THE OPPORTUNITIES FOR

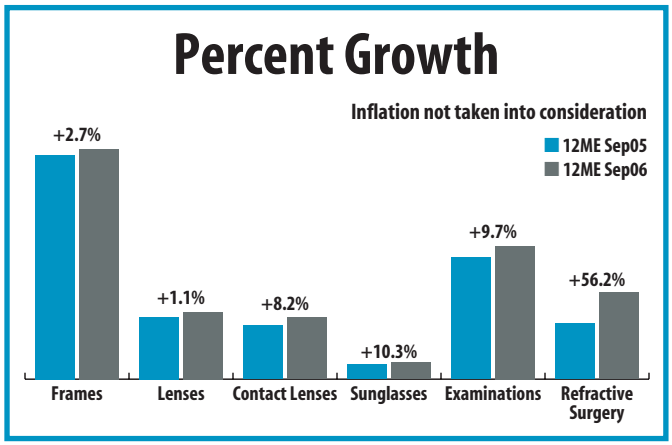
Digital Surfacing

PART 1

Digital or direct surfacing will allow the ECP to better satisfy vision and frame choice through customized lenses. Therefore, what are the lab opportunities? What are the issues that the lab needs to resolve in order to support the change in business?

By Mark Mattison-Shupnick

This is Part 1 of 6 of a deeper look into each of the opportunities/issues of digital surfacing. For the lab contemplating implementation of this new technology, what are the lab's considerations? How will digital surfacing affect its capabilities, and what does it mean for the lab of the future?



From our December discussion, digital is the key operative word here. It suggests a new level of precision is possible and, along with that, a way to deliver personalized and minute lens surface differences to better manage vision in new ways. This new precision capability and the manufacturing of sophisticated surfaces will now be located in a lab that requires more sophisticated laboratory processes. In addition, technicians and those that are responsible for the technology in the lab will also become sophisticated in the science of digital or multi-axis, single point surface creation.

This is good for the industry and will provide an opportunity for growth in a market where frame and lens sales units, especially at the independent, have been relatively static year on year. Under pressure from growing contact lens sales, refractive surgery procedures and over the counter readers in a growing population, merchandisable improvements to spectacles are essential. Digital surfacing can deliver better vision, higher levels of personalization, increased efficiency and a reduction in the steps and tooling needed. In Europe, where digital surfacing has been established for a number of years, customized progressives have achieved penetrations of more than 25% in some sectors. This covers independents, the vertically integrated and retail chains.

By itself, digital surfacing does not make a better product. It's only a manufacturing method. It must be managed properly to deliver the benefits. So how does a lab determine how to implement and get the most out of digital surfacing? Also, when implemented and making lenses, what new tools will the lab provide the ECP?

What will be the attributes of customized lenses?

A review of potential lab technology will help describe the options for the ECP and his patients. We'll use progressives initially to develop the context for lab capability but other lenses will be available as digital surfacing is adopted more broadly.

Today, when a standard front surface progressive lens is used its origin is a semi-finished lens blank. The front surface was created from molds using a translation method called slumping or electroforming. The mold is a replication of a surface that was directly cut onto its origin in ceramic or glass. So, the design was not cut directly onto the mold surface but was translated to it. These molds are then cast and iterated until the desired target design is reached.

Digital surfacing allows the direct surfacing of molds and/or lenses. No translation per se is required. Of course, the cut surface is tested to be sure that it is the intended design. In addition, there is control of the cutting axes other than a base and cross curve so surfaces that can be described in multiple axes can be cut directly and cast or molded to produce SF progressives. Finally, lenses can also be digitally surfaced directly to produce progressive or other sophisticated surfaces.

Dr. Mike Morris of Carl Zeiss Vision believes that progressives in the future will be divided into two types: fixed designs and customized designs.

Fixed designs have preset characteristics such as size of viewing zones and corridor length that are consistent for all patients, and only the prescription powers are varied. While these can be delivered via digital surfacing to achieve the greatest possible clarity of vision, they cannot be considered designed for individual needs.

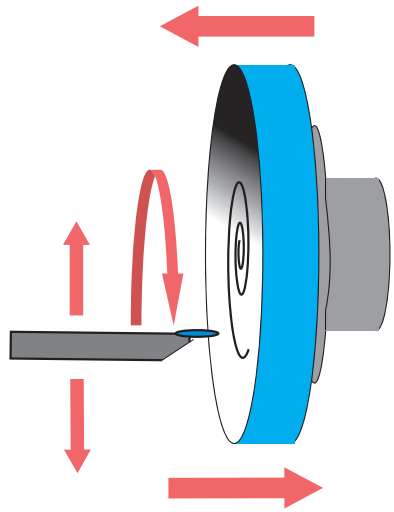
Customized designs are created at the time of production based on specific wearer needs and the position of wear of the lenses. This means that several variables will be required to produce a customized progressive lens. These variables include the way in which lens power is distributed between the front and back surface, the specific fitting characteristics of the frame and how the patient will use the spectacles.

This is something we all need to prepare for, because the prescription may be the same, but the lens that delivers the prescription will be different in entirely new ways.

Customization will alter the lens design with patient information other than the prescription, PD and fitting height. It will deliver some or all of the following: powers compensated for lens tilt, vertex distance and wrap angle. The peripheral characteristics can be optimized for position of wear, corridor length and viewing zone size. Front surface progressives can be further optimized by specially cutting the back surface to reduce unwanted errors in the periphery away from the corridor. Peripheral design will be modified based on the frame chosen and fitting height needed. Reading distance or multiple corridor lengths can be specified. Others will add design changes for daily tasks i.e., the estimated percent of time spent driving, working at a computer, walking, sitting, etc. Finally, others will incorporate measurements of how the eyes and head move when reading or using other areas in the lens.

Which prescriptions will benefit from which of these customizations? How much will they cost? How long will they take to get? What tools will the ECP need to actually order lenses with these attributes? First, if the lab will deliver this, what are they asking? Let's take a first look at some lab questions.

Lenses Cut Using Single Point Diamond Turning



How does single point diamond turning deliver the ability to improve and customize progressive lens surfaces? It is the spinning of a mold or lens against a single point cutter while moving the lens closer and farther from the cutter. This results in a series of joined surface heights that deliver a specific progressive design.

For Varilux Physio, the design is cut and polished on a mold's back surface. Lenses are then cast and the accuracy of production of the design is verified. Any changes that are necessary are made to the software that controls the cutting operation. Testing determines how many software changes are required until the design is right. Wearer testing also confirms the design required.

For a lens like Zeiss Gradal Individual, the design is cut directly onto the back surface of a single vision lens blank. Regardless of front or back, designs are verified to know that they deliver the vision clarity intended.

More about design differences in the next issue.

Labs Are Considering…

If lenses can now be directly surfaced with digital control, then where can I get them?

Currently, a variety of customized designs, each with different attributes, are available from Essilor of America (Varilux Physio360, Varilux Ipseo, Definity, Definity short and Accolade Freedom) and Carl Zeiss Vision (SOLAOne HD, Zeiss Gradal Individual). HOYA, Shamir, Signet Armorlite and SEIKO each have a design with some customization available.

Optical lab owners are asking themselves whether now is the right

time to be capable of digitally surfacing lenses? The considerations are many. 1. The equipment is new in the US and will cost the lab upwards of $500,000. 2. The demand for customized lenses is already about 4% of the PAL market and ECP awareness is growing rapidly so there is a reasonable opportunity to amortize the cost of the equipment. 3. Depending on the level of customization, the software requirements can vary greatly. Labs typically do not develop software but rely on others for their lab management systems, financial analysis, billing software, etc. 4. The manufacturing responsibility becomes the lab's if the lab is creating a progressive design. 5. Therefore, the lab must have the ability to engrave and verify that they've created the intended design. 6. Can I get the variety of designs that now meet the needs of my customers? And 7. How hard is it to cut and polish and deliver the right design? Overall this manufacturing technology is still relatively new in the US and we can expect continued changes to design and equipment to produce these high precision designs.

Lens Blanks

Depending on the design attributes of the final product, labs will start with a SF progressive or single vision lens blank. SF progressives designs, from molds digitally created, are manufacturer warranted. If further back surface optimized, alignment while processing is critical. For SV blanks where the progressive is placed on the back surface, alignment may be determined by semi-visible engravings on the SV front or added after by analyzing the position of the design in the lens.

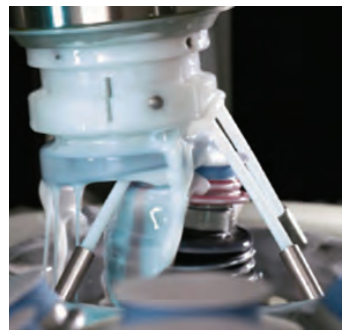
Generators and Polishers

These generators single point turn the lens surface. The accuracy and precision is dependent on how fast the height changes can be made (slew rate) while the lens surface is being turned. In addition, the speed that the data can be delivered to ensure cutter position is critical to achieve the desired surface.

COURTESY OF SCHNEIDER OPTICAL MACHINES

In both cases, there are still situations where the design cannot be achieved because it requires capabilities that exceed those of the generator. This is especially true of designs that have stronger characteristics such as high powers, very short corridors or rapid transitions between viewing zones.

The process, sometimes called "Cut and Buff" prepares the surface and then buffs for transparency. Traditional polishing would destroy a progressive lens design, so great care has been taken with digital surfacing and polishing systems. Most generators have a second and sometimes a third cutter so that a very fine surface can be cut. This significantly reduces the amount of polishing that must be done to get a glossy surface, but the polishing or buffing process still limits the precision of design production. The best systems are carefully optimized to the specific design being produced, adjusting several variables such as pressures, tool shape and dwell time to achieve the highest precision of design reproduction.



Therefore, polishing has been more difficult to master than cutting. In this case, it's really a high luster buffing that the surface gets to improve transparency. Multiple tool radii are required with the lens position controlled for the location of the varying surface heights.

Semi-Visible Engravings

COURTESY OF KEPETS SYSTEMTECHNIK

Since the lab has created or optimized the surface, the lens may need semi-visible engravings added to assist in power verification, edging layout and fitting. Therefore, each digital surfacing module will have a CO^2 or Excimer laser in line with the system. Lenses are aligned and engraved with any variety of information including personalization, the patient's initials or the invoice number so the lenses can be identified.

Did I Make What Was Ordered?

Finally, verification of the order is required and that is accomplished using a mapping device that measures the through power of the actual lens, creates a lens map of the power distribution and compares that map to the intended design. The software program calculates the differences and the lens is a go or no go.

Who's The Manufacturer?

Unlike manufacturer-supplied SF progressives, where the design is manufacturer warranted, digitally surfaced lenses from the lab must also come with the lab's warranty of design performance.

Unlike manufacturer-supplied SF progressives, where the design is manufacturer warranted, digitally surfaced lenses from the lab must also come with the lab's warranty of design performance.

Therefore, each lens design a lab offers will require that the lab have in place new metrology i.e., the methods for analysis and verification as well as internal certifications from the original design manufacturer. We can therefore expect that labs will implement more automation for mapping and marking lenses. They'll also use more robotics to move the lenses from one station to another with precision and accuracy.

So each laboratory is asking questions about customized lenses and the methods to supply them. This is especially important for labs that have existing equipment that needs replacing. To meet this need and to address the fact that customized progressives are still in limited use but growing, new models of generators and polishers capable of digital surfacing are also useful for standard spheres and toric lens surfaces. Therefore, with more versatile equipment on the laboratory floor, labs will be ready to implement customized progressives with the assistance of the lens manufacturers. Like the Crizal Alize and Teflon AR technology transfers, we'll see digital surfacing technology transfers with progressive lens design licenses and the software needed to create those designs accurately.

Spheres will become aspheres, toric surfaces will become atoric and the fields of clear view for the patient will increase for better patient satisfaction. Fixed design progressives will be further improved by cutting an optimizing surface on the back. In combination, the periphery becomes clearer since unwanted astigmatism is reduced.

How can the ECP know that the customization ordered is the customization received? The ECP must trust their lab since the verification of design is the lab's responsibility to them and the company that they received the design capability from.

Technology does not stand still and as the designs improve so will AR and hard coats to further enhance the improvements made to the design. In both cases, the more merchandisable benefits that we can bring to wearers, the better. Patients also understand that new technologies cost more.

What Should the ECP Do Now?

Begin by reading the ads and articles in the trade journals. Request lens and lab representatives to visit and detail their digitally surfaced lenses, attributes and benefits. Understand their methods and tools that show that correct customization was received. Request literature.

Experiment by trying them yourself or on a staff member. Determine the comparisons and the goals for the test. Extend the trial to patients quickly for a variety of responses to best determine the positioning of each of the products within your own brand.

Then develop a Plan of Action to include customized progressives in your practice. Set goals; educate all about their role in teaching patients about the opportunity and what they will do for them. Encourage staff to be adventurous, discuss successes and issues at staff meetings so that customized progressives become a seamless addition to the practice. Finally, measure your success using reports from practice management software, request an analysis of purchases with historical data from your lab and determine things to work on for continuous improvement.

Next Issue

- What are the different digitally surfaced products?
- Which patients are the right targets, and how do you talk to them?
- Answers to questions received from readers.

New in the Market Since Last Article

New research teaches that the myope has a longer eye than the hyperope, the retina is also steeper and therefore, the way that the power is distributed on the lens surface affects the way that the patient comfortably uses the lens.

New Harmonix Technology from Essilor considers the differences in eye shape and the Accolade lens design automatically meets each patient's physiological needs. Digital surfacing can also free the optician from some of the limitations of "minimum fitting height" requirements. The design of the progressive is adjusted for the frame size chosen, fitting height required, prescription and what is known about the visual characteristics of wearer. In new Accolade Freedom, eye and frame shape are considered when the prescription is created. The design is changed to improve distance area in large frames and shorten the corridor in smaller frames, all automatically.

Questions or comments? Let me know at mmshupnick@jobson.com

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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.

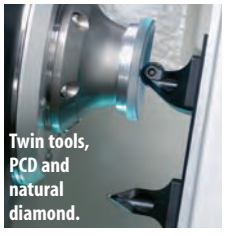
For example, Essilor has begun Digital Surfacing Extended Offering (DEO). Beginning third quarter, the first independent laboratory will offer Varilux 360° as part of a turnkey package. With equipment specified by Essilor and with software to download instructions from an Essilor server, the designs 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.

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Digital Surfacing

IS THE WOW NOW?

PART 3

The emergence of any new spectacle lens technology is invariably accompanied by claims of better vision. These claims often remind us of past claims and our skeptical responses. "Wider near and intermediate" or "most like natural vision" were all touted by manufacturers for each successive progressive launch.

By Mark Mattison-Shupnick

When I look back I realize most of those claims were actually true. Lenses got better; patients adapted faster and were more satisfied. The average lens sell price increased and the ECP became more successful.

With the introduction of digitally surfaced lenses, many ECPs are similarly skeptical of manufacturers' claims. Even among those who believe digitally surfaced lenses represent a significant step forward, many ECPs want to know how their presbyopic patients can take full advantage of this new technology. They want to know "Is the 'wow' now?" For those who may be wondering about the value of digitally surfaced progressives, a bit of perspective may be helpful.

My experience with progressives has been one of constant improvement. Each of the areas of a progressive became better integrated with each other for improved comfort. Corridors have been shortened; first, to match frame size needs and second, to better meet the needs of the older presbyopes who appreciate it when the reading area is reached sooner.

The majority of the progressives you sell today are to patients who already wear them. They understand the lens and adapt without issue. There are few if any non-adapts. In fact, the average add power dispensed today is between +2.00 and +2.25D.

Near zones are more congruent and better positioned based on the wearer's prescription i.e., inset and corridor length are adjusted for the distance prescription. Also, the periphery has become clearer as manufacturers achieved the mathematical limits of blur reduction for a given corridor length and add power.

All this means lenses went through a series of design changes that increased wearer success and improved the way the design could deliver specialized attributes. Therefore, there became an opportunity for segmentation i.e., making progressives for special uses (small frames, larger near zones, computer, bifocal wearers, etc.). It also moved this category closer to the opportunity to really personalize progressives for the different kinds of wearers that visit an office every day.

So what makes lens designing different from a digital surfacing point of view? Is it a "wow" now?

Think of It This Way

Today, the consumer is more empowered than ever. Armed with information from the Internet and other sources, consumers seek more product choices and better service. This is significantly affecting the way that eyecare addresses their demands for personal service and products. Patients see an almost unlimited selection of like products, so the need to differentiate your office and increase service capability is critical. The opportunity to dispense a product made for 'just you' is a unique opportunity as the consumer demands more personalization of the products that they buy.

Let me quote Pierre Fay, executive vice president of Luxottica, regarding digital surfacing. He says, "In the very near future, lenses will adapt to the consumer rather than the consumer having to adapt to their lenses."

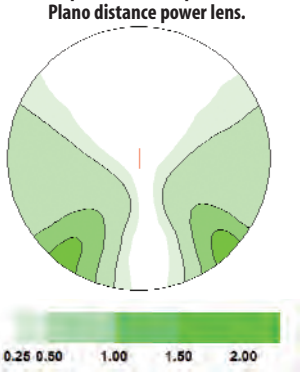
What does this mean in terms of Digital Surfacing? Digital surfacing provides the mechanism to deliver truly personalized lenses i.e., lenses adapted for the patient's vision and lifestyle requirements. It also meets our industry's need for constant improvement to the way we make people see with the eyewear delivered. It increases patient satisfaction and improves business.

How Will Digital Surfacing Improve Lenses?

Naively, one would expect that for any variety of patients' prescriptions, especially when they are similar, a particular progressive would deliver the same quality of vision to each patient, i.e., the same useful performance for distance, intermediate and near with the same peripheral effects. Not so. Patients see the results of their prescriptions combined with the effects of the lens design periphery. Depending on their own needs and sensitivities, they see differences or prefer one progressive to another. Digital surfacing can reduce those differences and improve the visual experience to make more patients happier the first time.

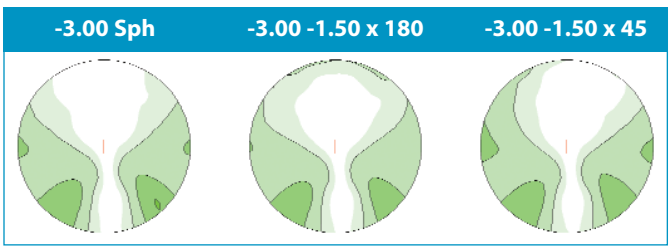
We all have experienced the patient that tells us they see differently out of the temporal side of one of their lenses. The very fact that the lower periphery of a progressive surface gets steeper faster vertically than horizontally means there will be cylinder created. When combined with the patient's prescribed cylinder, the resulting cylinder may affect peripheral vision right or left.

RMS power error map, modern Plano distance power lens.

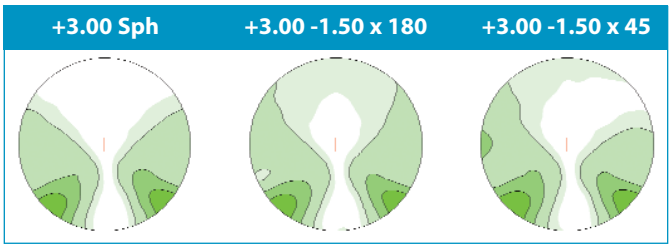


This effect can be illustrated using a map of RMS (root mean square) power errors. RMS is a common mathematical method of combining a number of factors into one value, here the spherical and astigmatic power errors in a progressive to create a single blur value tha can be mapped. For distance vision, the error that creates a "noticeable border" is about 0.25D, for near the value is higher. In progressives, clear functional zones usually have less than 0.5 to 0.75D of blur depending on task and sensitivity.

Here, three differrent -3.00 prescriptions deliver slight differences. In these three examples, the same base curve lens 'sees' a little differently depending on Rx and patient perception.



Here's the same comparison for +3.00 powers.



The point here is to recognize that when using the same base curve for different patients, especially for those prescriptions at the edges of the prescription range, they don't get the best vision possible. The same is true when the recommended base curve for each eye's Rx is different. In this case, the lab will usually use the flatter base curve for both eyes in favor of cosmetics. Therefore, digital surfacing can be used to fix these differences.

The most flexibility to improve designs is when both surfaces can be modified through digital surfacing either where the front is created from a digitally surfaced mold and the back helps modify remaining unwanted results or when the characteristics needed for the patient will be delivered using the best combination of front and back design. They could be a combination of progressive, toric, spherical and aspheric or atoric.

For Example

Let's look at an example of a targeted design, the way it would deliver its prescription after surfacing and how a lab with digital surfacing ability could optimize that same prescription.

These following ray-traced optical astigmatism plots illustrate the point. The first illustration represents the "Intended Design for Plano +200 Add." This is the design that we would expect for all patients using that base curve.

However, when we use this lens blank for an Rx at the edge of the prescription range for that base curve, +2.00 -1.50 x 045 (with 2 deg pantoscopic tilt and a slight 5 deg face form), the distribution of astigmatism delivered is different. There is an increase in astigmatism and the usability of the viewing zones is changed.

The third illustration or "Optimized Lens" file has been optimized for the Rx +2.00 -1.50 x 045 (with 2 deg of pantoscopic tilt and 5 deg of face form) and while this is actually a simulated example, the actual example is very close. Remember from Part 2 of this series, digital surfacing allows an exact surface replication of the design required. A lens can therefore be optimized to deliver better vision, and for some patients, a wow.

Design Equals Performance

If digital surfacing can deliver exactly what is required to optimize vision and provide patients with a better experience for them personally, then one must start with the right design. As we said before, just being able to digitally surface lenses does not automatically mean a better lens. One must start with the right design first, one that is the result of good vision science and wearer tests that confirm their efficacy.

Vertical Tasting

Like wine tasting, where one can compare different brands of the same grape, one could also compare the same brand's offerings of different years or the same year's bottling from different vineyard blocks. They may both be Pinot Noir from the same label but may be very different in preference.

We've been doing the same in progressives i.e., comparing brands or new designs from preferred suppliers. Let me suggest that as professionals you compare them vertically. Compare your previous best PAL with the 'new digitally surfaced' design. So consider a personal comparison of Varilux Comfort with Varilux Physio and Varilux Physio 360° or SOLA Percepta, SOLAOne and SOLAOne HD. Where there are small and subtle changes noticed initially, when you go back to the previous version after a period of time, it's easy to see where the improvements have been made.

Try it with Varilux Ellipse and new Varilux Ellipse 360° or AO Compact, AO Compact Ultra and AO Compact Ultra HD.

What are the new attributes that can be changed or improved?

Improvements to the way that a lens delivers its intended design, also means that aberrations and environment have less of an effect on the vision of the patient. A reduction of aberrations like coma, or an improvement to the contrast of objects improves the way patients see.

Coma, a comet-shaped blur that causes images to flare, affects off-center acuity and further blurs the edges of the object, reducing contrast. Reducing coma improves the visual experience, particularly in low light conditions. This improvement can be seen especially around lights at night since the pupil is larger. As a result, vision is clearer because there is less aberration and an improvement in contrast. More about contrast sensitivity in Part 5.

To further improve vision in the mid-range band, the orientation and effect of the front surface astigmatism is reduced by digitally surfacing the back so the border of the corridor is widened. If more vertical, vision is clearer and the usable field of view is increased.

My View

Michael Morris, OD, Carl Zeiss Vision Inc., Senior Director, Americas, Professional Relations and Clinical Affairs

My View of Customized Progressives

I have been doing progressive lens research and development for more than 15 years, and the most exciting thing to come along in that time is direct surfacing production technology. This enabling technology can liberate us from the constraints that have hobbled us since the invention of progressives—but only if we use it wisely.

Direct surfacing production offers a number of significant advantages over the semi-finished manufacturing model. The first is freedom from the limitations of semi-finished progressive lens blanks, which force us to cover the full range of prescribed powers with a limited number of base curves. With these, people whose prescriptions are near the boundary between two recommended base curves do not get the same quality of vision as those lucky people whose prescriptions are at the center of the range. With the right software and freeform production, we can optimize each lens for each individual prescription.

Another advantage is that a wide range of products can be made from a relatively small number of lens blanks. This simplifies production systems and allows more flexibility to offer a wider range of designs with more material options.

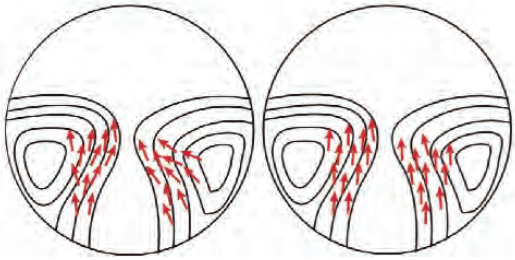
But the biggest advantage, by far, is that we now have the potential to deliver customized progressive lenses based on individual patient needs. With conventional progressive lenses, everyone is forced to wear a design chosen from a very limited range of choices. I like to compare customized progressives to tailored suits: each person chooses a style that fits his or her needs, and then that suit is individually fit for the best comfort, performance and appearance. By comparison, what we currently do for patients is lead them all to the same rack of clothes with a very limited range of styles and sizes.

A progressive lens must deliver all ranges of vision in a very limited space. Right now, you don't get to choose how much of the lens should be allocated for distance, how much for near, or how much for distances in between. Of course, you could try to match patients to the semi-finished lenses that are closest to their needs, but that would require an encyclopedic knowledge of existing designs, as well as extra dispensing time.

Wouldn't it be ideal if every patient could get the right balance of lens properties that fit the kinds of activities they do each day? The retail clerk who stands all day needs a reading area located lower in the lens than the retiree who reads books in a recliner. A taxi driver who likes to go to ballgames may need more distance vision than the engineer who spends a lot of time with his Xbox. I believe direct surface manufacturing is the enabling technology that makes it practical to deliver truly customized progressive lenses.

I also have some concerns. I worry that products that don't offer clear advantages over semi-finished progressives are damaging the reputation of this wonderful technology. I fear that the industry is creating confusion by making exaggerated claims. I know we risk alienating eyecare professionals by adding complexity to the lens selection and dispensing process. And I am not sure all laboratories are set up to verify the very complex optical surfaces created by this form of manufacturing.

Despite these concerns, I am certain we have entered a new era and that customized progressives will provide better vision for all of our patients and greater success for eyecare professionals.



Surface astigmatism is reduced and made more vertical for a wider clear field of vision

What about single-vision and other multifocal lenses?

Better vision and a better visual experience are not limited to the progressive wearer. Think personalized for single vision. In this instance look around the store and find those frames that have created the most vision issues when trying to add the patient's prescription.

Digital surfacing will improve the way that we deliver wrap eyewear prescriptions by being able to modify the lens periphery as well as the on center prescription effects. At some point, the very personal choice of frame won't inhibit the way that its lenses deliver vision.

For traditional multifocals, the choices will be similar. For those that will not buy progressives, the opportunity to improve the total vision experience by adding an asphere or atoric as the back lens surface can improve the clear field of view.

Is there a perfect patient?

Since lens maps and design have never been absolute predictors in patient preference, can one pick the perfect patient for digitally surfaced designs?

Improved clarity and reduced distortion are advantages for all patients. Some patients less sensitive to the effects of lenses or with moderate prescriptions may not notice large differences. If the benefits cannot be demonstrated then the increased costs may be difficult to justify. However, most patients will see incrementally better, near emmetropes (low power prescriptions) and high power or high cylinder (>1.50D cyl) should be immediately impressed with their new eyewear.

The patient that wants the best in the category is also ideal for these lenses. The practice that positions itself on delivering the best in care and the products they dispense is also the right practice to convert the majority of their patients to digitally surfaced lenses.

Lastly, the patients that have adapted but still are somewhat dissatisfied with the performance of their current progressives are an important segment of the target patient base. They like and wear progressives but want a larger clear field of view or crisper vision. Digitally surfaced lenses can make the difference.

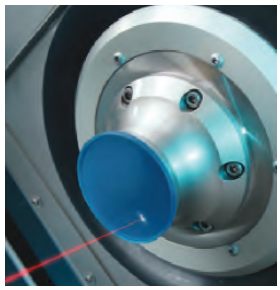
Should the ECP write Rx's in a different way?

No. Digital surfacing builds the sophistication into the lens. There may be some additional information required.

Most progressives make an assumption of fitting vertex; frame tilt and face form so with careful monocular PD and fitting height measurements lenses deliver the intended benefits.

Some new digitally surfaced lenses will require vertex and tilt values to better personalize the Rx. We'll review this in more detail when we discuss the precision opportunities for new measuring devices. For more information, refer to the Essilor or Zeiss lens requirements.

New since last article



Integrated laser marking

Introduced for the first time at the MIDO trade show in Milan, Italy, Schneider Optical Machinery premiered a complete on-board laser-marking unit in its digital surfacing generator HSC smart. The integration of the laser marking into the generator enables perfectly positioned markings and significant cost savings for small to mid-sized labs implementing digital surfacing.

Varilux Ellipse is now available in a Varilux Ellipse 360° version. The short corridor front surface design is further personalized using Point-By-Point Prescription Mapping. The result is a unique back-side design that optimizes each Varilux Ellipse progressive prescription to maximize the patient's field of vision and reduce lens distortion. Since 85 percent of add power is achieved in 9.5mm, minimum fitting heights of 13mm are possible.

Carl Zeiss Vision has extended its offering of direct-surface customized lenses by adding SOLA Compact ULTRA HD in 1.67 clear and Transitions Gray. An advanced short-corridor progressive lens design, Compact ULTRA features a low 13mm minimum fitting height that allows progressive wearers to select from a wider variety of smaller, fashionable frames. This fitting height is made possible by a revolutionary corridor design that delivers unsurpassed reading area at all fitting heights. The Compact ULTRA design also offers excellent binocularity, low skew distortion and low astigmatism.

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Digital Surfacing

HOW DOES DIGITAL SURFACING PRODUCE THE COMPLEXITY OF DESIGN? PART 4

The detail required to create complex surfaces by digital surfacing involves new techniques and/or technology. This means that lens preparation, calculations, blocking, cutting, polishing, marking and verification should be thought of differently. Therefore, the lab that offers digital surfacing should be considered special. It has incorporated this new sophistication to produce a new class of lenses and delivers them with increased precision. This is much more complex than will be required of the ECP to implement individual, digitally surfaced progressives. Even though some digitally surfaced lenses will require verification of the optimized prescription instead of the original prescription, lens power will still be verified at the distance and near checking circles.

By Mark Mattison-Shupnick

From blocking to marking – a list of critical needs

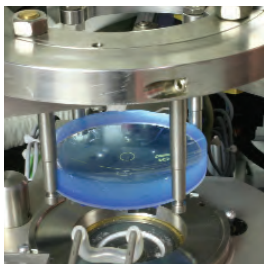
Taping

While not new or different from any other lens, lenses to be digitally surfaced are also taped to protect the surface and provide easy and secure alloy attachment. Next a block is attached to the lens blank so that it can be positioned and processed through assorted laboratory machines.

Blocking

Increased accuracy is required when blocking lenses for digital surfacing. Consider two situations: 1) The front surface progressive is modified with a digitally surfaced back (Varilux Physio 360°, Varilux Ellipse 360°, Definity), and 2) The progressive surface is being placed entirely on the back surface (SOLAOne HD, Compact Ultra HD, AO Easy HD). In the first case, inconsistent positioning of the block or any wedging (prism) will alter the optimizing effect of the digitally surfaced back. Therefore, the tolerances that the lab would have previously accepted are no longer acceptable.

In the second case, the location of the umbilic, the centerline of the corridor, and its height placement are critical relative to any semi-visible engravings located on the blank's front surface; however, most digitally surfaced back surface progressives are engraved on the back after processing minimizing errors.



CCU100 Blocking

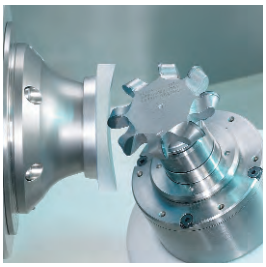
Digitally surfaced lenses will be only as good as the initial blocking. In the example of the Schneider CB Bond (manual system) and CCU 100 (automated system) blockers, they combine a variety of technologies for precision. To aid in blocking lenses, a high-resolution optical detection system is provided. In this way, lens markings can be easily identified and used for lens positioning. In addition, lens clamping is variable, both in pressure and position. This prevents tilt and wedging that might induce unwanted prism. Numerically controlled (NC) prism and axes adjustment ensure the required blocking precision for umbilic, OC and prescription axis location. Several lens manufacturers have developed their own proprietary visual systems to ensure that accuracy is maintained.

Generators

Generating a surface was traditionally done by a cupped diamond wheel, and then improved to polycrystalline diamond milling. For digital surfacing, a milling tool is used for fast stock removal and the diamond-

turning tool is used to achieve the surface smoothness so that only light polishing (buffing) is required. This also results in high throughput.

In addition, original generators cut in three axes simultaneously, digital surfacing requires at least four axes or additional "degrees of freedom" to be able to create the complex surfaces that incorporate Rx, add power change and corridor position, aspher- or ator-icity and base curve optimization. Schneider generators provide process management i.e., calculates the cutting parameters regarding surface topography and individual Rx parameters to provide the right tool position, velocity and acceleration required. Regardless, it is still called generating. The components are as follows:



High speed Milling

PCD and Diamond turning

Generating – Uses the milling tool to increase throughput, reduce diameter, bevel and create the initial contour of the surface.

High-speed cutting – Is a turning process using a natural diamond for a very fine surface quality. A PCD tool is also available on some machines, e.g. when that generator is used for traditional Rx work along with digital surfacing.

Speed – Each single run of the tools is completed in 15-20 seconds with the milling tools spinning at 12-25,000 rpm (depending on machine and motor size). Speed is also a function of information processing rates i.e., how the cutting height position is precisely controlled as the lens turns at up to 6,000 rpm. Extremely short cycle times, some 10 times shorter than the cycle times of state-of-the-art drives are achieved. This allows for sampling rates much faster than conventional systems.

Spiral distance – Generating and high-speed cutting is done in a spiral. The separation between final cuts, as the lens turns, is in the range of 0.03-0.065 mm. The shorter the distance between the data points and the smaller the spiral distance, the smoother the surface. However, if the spiral distance becomes narrower productivity goes down. So, determination of the spiral distance is a trade-off between smoothness and throughput.

Digital surfacing means that the machines input is a digital data file that describes a progressive or other surface in all detail. It can then be converted into a spiral movement, allowing the joining of many cutting points smoothly.

Accuracy – In Part 2, we commented that these generators would reproduce the design exactly as it is specified. To achieve this, you must choose a generator that has the surface control required to achieve the lens design requirements. Local tolerances of <500 nanometers and global tolerances <4 µm are achieved in the Schneider equipment.

Therefore, the generator is the critical component in replicating the digital surface needed. The combination of highest precision and speed provides the laboratory with the best opportunity possible to take advantage of individualized progressives.

Polishing

CCP102 Polishing

Polishing is not polishing in the traditional sense i.e., for spherical and toric surfaces, hard laps are used. For digitally surfaced lenses there is no hard lap that can conform to the complex changing surface. As a result, the tools must be adaptive to the surface.

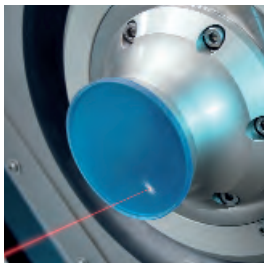
So, if the tool must adapt to the surface, the design of the polishing tool and the method of guiding it is important. In the Schneider polishing system, 3 adaptive tools of different initial curvatures replace thousands of hard laps. In addition, the polishing process demands another kind of polishing kinematics compared to conventional hard lap polishing. Therefore, to get the tool surface to adapt properly and touch the entire surface an analysis of pad pressure, its changing shape and tool speed are required. The result is the machine's calculation of time and position at various positions on the lens surface.

There are three process steps needed to polish. 1) The lab management system transfers the topography of the surface, 2) The correct tool is selected and 3) A routine is calculated for tool travel over the surface. Last, intelligent process management of path, dwell time, and swivel profile is individually configured for the two lenses.

To further improve efficiency most labs automate the interchange of lenses and tools using robotics. This eliminates operator error and provides time control that allows standardization of overall process times. Polishing tools are padded with a polishing pad and can be used repeatedly up to 30 times. The polisher counts the number of times a tool is used and switches it out when needing a new pad. In this way, automated tool control allows an automated 24-hour production schedule, if necessary.

Polishing times vary between 60 and 240 sec per lens (Polycarbonate requires increased polishing time). All Schneider polishing machines process two lenses at the same time to maintain job throughput integrity.

Laser Marking



On-Board CO2 Laser Marking

Individualized progressives from digital surfacing may also require lens markings since the lenses may have been created using a single vision blank. Therefore, a variety of different methods, from in generator to after polishing, are available to mark lenses.

The choice of which laser is used is a function of quality, speed, capital investment, operating costs and reliability requirements. For example, the HSC smart is available with a complete on-board CO2 laser-marking unit. The unit is capable of producing perfectly positioned markings and significant cost savings for small and mid-sized labs.

My View

Gunter Schneider, Schneider GmbH & Co. KG, President

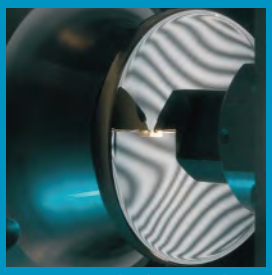
Eyesight is probably the most precious sense we have. Any improvement to less than perfect vision increases our quality of life. It seems a coincidence that a natural diamond now plays a key role in today's perfection of eyesight. It is part of our equipment and has been wonderfully serendipitous since the beginnings of our freeform or digitally surfacing technology more than 10 years ago.

In the early '90s, my company was absolutely new to the ophthalmic industry. Being successful with modern CNC technology in the precision-optics industry, I was astonished by the many technologies required to manufacture different kinds of spectacle lenses. In my view, a digital data file could easily describe any lens geometry so why not just transfer this data to a machine capable of making a perfect customized lens? The idea of producing individual customized lenses was born.

Professionals who have mastered geometrical optics and the many factors of human physiology that influence our precious sight determine customized lens designs. From the start, my ambition was to create equipment that can make these sophisticated designs into actual lenses and exactly match a prescribed individual correction.

This challenging task requires the ultimate tool to do the job—a natural diamond. Often only known as a perfect gift, the diamond is the quality-defining top of today's advanced generators.

A modern freeform generator delivers the lens geometry and surface shape required within the tolerance of single microns. This is a really a new class of generators and hardly compares to traditional coarse-cutting generators which required a fining and polishing process to reach the final lens shape. The natural diamond, accelerated by highly dynamic drives and high-speed controllers, transforms the lens blank into the perfect shape. Polishing is still required, but has changed completely as well. Only three different soft tools, following a computer-controlled polishing strategy, are sufficient to achieve cosmetic perfection. Thousands of hard lap tools are replaced for good.



Natural Diamond Tooling

Any size of lab can benefit from the new freeform technology. Today, complete freeform lines are offered for small, medium and large labs. The solutions vary by size and automation required, but excellent product quality can be accomplished in all cases. The supply of designs and technology parameters via the Internet make it easier than ever before to run a freeform lab in any location you prefer.

Therefore, the additional value of individual and customized lenses does not depend on lab size, but on total control of the production chain. This goes far beyond the core of freeform production—generators and polishers. The making of a good digitally surfaced lens starts with the correct measurements by the optician and finishes with the quality check of the final product. An individual lens is superior to a standard progressive provided the makers of the freeform lenses are aware of the importance of the parameters under their control. In addition to machine performance, the operators are key to the manufacturing process. As the equipment manufacturer I am especially interested in providing thorough training of machine operators. They are key to making the promise, of superior freeform lenses, true. The merits of an increasing digital business will last as long as all players in the game focus and maintain excellent quality.

For me, the brilliance of the diamond we use stands for our high aspirations to make the freeform story a success.

Stand-alone laser markers can be CO2, YAG or Excimer lasers. The differences are often cost and the effectiveness at which they can mark the variety of materials that a laboratory processes.

When choosing a laser marker consider the clarity of markings. Standard, fine and finest would characterize CO2, UV Solid-state and Excimer respectively.

At this point lenses have all their power, corridor length, design and marking characteristics completed. The next step is to add coatings to complete the lens. We'll talk more about hard and AR coatings for digitally surfaced lenses in Part 5.

The Capital Investment

The capital investment i.e., the machines plus the typical accessories like tanks, chillers, tables, conveyors, robotics, etc., need to be added to the cost of the purchase. Understanding the throughput per hour allows lab principles to determine how large a system to purchase. For example, to process 25 pair per hour or to do an approximate 175-190 pair per shift, a table like the one to the right allows an estimate of the number of blockers, polishers and laser markers required by generator chosen. A HSC Master doing 80 lenses/hour would require one CCU100 (with taper included) and two CP102 polishers. Any laser marker would satisfy the throughput needs of this lab. (For more information visit www.schneider-om.com)

	Device	Lenses/hr
Taping		150
Blocking	CCU100+taper	75
	CCU100	105
	CB Bond	120
Generator	HSC smart	50
	HSC master	80
	HSC giant FF	100
Polishing	CP102	50
	CP Swift	55
Laser Marking	CC100Y	150
	CC100E	300

The return on investment requires an additional review and is consistent with the way that any lab would determine whether purchase of such a system gets paid for in a reasonable period of time and that the capability is required to better compete.

Regardless as we've said, for small labs, the purchasing decision may

be a difficult one. There is the high capital outlay, $500 thousand to $1 million dollars. However, the overall volume of digitally surfaced lenses is predicted to escalate and it will become easier to justify the expense. As a result, we expect to see many labs decide to purchase and for the ECP, additional locations will make lenses available.

The numbers of "fixed design" progressives (front surface SF progressives) will continue and require processing. As a result, many labs consider using the same generator, as they will do for customized lenses. In this way, equipment is amortized faster. Some that have implemented new digital surfacing capable equipment have said that powers are truer and there is less overall spoilage. In fact, for some they recover breakage from traditional polishers on the adaptive polishers thereby reducing rejects. (Photos and tables courtesy of Schneider.)

How should I get ready for VEW and OLA?

As in any purchase, whether for lenses or equipment, do your homework. In this month's article we've highlighted why the generator and polisher choice for the lab is critical. Use the descriptions and explanations to comparatively evaluate your choices. That means personal research that allows a competitive analysis of ability, cost, throughput and maintenance. Build a table of each of the characteristics, benefits and advantages for your lab or office.

Go to Vision Expo West and the Optical Laboratories Association meetings. Visit the Schneider booth for a first hand look at equipment and the ability to get answers specific to your lab requirements. Both the Carl Zeiss Vision and Essilor booths will have experts available to detail lens benefits, dispensing programs and the instruments available for professional practice growth.

To get ready, read the trade magazines, go online to each of the company's websites and ask your professional peers their own experiences. Consult professional associations and the various on-line chat boards will have anecdotal information or experiences. Of course, for capital investments, consult with your accountant.

New since last article

Schneider HSC giant FF – launched at MIDO

The freeform generator HSC giant FF has been specifically developed for modern labs, which have a need for maximum throughput and minimum cost of ownership. The new machine design enables the simultaneous processing of two Rx or digitally surfaced lenses at incredible speed without compromising quality.

Two independent workspaces in conjunction with specially developed damping controls allow reaching sub-micron accuracy during the fine turning process of a lens while the milling unit already cuts the next lens with full power. The inclined machine base has been specifically optimized for simultaneous processing of two lenses. The special vertical chip flow and upside-down configuration guarantees that all swarf goes straight down into the drainage, supporting continuous processing of polycarbonate and other long-swarf materials.

Options are non-tactile Auto Tool Detection, on board laser marking and the Power Safety System, which reacts within microseconds in the case of unexpected power failures eliminating the risk of machine damage.

Questions received and answers offered

In response to Part 3 – "Is It Wow Now?" we received this response to "Wow" from Roger Mummert, a widely published writer whose travel, food and lifestyle articles appear regularly in the New York Times. He also writes and lectures for professional organizations and the contact lens industry.

Adapted from his letter "A Love Affair with Superman Vision"

After listening to one optician after another say, "You put these lenses on people, they stand there and say, 'Wow, oh, wow,'" I had to try them. The lenses they were talking about involved wavefront optics or digitally surfacing.

Mark Stadlen, OD, and optician Jay Binkowitz of American Optical in Astoria, Queens, made up a pair of spectacles with Varilux Physio 360° lenses. I did exactly what I'd been hearing about. "Wow," I said, "Oh, wow."

It was like someone turned on the lights. It was like the moment when the cable guy, on a house call, said, "You really haven't been using your high definition plasma to full effect," and then clicked on 1240 dpi. Shazaam!

For several months afterward I nearly didn't want to take off my glasses. "I simply enjoyed the best vision of my life…." With my Varilux Physio 360° lenses, I could discern individual leaves on distant trees, I could read package inserts, I was ordering for the table when no one else could distinguish chile rellenos from chimichangas. "I was a visual Superman."

Well, Superman took a fall. I slammed a hatchback car door on my head and broke my new glasses. "…I had sheared off the ear piece. Fortunately, the lenses were unscathed, and back to Mark and Jay they went.

My backup specs were a three-year-old pair of Varilux Comfort lenses. They did a yeoman's job of providing decent vision, but the world was entirely less vibrant. Whereas my initial Wow! factor with the Varilux Physio 360°s was about clear distance vision (everyone loves distance!), now I noticed a distinct step down in my close work. I simply didn't read as well.

Jay called with the good news: "Your Varilux Physio 360°s are fixed."

All is right with the world again, here in Superman's lair. I've just got to stay away from my kryptonite: hatchback doors, at least those bearing bike racks.

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Digital Surfacing

HOW CAN WE ADOPT MORE SOPHISTICATED DISPENSING AND SALES TECHNIQUES CONSISTENT WITH THE BENEFITS OF DIGITALLY SURFACED PROGRESSIVES?

PART 5

To answer this, I can't help but begin this month's installment by talking about some comments I've read on Optiboard.com and ODwire.org. Both sites are terrific forums for getting a pulse of a segment of the marketplace. When searching "Digital Surfacing" it returns posts that describe it as – 'confusing, marketing hype, better vision in my personal glasses, requires a choice of a knowledgeable lab,' and 'we're fortunate to have so many choices.'

The optical industry tends to be cautious of change and initially skeptical of the "hype." So, the questions beg for some simplicity and agreement of language.

I'll use a part of an Optiboard post by Darryl Meister (Carl Zeiss Vision) where he states, "The real confusion here lies in the difference between mold making and lens making. A free-form or digitally surfaced lens is a lens surfaced using a free-form generator and polisher. It is not simply a lens that has been cast from a 'digitally surfaced' mold." Lenses made from digitally surfaced molds use this precision technique to create better molds. It depends on the manufacturer's science and the ability to deliver the designs consistently mold after mold and then through the lens casting or molding process. Depending on the material being cast or molded, material shrinkage during curing will change the curves so the mold has been iterated to be sure to deliver the final design. Examples are Varilux Physio, Zeiss GT2 and SOLAOne, etc. Digitally surfaced lenses have the design cut directly onto the lens surface and the design is reproduced exactly as we discussed in Part 4. See the description of how Schneider generators and polishers reproduce designs to 0.1 micron accuracy. Examples of digitally surfaced lenses are Varilux Physio 360°, Varilux Ellipse 360°, Zeiss Gradal Individual, SOLAOne HD and Compact Ultra HD.

He goes on to say, "It is equally important to note that a "free-form" lens doesn't really imply any greater level of optical performance or sophistication. Unless the lens has actually been customized for the wearer in "real time" by lens design software, prior to free-form surfacing, the performance of a free-form progressive lens is really (may be) no different than a comparable semi-finished lens. I think some manufacturers with limited lens design tools sometimes exploit this misunderstanding of the term "free-form" by implying that, because their progressive lens came off a free-form generator, it is similar in technology to some of those premium, customized free-form lenses out there -- like Gradal Individual, Varilux Ipseo, etcetera."

So, to get the most out of Digital Surfacing you must understand the level of design customization offered by manufacturers and a basic understanding of the way the lenses are manufactured. Learn the actual benefits being delivered. Understanding the technology in detail requires more mathematics and physics knowledge than most of us have and is not essential to enjoying success with the products.

Some posts suggest that the claims are all "marketing hype" since these companies spend significant monies to develop products and technologies. I agree with those that are appreciative of the efforts of companies like Schneider, Carl Zeiss Vision and Essilor in bringing new technology that provides wearer benefit and business growth opportunities. It's now up to you.

Is the Wow 100%?

With that being said, nothing is 100%. Some patients won't experience a wow effect with a customized progressive. Sometimes, a conventional lens provides almost ideal vision because a chance combination of factors allows the maximum benefit of the design to be expressed. Patients who already have almost perfect correction may not see any improvement. But if you consistently use customized progressives you will realize a greater level of performance for a wider range of patients. By using the best products currently available you show your customers that you really care.

I am certain that wavefront-designed and digitally surfaced lenses will become the majority of the progressives sold and dispensed everyday. As we make this shift in technology, how do we sell these products most effectively? Do you and your colleagues know how to describe the benefits? Do you have all the tools that are needed? Do you know how to recognize whether you have received what you ordered?

Providing the best for patients

Using more digitally surfaced lenses raises the expectations of patients. We deliver better vision while we effectively replace older designs, their compromises and lesser profitable products that cannot fuel new research and industry growth.

One effective method to increase usage is to show patients how digitally surfaced lenses are the logical next step in design improvement along with a price discussion to better position and describe their benefits. If organized effectively, it simplifies the message for both dispenser as well as patient. It also helps reduce the progressive lens toolbox to a manageable number.

Category	Good ($$)	Better ($$$)	Best ($$$$)
General Purpose	Varilux Comfort SOLAMax	Varilux Physio SOLAOne + Transitions + Poalrized + Polycarbonate + 1.6, +1.67, +1.74	Varilux Physio 360° SOLAOne HD Gradal Individual Varilux Ipseo + Transitions + Poalrized + Polycarbonate + 1.6, +1.67, +1.74
Small Frame	AO Compact Zeiss Bervity	Varilux Eclipse SOLA Compact Ultra + Transitions + Poalrized + Polycarbonate + 1.6, +1.67, +1.74	Varilux Eclipse 360° SOLA Compact Ultra HD + Transitions + Poalrized + Polycarbonate + 1.6, +1.67, +1.74

For example, create a chart for your office like the chart shown. Add the digitally surfaced lenses you use and it's easy to show patients the benefits and the cost of an upgrade from Varilux Comfort or Varilux Panamic to Varilux Physio. The increased cost to the patient is when the lens "delivers sharper vision because up to 30% increased contrast sensitivity makes colors brighter and details sharper." Further improve it by using 1.67 high index for "lenses that are up to 40% thinner and lighter for better looks and comfort; each for x dollars or bundled together at y dollars." Upgrade from Varilux Physio to Varilux Physio 360º or from SOLAOne to SOLAOne HD to provide your patient optimal vision better customized to their prescription. Once your patient understands the benefits, they will better understand the difference in pricing for more advanced technology. If it's clear to the dispenser, it will be clear to the patient.

Know What to Say

As a professional, digitally surfaced lenses can be tantalizingly technical. After all, they are precision designed and cut, uniquely polished and delivered. However, most patients only want to know that the confidence you have in them is complete. Putting the technical into consumer terms that resonates with every individual is critical. From www.thinkaboutyoureyes.com, . . . to get to 20/20 and beyond...

Every eye is unique, like your fingerprints. With today's technology, customized solutions can be created like never before.

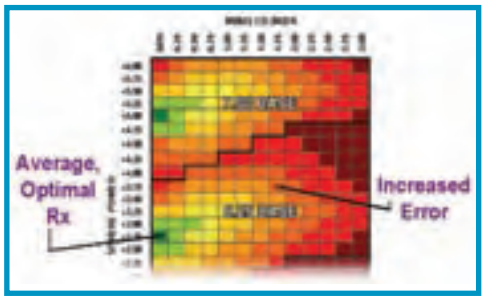
Sharper, more vivid, detailed vision is possible with the latest eyeglass lens innovations—advances with names such as digital lens design, wavefront technology, 360° digital surfacing technology, state-of-the-art, anti-reflective, and visible light transmission technologies.

Imagine the first time you saw a DVD versus a VHS tape. . . or HiDef versus regular TV. The difference in sharpness, color, clarity, and contrast was incredible. You can experience the same improvement in your vision. Let me show you how.

Without base curve limitations

Digitally surfaced lenses allow for the customization of the lens to the wearer's individual needs. To review, a lens like Zeiss GT2, SOLAOne or Varilux Physio delivers increased surface design precision in a front surface progressive i.e., digitally created molds. Using the patient's prescription and fitting requirements, the product can be further optimized to better adapt to the patient. Cutting the progressive and the prescription on the lens' concave surface can further optimize a progressive as in Varilux Ipseo, SOLAOne HD or Compact Ultra HD. Or, use the progressive front of Varilux Physio and add a complex surface to the back to further optimize the prescription. This is Varilux Physio 360°. Another lens that uses dual surface optimization is DEFINITY. How does this customization make a difference?

Prescription optimized lenses deliver crisper vision and wider fields of clear view. That's better vision overall, especially for those patients whose prescriptions were farthest from the average optimal Rx for that base curve. When digital surfacing the lens as well as the mold, the prescription can be optimized for every power. Refine the prescription further by compensating for vertex and tilt.



The Right Tools

If new precision is delivered in the lens, new fitting precision is also logical. At the very least, demand all PD's from Pupillometers. For height, vertex and tilt consider more technically precise measuring devices.

The iTerminal by Zeiss is an example of a new and unique dispensary system that combines advanced fitting and measurement precision with enhanced patient consultation ability. Using a precision digital camera and

computerized measuring system, it delivers measurements to 0.1mm accuracy for monocular PD's, fitting heights and vertex distance. It also measures pantoscopic angle and frame wrap for complete prescription customization. For patient consultation, review chosen frames or show interactive demonstrations of lens enhancements like AR, polarized and photochromics.

Implementing a dispensing technology like iTerminal will improve staff capabilities by simplifying complicated fitting measurements and deliver greater accuracy. It takes the uncertainty out of progressive fitting by new staffers or across the variety of capabilities in a large staff. Not only will it improve progressive performance, but it will reduce remakes and increase patient satisfaction.

Lastly, adding new technology in the dispensary that all patients can see sets your practice apart. It provides a sophisticated and engaging patient experience. Moreover, it is more consistent with the cost and identity of digitally surfaced lenses. Would you purchase a $1200 suit without individual measurements and tailoring? It's the same when a $400 progressive gets dotted using a felt tip pen. The felt tip pen is inconsistent with the presentation of precision and the expense of the design.

Got What You Wanted?

Surface height measurements

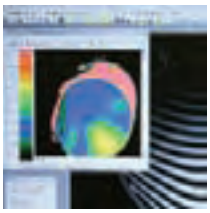
One of the lab's concerns and one that certainly should also be the ECP's is whether the lens was received as designed. Semi-finished progressive lens manufacturing allows the caster the opportunity to verify the production for consistency of design from lens to lens, both daily and over a period of time. In Digital Surfacing the lab is responsible and therefore must have a verification system available. It must be able to read the surfaces or through power and compile the data into a map of the lens that can be compared to the intended design. Then the delta of the two maps can be used as a go/no go test for accuracy.

Schneider offers the PMD100 in a floor standing or table top unit that uses Phase Measuring Deflectometry. This is an optical device that uses a CCD camera to capture a light source and grating bounced off a reflective surface. The data received is processed into a map of the lens.

Measurements of local curvatures of total surfaces are possible in a wink of an eye. For the lab it provides measurements of progressive front and back surfaces, direct measurement of optical power and gradients, monitoring of lens cosmetics and cleanliness, measurement of lenses while still blocked and is robust since there are no moving parts.

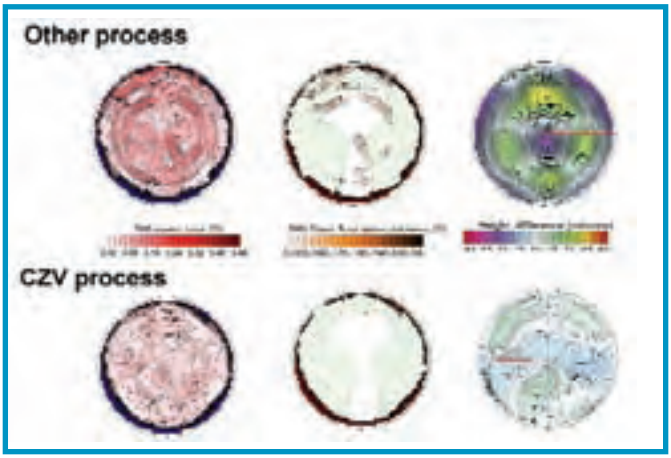
PMD 100-T

Reflecting Grating



Illustrated Map

The illustration below (source, Carl Zeiss Vision) shows lenses created using two different production systems from the same set of design files. One process did not produce the design with sufficient precision, leaving small areas of localized power errors that were the result of surface height differences from the intended design. The other process produced a lens that complied with the design specification to a high level of precision. To reiterate, the digital surfacing process is a manufacturing technology that can be used correctly or incorrectly. The rigor of precision and the guarantee of design are not easy and require a significant investment in the science. Laboratories making these lenses must invest in technology to ensure that the lenses they make are delivering the desired results.



Seen at VEW

Varilux Comfort 360º - New Varilux Comfort 360º lens delivers the patient adaptation of Varilux Comfort lenses and the unsurpassed ease of fitting that ECP's have appreciated. Patients will now receive wider fields of vision through reduced peripheral distortion when upgraded from Varilux Comfort to Varilux Comfort 360º

Hoyalux iD Lifestyle – HOYA added to their digitally surfaced library with Hoyalux iD Lifestyle. With Hoyalux iD LifeStyle, the vertical progressive component is standardized on the front surface – in other words, it is molded at the factory. The customized horizontal progression on the back surface is digitally surfaced.

Advanced surfacing with Schneider's blocker CB Bond and generator HSC Smart - SCHNEIDER showed two of their surfacing machines for small and medium-size labs – the manual blocker CB Bond and the gen-

erator HSC Smart. The two machines bring full Rx and freeform surfacing capability to small production facilities.

The blocking stations of the CB Bond have been specifically designed for higher precision in manual alloy blocking. Blocked lenses are perfectly prepared for high-performance generating on the HSC Smart, the only compact generator which comes with a separate generating spindle for fast stock removal of all materials including polycarbonate.

AIT "Center" - Developed by INDO, this sophisticated measuring system automatically measures patient PD and height, vertex distance and most pantoscopic frame angles. Three built-in cameras and infrared LED record three-dimensional patient measurements making dispensing easier and more accurate.

In Error

In Part 4, the throughput table on page 3 listed the Schneider polishing machines as CP102. It should have been listed as CCP102.

My View

Carl Bracy, Vice President of Marketing, Essilor of America, Inc.

Digital Surfacing is definitely the buzzword. When surveyed by Essilor and in the 2007 Lab Usage Survey conducted by Jobson, more than 75% of ECP's were aware of the term *Digital Surfacing*. However, fewer are sure that they've used these lenses and very few can articulate the features or benefits of this technology. When asked if they expect to use lenses created by digital surfacing, they said yes and were definitely enthusiastic. Virtually all thought that they would sell more digitally surfaced lenses in the future.

Therefore, the opportunity for more education about digital surfacing is key to the success of the ECP and the satisfaction of the patient.

After talking with ECP's, Essilor staff and our labs, I believe that the main confusion lies in mixing or confusing the technology necessary to design lenses versus the technology of manufacturing. Essilor believes design concepts and technology drives performance while manufacturing technology delivers it. Here's what I mean.

Think of Digital Surfacing as 3 parts

1. Design Concepts – Evolving Performance

New technology offers an opportunity to provide each patient a more customized product. It is an evolving process as technology improves and designers are given new tools. In our view, success starts with the right semi-finished progressive design. It's a complex surface already and the result of significant research. It can be further enhanced when combined with digital surfacing techniques. For example, the final design of a Varilux Physio 360º lens is the result of the front surface design of Varilux Physio, the patient's prescription and an optimization of the back surface beyond a simple toric surface. By using two surfaces to personalize the prescription we can achieve improved optics and vision.

Digital surfacing also allows customization of a lens' design to fit the frame chosen and fitting height required. In Accolade Freedom, only the frame dimensions and fitting height are required. The back surface is digitally constructed to deliver the prescription and modify the design for the frame.

DEFINITY uses an innovative approach by splitting the add power between the front and the back of the lens. The result is lower overall distortion when compared to the distortion of a progressive of equivalent total add. Again, the back surface is designed with the front design, prescription and fitting characteristics required.

These have been breakthrough concepts and have significantly improved visual performance for wearers and created opportunities for the professional. It will not end – look forward to these same types of improvements to now be applied to more designs, from single vision to bifocals, clear and sunlenses.

2. Manufacturing Technology – Revolutionizing Delivery

Digital designing demands an integration of the latest calculation software and cutting techniques to be able to calculate a complete PAL design for each individual prescription. To create the lens, Essilor have created a proprietary calculation, surfacing and verification that guarantees performance.

In addition, a seamless transfer from ECP to lab and its equipment is critical. As a result, lens manufacturing must employ a complete IT integrated package that translates data from Practice Management Systems directly to the Lab Management System. This system then drives each machine and instrument with precision.

3. Technology Transfer – Broaden the Opportunity to Broaden the Benefits Experienced

As the market leader, Essilor is committed to make these advanced products available to everyone. Therefore, a critical step is to transfer these technologies (delivery) and license designs (performance) to allow all ECP's to benefit from these advancements.

For example, the ability to create the variety of Varilux 360º designs is in process with Lab Italee (Los Angeles, CA). More transfers are intended.

What About the Near Future?

There will continue to be an overwhelming quantity of new products introduced. As a result, each ECP must ensure that the products delivered provide meaningful benefits for their patients. Therefore, learn about and teach staff to match product with each customer segment as defined by patient need. Try the new products and share results.

Understanding the lab technology is not a requirement to provide the best-designed products for patients. But you must be able to rely on your lab to have the latest manufacturing technology to produce more accurate and reliable designs.

Lastly, new, sophisticated products require strong marketing support. Essilor promotional programs help practitioners consistently grow their practice through trial and training. Technical support and dispenser education increases patient satisfaction and customer retention. We are pleased to be able to support technical supplements like this one as a forum to share opinion and information.

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Digital Surfacing

2007 A YEAR OF CHANGE... WHERE DO WE GO FROM HERE?

PART 6

Digital surfacing has changed the U.S. optical market in 2007. By all estimates, digital surfacing has changed the market and will become some part of all labs, doctors' and dispensers' offerings as we move through 2008. The change has meant new manufacturing processes as well as new opportunities for lens designs, precision and a means to increase the customization and personalization of progressive lenses in the market.

By Mark Mattison-Shupnick

Remember, digital surfacing is a manufacturing process and by itself does not guarantee a better lens design. It does, however, provide for delivering new designs and customization for improved vision by creating lenses that achieve increased contrast and sharpness, wider, clearer viewing zones as well as lenses tuned to the personal needs of each patient.

By using this new processing technology, each lab and practice improves his or her knowledge about the ways that we can further customize eyewear. For the lab, it has meant a large capital investment in new machinery, training and digital sophistication. For the ECP, learning the benefits of each lens design and the methods used to describe and dispense them increases professional capabilities. It has also meant financial growth for the industry that will fuel additional R&D, marketing programs and newer visual benefits for each patient.

It is estimated that between 1.2 and 1.5 million pairs of lenses, the result of digital surfacing, will be dispensed this year or about 7 percent of all sold. That covers all the forms of digitally surfaced lenses i.e., lenses created from digitally surfaced molds, SF progressives digitally enhanced, dual surface and/or concave surface progressives.

According to Dr. Wenko Süptitz of Schneider Optical Machines, these highly sophisticated and automated equipment free-form systems drive two other developments in the market. First, digital surfacing has become so fast and robust that this technology now successfully competes with traditional prescription laboratories' surfacing equipment. Its advantages include simplified logistics and processing, increased flexibility and the option to make optimized aspheric and atoric lenses—a technology that does not require special free-form design software. Secondly, digital surfacing equipment lines are now available in reduced scale for smaller production demands and made more affordable. As a result, the technology of the large machines like HSC Master generator and CCP 102 polisher are now possible for smaller labs. This new economical line consists of the blocker CB bond, generator HSC smart, polisher CCP swift and laser marker CCL C*mark.

As a result, new lens designs, processing software and equipment availability will fuel better patient's options throughout 2008. It's been a process of evolution and revolution.

A Review of the Differences

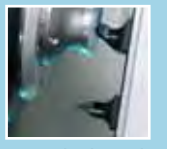
Let's review the differences between digital surfacing and/or digitally surfaced lenses. In the two columns below, digital surfacing as the manufacturing method is described on the left and the resulting lenses are reviewed on the right. It is critically important to understand that merely producing an existing progressive design by digital surfacing does not improve the design. New vision science and an optimization program are required to drive digital surfacing equipment to produce lenses with improved vision and personalized characteristics.

Manufacturing – Digital Surfacing

Blocking - Increased accuracy is required when blocking lenses for digital surfacing. Therefore, the tolerances that the lab would have previously accepted are no longer acceptable.

The Schneider CB Bond (manual) and CCU 100 (automated blocker) combine high-resolution optical detection systems with variable lens clamping both in pressure and position. In this way, lens markings can be easily identified and numerically controlled (NC) prism and axes adjustment ensure that the required blocking precision for corridor, OC and prescription axis location.

Generating (Milling & Turning) - Generating creates the complex surfaces that incorporate Rx, add power, corridor position, aspher- or ator-icity and base curve optimization. A milling tool is used to increase throughput, reduce diameter, bevel and create the initial contour of the surface.



High-speed natural diamond cutting tools in a turning process are used to create a very fine surface that only requires light buffing. A PCD tool is also available on some machines when that generator is used for traditional Rx work along with digital surfacing.

Polishing – The polishing tool must conform to the complex changing lens surface. As a result, the tools must be adaptive. The Schneider polisher analyzes pad pressure, changing surface shape and tool speed required. The result is the machine's calculation of time and position at various positions on the lens surface. And intelligent process management of path, dwell time and swivel profile are individually configured to polish a pair of lenses simultaneously.

Laser Marking - All progressives require lens markings. If created from a single-vision blank, a variety of different methods from in generator to after polishing are available to mark lenses.

On board CO2 laser marking

Verification – For the lab, design replication and consistency verification will require surface measurement either directly or by reflection. Schneider offers either a floor (PMD 100) or tabletop (PMD 100-T) unit that measures surfaces by Phase Deflectometry. For the ECP, some Rxs may have been compensated for position of wear so the lab will return a verification Rx as well as the prescribed Rx.

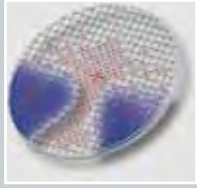
Best of AR – The best digital designs are best delivered when AR is added. Order only the best of the highly durable, easy to clean and keep clean finishes. Consider lenses with Crizal Alize with Clearguard, Zeiss Carat Advantage or SOLA Teflon.

Lenses – The Results

New Vision Science – Lens design drives the performance characteristics of the lens. New science has refined the design to be adapted to the visual needs of the wearer.

Optimization Software – An initial "lens" model is analyzed using optical ray tracing for an assumed wearing position. The software then minimizes optical blur, distortion and other factors using additional fitting, lifestyle, biometric and/or frame data. A final lens can be described mathematically representing the best result. Digital surfacing now makes it possible to deliver the lenses with a variety of degrees of customization. Consider Zeiss Individual, which also uses vertex and tilt data to optimize the prescription.

New Molds for SF Progressives - Using Wavefront Advanced Vision Enhancement (W.A.V.E.), a wavefront adapted technology, Essilor produces lenses with reduced distortion, improved contrast and clearer vision. Consider Varilux Physio where better control of higher order aberrations delivers unsurpassed visual sharpness.



Zeiss GT2 uses ZOOM technology to dramatically reduce lower and higher order wavefront aberrations, control the point-by-point design of the lens surface for excellent binocularity, clarity above the 180º and a wearer preferred near viewing angle.

Further Improve SF Progressives – Digitally surfacing the back of Varilux progressives provides a second opportunity to further customize the design to the patient's prescription. This reduces the front surface effects of unwanted astigmatism considering the patient's cylinder and axis. Consider Varilux Physio 360° to increase the clear field of view. Varilux Ellipse 360º for small frames and Varilux Comfort 360º for the proven ease of adaptation and fitting.

Automatically optimize corridor length for frame size and fitting height using Accolade Freedom. This maximizes the horizontal visual space whatever the frame while the vertical visual space is maximized for frame size by reducing the progressive length as needed to enhance near vision.

Concave Surface Progressives – Using complex software, a progressive and prescription can be transferred to the back of the lens and be made in the lab. Some manufacturers can further customize the lens using the prescription, base curve chosen, fitting characteristics and biometric data to create a cutting file for a personalized progressive. Using a spherical SV lens blank, all lens characteristics are created on the concave

surface of the lens. Magnification differences between visual areas are reduced, all zones are located closer to the eye increasing the clear field size and control of off-center astigmatism and power error remove the traditional limitations of base curves. Consider new SOLA HDv, Varilux Ipseo, SOLA One HD, SOLA Compact ULTRA HD and AO Easy HD for prescription-optimized progressives.

Dual Surface Progressives - Divides the progressive onto both sides of the lens or, creates two distinct non-progressive surfaces that, when combined, are progressive. The benefit is that the sum of the astigmatism (blur) of the parts is less than the astigmatism. Digitally surfaced, Definity and Definity short deliver wider intermediates and a clearer periphery than traditional progressives. Another manufacturer controls one surface for field width, corridor length is controlled on the opposite surface.

Best of AR - The best digital designs are best delivered when AR is added. Order only the best of the highly durable, easy to clean and keep clean finishes. Consider lenses with Crizal Alize with Clearguard, Zeiss Carat Advantage or SOLA Teflon.

Automatically optimizing designs for fitting and frame choice

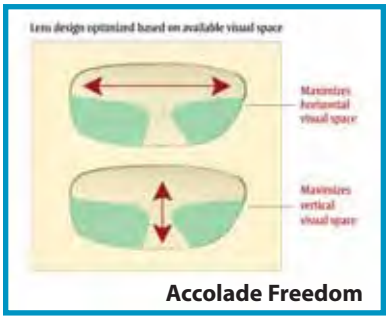
Delivering multiple corridor-length designs or designs with continuously variable corridor lengths is possible using digital surfacing. From this month's CE on lens customization (by D. Meister), "By providing a wide range of potential corridor length options, progressive lens wearers will always get sufficient near vision utility in small frames, without compromising optical performance any more than necessary."

SOLA HDv

New SOLA HDv from Carl Zeiss Vision morphs the design of a concave surface progressive creating a continuously variable corridor length to accommodate any small frame and required fitting height from 35 to 13mm.

Accolade Freedom by Essilor incorporates FrameOptimization and Harmonix Technology to create a digitally surfaced progressive optimizing vision (design based on the ametropia) while improving frame choice adjusting horizontal and vertical visual space).

Lens design, corridor length, inset, fitting height and prescription can now be automatically optimized for frames chosen.



Accolade Freedom

The Future is in Digital Surfacing

Just as progressives can be enhanced by digital surfacing, ordering an aspheric or atoric back on SF single vision or lined multifocal blanks are also expected to be available during 2008. In this way, improvements to a patient's vision are possible for all prescriptions and lens preferences. Optimizing the prescription with digital surfacing can remove the limitations of traditional base curves and can better adapt the lens to a patient's needs.

If base curve limitations can be removed, then the prescription can also be more easily improved for special frames like wrap sunwear where the requirement of 8 base lenses and lens wrap (tilt) require a compensated and optimized prescription centrally and peripherally.

Lastly, unique options like slab off, special prisms, localized add segments and lenticulation can help make special or high-powered lenses conjured by doctors and opticians possible on a per patient basis. Have a special lens need? Contact your lab and see how digital surfacing can make that lens real.

Converting to digital surfacing?

Andrew Karp, lenses and technology editor, Jobson Optical Group, initiated a lab usage survey regarding this new technology and reported on it at the Optical Laboratories Association meeting. Of the 79 percent of respondents that said that they currently didn't own digital surfacing equipment, 61% intended to invest in it over the next 24 months.

When asked the reasons for such an investment, 80-90 percent agreed or strongly agreed with the statements that digital surfacing technology allowed them "to do their own work in-house, keep up with the competition, eliminate hard laps and use the system for their standard prescription work also". Of the remaining 39 percent that did not intend on investing, 90 percent agreed or strongly agreed with the statements "the initial investment is still too high and the market is too small". However, they also agreed that if the costs were reduced and that there was significant training available they would reconsider. I think that they will be more interested in the new systems reduced in scale and cost. Clearly, digital technology is changing the market and many will invest in 2008.

Seen at OLA

Reduction in scale without reducing technical ability – Schneider Optical Machines introduced the new CCP swift, a smaller manually operated version of the automated polisher CCP 102. The CCP swift uses the same polishing technology and polishing pads as the CCP 102. The result is a proven technology scaled for reduced production requirements without a compromise in quality. The CCP swift uses the same soft-tool polishing as the automated machines and results in very competitive tooling costs.


CCP swift

Operators are taught which tooling to choose dependent on curve radius, usage cycle, etc. Tool usage is also monitored and will tell operators when tool replacement is necessary.

This meets the lab's request for a choice of machine size, cost and production capability. It also creates an opportunity to work with companies that may be licensing a technology transfer of designs between machines and locations. Add a CB bond Blocker and expanded business unit Tool Systems for a complete small production system.

- New for reduced production - Generator HSC smart, Polisher CCP swift
- For high production - HSC master Generator, CCP 102 Polisher
- Also new for lens marking - CCL C*mark, CO2 Laser marking unit.

Design morphed to match frames - New SOLA HDv, customized high-definition vision uses the patient's prescription, fitting height and frame size to morph the corridor length to deliver full reading performance while maximizing the clear area of the other viewing zones.


CCL C*mark

New machine entries – Gerber Coburn introduced a modular approach to traditional cut-to-polish and digital lens processing. They introduced the DTL200A generator and MAAT100 sub-aperture polisher. Optotech showed another approach to diamond turning; use of a sintered diamond tool. They also introduced the ASP 80 CNC DT polisher that has four FEM tools for the polishing of two lenses simultaneously.

Customized Progressives	Source	Front	Back
Digitally Enhanced			
Varilux Physio 360°	Essilor	Progressive	Digitally Surfaced
Varilux Ellipse 360°	Essilor	Progressive	Digitally Surfaced
Varilux Comfort 360°	Essilor	Progressive	Digitally Surfaced
Accolade Freedom	Essilor	Progressive	Digitally Surfaced
Concave Surface			
Varilux Ipseo	Essilor	Spherical SV	Digitally Surfaced
Zeiss Gradal Individual	Carl Zeiss Vision	Spherical SV	Digitally Surfaced
SOLA HDv	Carl Zeiss Vision	Spherical SV	Digitally Surfaced
SOLAOne HD	Carl Zeiss Vision	Spherical SV	Digitally Surfaced
Compact ULTRA HD	Carl Zeiss Vision	Spherical SV	Digitally Surfaced
AO Easy HD	Carl Zeiss Vision	Spherical SV	Digitally Surfaced
Kodak Unique	Signet Armorlite	Spherical SV	Digitally Surfaced
EyeMade	INDO, Signet Armorlite	Spherical SV	Digitally Surfaced
Succeed	SEIKO Pentax	Spherical SV	Digitally Surfaced
Autograph	Shamir	Spherical SV	Digitally Surfaced
Mulitgressiv MyView	Rodenstock	Spherical SV	Digitally Surfaced
Dual Surface			
Definity	Essilor	Progressive	Digitally Surfaced
Definity short	Essilor	Progressive	Digitally Surfaced
HOYALUX iD	HOYA	Digitally Surfaced	Digitally Surfaced
HOYALUX iD Lifestyle	HOYA	Vertical Progressive*	Digitally Surfaced

* Complex vertical surface

Measuring instruments - Satisloh showed its new measurement tool for advanced surface analysis, the Surface-Analyzer (SA) is based on an all optical high-precision reflectometry technique. It is ideally suited for process development and process control in ophthalmic lens surfacing.

My View

Demystifying Digital Surfacing, By Andrew Karp, group editor, lenses & technology, Jobson Optical Group

Since digital surfacing has emerged in the U.S. in the past few years, the technology has already begun to profoundly affect the way ophthalmic lenses are designed, manufactured, distributed and dispensed. As we learn to take full advantage of digital surfacing's potential, let's consider how it is impacting various levels of our industry.

For lens manufacturers, digital surfacing provides an opportunity to offer advanced technology in the form of high-value premium products. This will be done by selling actual lenses or "virtual" lenses in the form of data files containing proprietary lens designs which are then uploaded by optical laboratories that pay a "click fee" to produce the lens.

Optical labs are using the technology to increase efficiency and reduce their lens inventories, such as when they convert single-vision lens blanks into digitally surfaced progressives. This creates the capability to produce any variety of branded lenses as well as various types of specialty lenses that cannot be made with conventional surfacing techniques.

Eyecare professionals benefit by being able to offer their patients the most technologically advanced lenses available. Offering these products reinforces the ECP's role as lens experts.

Finally, consumers benefit from the improved or optimized optical performance available with digitally surfaced lenses. In some cases, these lenses can deliver a more personalized experience that factors in the wearer's viewing habits, visual activities and frame selection and fit.

Despite these advantages, there are some obstacles that will continue to be smoothed out during 2008. The cost of the lenses is relatively high, due to research and development and production costs. The technology for producing the lenses is complex. Labs need to integrate each supplier's lens design software with their lab management software and lens processing equipment. Perhaps most important is the question of how to best market these lenses to consumers in a way that will persuade them the lenses are perceptibly better than conventional lenses, and that such a difference is worth paying more for. With that said, 2008 will be an exciting year.

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