or cylinder powers. The combination of the surface is defined mathematically and cut and polished to deliver both. For Varilux Ipseo, SOLAOne HD and Compact Ultra HD, the prescription and progressive is cut onto the back surface, the front being spherical. In both lenses, the manufacturers assume an average vertex and tilt to calculate the lens powers. For the Zeiss Gradal Individual, the lens is personalized using vertex and tilt measurements from the actual fitting.

In the future, a variety of lenses will require additional measurements for personalization and a variety of tools will be available. For example, Carl Zeiss Vision introduced Eye Terminal at Vision Expo East, an instrument designed for the ECP for accurate and repeatable lens measurements. More about these devices in the next issue.

What Happens to "Base Curve?"

Lenses will still have a recommended base curve and manufacturers will continue to supply base curve charts for reference. However, the option exists for back surface progressives to use a larger variety of base curves for the same prescription when trying to match the curve cosmetics of frames. So a -2.00 lens could be designed on a 4 base or an 8 base curve if used in a standard shape or in a wrap frame respectively. For the wrap frame, the Rx, add and the effects of the wrap angle can be optimized for a 7 or 8 base so that the central power incorporates the prism needed for good binocularity and peripheral optics are more usable by optimization.

If you have questions about a particular job; call your lab or the manufacturer for details and explanatory literature.

What Should be the ECP's Expectation of the Lab?

Labs will continue to be the ECP's best resource for information and recommendations for patients' lenses. As they get more experienced, they will share more of the experiences of their customers and their customers' "pearls".

Seek out those labs that have begun to offer digitally surfaced products for information and experiences—seek out peers that have begun to add digitally surfaced products to their portfolio of lenses. The overall reactions of the vast majority of patients and professionals trying the lenses are that they provide improved clarity of vision and a more comfortable wearing experience. For some it's "wow," for others the small improvements are noticeable and appreciated.

Where's the Liability of Design?

While there will be some variation, correctness of design now lies with the lens design originator and the producer of that design i.e., the lab supported by the design source. Of course, as in the standard supply chain, the ECP will hold the lab responsible, the lab will hold the manufacturer responsible, etc.

How Does the Lab Ensure Equipment Calibration And Design Verification?

The lab will initially rely on the equipment supplier and their technicians for calibration and design verification until they are functional. Essilor will require audit lenses, others will create their own verification systems. Regardless, learn and understand how your source of digitally surfaced lenses ensures that the ECP receives the right product.

For the lab, much of this new equipment is very robust i.e., self-calibrating with their own sets of controls and checks. New for the lab however, will be a requirement for increased knowledge about the technology. That will mean internal engineering staff capable of better understanding the integration of software with the technology of the equipment. In fact, this will open many new opportunities for lab staff as well as require the labs to source personnel with new skills. For some small labs, this may create some challenges.

Some compare this shift to AR and its implementation in the lab. Like AR, the labs quickly embraced and began to offer products as they improved their capabilities. The difference here is that the manufacturer or source of the lens design is a partner with the lab. As a result, the power of the manufacturer and the reputation of their design require that they help ensure success.

What Will the ECP do to Verify Lenses?

Lens verification for the ECP will be the same as it is now—verify distance and add power, fitting height and monocular PD's well as base curve, lens materials and treatments. The rest is left up to the patient because the assumption is made that the design is correct.

Since the manufacturers control the designs there should be audits of production and those that license designs have a responsibility to stop those products that don't meet product design criteria.

Today, labs do not have the ability to check the design attributes of semi-finished progressives. Like the ECP, the only items that are checked are lensometer readings, fitting height and PD; the last two are based on an assumption that the markings represent the correct position for the patient. There are many opportunities to produce poor quality.


Auto tool adjustment, HSC Master

Therefore, there is a bigger responsibility for the ECP using digitally surfaced lenses i.e., better measurement techniques and better-trained staff to ensure increased success. A current progressive, traditionally surfaced with a standard method does not ensure that they are made to the patient's requirements unless well measured and fit.

Audits

New techniques in the lab for design audit and equipment calibration will include such technologies as surface height reconstruction, Deflectometry and lens mapping by surface reflection. We'll look at these techniques a bit closer in a later issue.

Which Patients are the Right Targets, And How do You Talk to Them?

The right patient is the patient that wants the best in the category or has had some issues with the clarity of their existing progressives. How does the ECP understand the patient best suited for digitally surfaced progressives—talk to every patient about the newest technologies that provide the best vision and ask about the things that bother a patient when using their current progressives. In this way you uncover what a patient doesn't like about their lenses, not merely replicate what they already have.

Remember, as the prescription changes and as adds increase, progressive design changes. Adds get narrower or corridors are shortened based on small frame choice. These new progressives improve all distance vision and in some, the design or corridor length is adjusted for frame size.

Also, for the patient that expects the most precise correction and lens processing, digitally surfaced products add a new dimension to what is possible.

New Since Last Article

• The new optional Power Safety System (PSS) for the Schneider HSC Master generator reacts within micro seconds in the case of unexpected power failures eliminating the risk of machine damage. The system does not require a battery backup.

• Carl Zeiss Vision introduced the Eye Terminal at Vision Expo East 2007, an imaging and measurement instrument designed for the precise fitting of direct or digitally surfaced lenses. Using sophisticated measuring technology; Eye Terminal automatically compiles monocular PD, fitting height, frame tilt (pantoscopic and wrap angles), and vertex distance. The imaging system allows patients to view themselves in their eyewear from all angles and learn about lens enhancements. It adds to the professional identity of any office. Remember, it's the design that drives performance.


HSC Master with PSS.

Customized Progressives

Lens	Source	Front	Back
Varilux Ipseo	Essilor	Digitally molded	Digitally surfaced
Varilux Physio360	Essilor	Digitally molded	Digitally surfaced
Accolade Freedom	Essilor	Digitally molded	Digitally surfaced
Definity	Essilor	Digitally molded	Digitally surfaced
Definity short	Essilor	Digitally molded	Digitally surfaced
Zeiss Gradal Individual	Carl Zeiss Vision	Spherical	Digitally surfaced
SOLAOne HD	Carl Zeiss Vision	Spherical	Digitally surfaced
Compact Ultra HD	Carl Zeiss Vision	Spherical	Digitally surfaced
AO Easy HD	Carl Zeiss Vision	Spherical	Digitally surfaced
HOYAlux id	HOYA	Digitally surfaced	Digitally surfaced
Kodak Unique	Signet Armorlite	Spherical	Digitally surfaced
EyeMade	INDO, Signet Armorlite	Spherical	Digitally surfaced
Succeed	SEIKO Pentax	Spherical	Digitally surfaced
Autograph	Shamir	Spherical	Digitally surfaced

Questions Received, Comments Offered

Q Isn't there a huge advantage to putting the Rx on the back surface combined with the progressive design?

A By itself, moving the progressive to the back surface does not always improve the design. A progressive, a combination of front and back design, delivers the designer's intent and depends on the way that an individual uses the lens. Some front surface designs can be shown to deliver the same or better characteristics depending on design and patient. Dual side progressives provide a designer with more room to reduce distortion and blur. However, in general, newer designs using higher precision to create molds or surfaces provide better vision, comfort and utility for wearers. Evolve patients to newer designs, they will appreciate the visual improvements.