

The Rapidly Changing Landscape of Refraction Technologies

*How They Will Impact Your Practice?
Where do You Go from Here?*

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- I have no financial or proprietary interest in any of the products discussed
- I have received honoraria for speaking, writing, participating in an advisory capacity or research from: Alcon, Allergan, BioTissue, Optovue, Shire, Vistakon, Valeant
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- Owner
 - Dr. MES Consulting



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Technology For the Better or Worse?

Change is Already Happening

- How Will it Impact Your Practice?
- Where do You Go from Here?



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Patient calls the office...

- I'm out of town and I have a red eye
- It's going around my family and I need drops called into a pharmacy in another state
- I'm very busy and can't be seen
- "All of our family has a prescription for eye drops, but they are all expired"
- Last red eye was 2+ years ago

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Patient calls the office...

- "You know what, I'll just go online and get a prescription"



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Phoropter

- Been in Use for over 80 years
- The Benefits
 - It works. Accurate, Reliable
 - Low cost investment, It lasts and lasts
 - Low maintenance
- Disadvantages
 - To train a good refractionist is a long and hard journal
 - Most Optometrists perform all refractions themselves
 - That becomes the constriction point of patient flow and productivity
 - With 0.25D steps, 20/20 vision is just about maxing out



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20/20 vision Which one is better?



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Automated Phoropter

- Enhancements to previous systems
- Thinner Profile with faster micro processors
- Color Touch Screen
- Improved Test and Target design
- Wow factor



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EPIC

- Refractions in Half the Space
- Delegation
- Adjustable Motorized Table
- Counterbalanced arm
- Prints hard copies to an external printer or EMR



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EPIC

- EPIC refraction in 6 min as compared to a traditional manual refraction in 15 min.
- Increase of 50-75% patient throughput
- Staff more efficient
- Profits increase

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Topcon KR-1W

5 -in -1 multimodality space saver:

- Auto-Refractor
- Auto-Keratometer
- Corneal Topographer
- Wavefront Aberrometer
- Pupillometer (Day /Night Rx)

Also includes dry eye testing- non-invasive TFBUT



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Transfers to the BV-5000

- Allows for refraction in the lane
- Increased efficiency
- Rarely have to change Rx
- Very accurate cyl and power

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KR-1W

- Extremely accurate wavefront machine
- Rx reliability
- Dry eye assessment
- Early pathology determination - trefoil, coma & peripheral aberrations

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Phoropter® VRx

DIGITAL REFRACTION SYSTEM



The Phoropter VRx is a quicker technology

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Reichert VRx

Efficiency is gained in the...

- Fast and quiet lens exchange
- Intuitive, easy to learn interface
- Accessibility of all operations
- Pre-programmed tests for astigmatism, phoria, binocular balance and near vision
- Ability to program refraction steps
- Instantly responsive two way communication with ClearChart digital acuity systems
- Ability to interface with pretest equipment
- Transfer of data to EMR Sys

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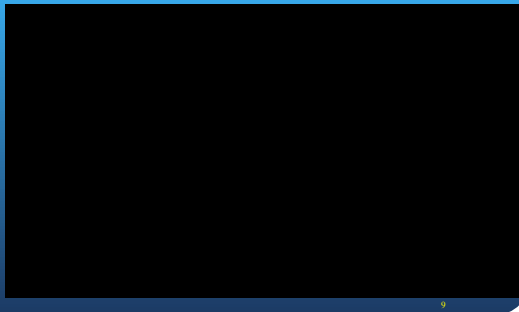
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Visionix Refractive Suite



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VX55 Technology



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VX55 System Key Points

- A new type of phoropter: Featuring the simplicity and comfort of a manual phoropter. With the Visionix VX55, enjoy electronic refraction technology without changing the way you work.
- A sound ergonomic design
- The VX55 enables Bluetooth wireless communication between the head and the tablet
- Full control of the phoropter head
- Complete control of the included integrated VX22/VX24 Chart
- Allows connection and transmission to other devices and EMR

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What do the Emerging Refraction Technologies aim to improve

- To cut the learning curve of performing subjective refraction (Patient Self-Refraction via Voice Activ Subjective-Refractor - Vmax Vision)
- Take Refraction out of the exam lane (Portable, Hand-held Refraction - Eyenetra and Smart-Vision)
- Break Down the Brick and Mortar Model (Online Refraction from Home - Opternative and Warby Parker)

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Review of the State of Success and Limitations of Emerging Technologies

- In the following, we report the refraction outcomes and put aside the medical and health aspects of an eye exam
- We ask the critical question: can any of the new refraction technologies match up with the accuracy and visual acuity outcomes as using a phoropter, which is the gold standard
- We measure level of success by:
 - How close are refraction outcome as compared to those from phoropter. What percentage falls within the difference of 0.25D
 - What percentage over minus
 - Can their VA match, better than or worse than those from phoropter

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Portable Refraction

Eyenetra



- The working principle is using different part of the cornea to view the same object image. If the vision is error free, there is only one combined image.
- By moving two objects, the travel distance is related to the refractive error along that one axis
- Now that each refraction has to be repeated at least 8 times to provide 45 degrees angular accuracy of astigmatism of the eye

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Eyenetra

NETRA:

Near Eye Tool for Refractive Assessment



- For mobile eye diagnostics or vision screenings, the handheld NETRA refractor measures sphere, cylinder, axis and pupillary distance through a series of measurements
- Age range limited to 13 to 65
- Sphere -12 to +5.5 in 0.25D steps
- Astigmatism 0 to -7D in 0.25D
- Exclusion: amblyopia, floaters, vertical divergence deviations, and any ocular pathology

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Eyenetra(NET) Patient Results

For all 27 subjects (54 eyes), the average absolute difference between NET and Subjective Refraction (SR) is 0.31 +/- 0.37D. Mathematically, 85% of all patients are within a spread of -0.31-0.37(-0.68D) and -0.31+0.37(0.06D) from phoropter

- When compared to SR, NET on average over minus by -0.36D
- 77% (among normal sighted patients) received 20/25 or better vision with NET (BCVA for subjective refraction not recorded in results)
- On average, the visual acuity difference between SR and NET VA is worse by close to one line on the logMar chart

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Eyenetra

- Benefits:
 - Very low cost equipment.
 - There is no need for chairs or stands
 - Useful for nursing homes, school students, onsite refraction for office staffs- "Bring the refraction to the patients"
- Drawbacks:
 - Clinical data showed that NET over minus patients, and BCVA is 77% equal or better than 20/25
 - Longer refraction time 20 minutes or more, due to the requirement to measure at multiple axis orientations
 - It did not meet the accuracy and visual acuity standards of a phoropter

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Portable Refraction



- Smart Vision Labs
 - SVOne consists of a Hartmann Shack Wavefront sensor
 - The core technology is a portable wavefront aberrometer
 - The technology has the appeal of using the cell phone camera as the WF detector

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Smart Vision Labs

SVOne

- Its technology is a Portable Hartmann-Shack wavefront aberrometer that is attached to a smartphone
- It is a WF based objective auto refractor
- Their recent business model is to deploy the SVOne unit at offices without optometrist present. A doctor reviews patient Rx results at a remote location, to approve or disapprove it

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Clinical Results-Smart Vision Labs

- 50 visually normal, young adults using SVOne
- Compare results to subjective refraction, and two commercially available autorefractors
- Repeatability was tested in a subgroup of 10 subjects. However, the results were not as predictable as retinoscopy and SR.
- No significant difference was observed between the SE for the different techniques.
- The report said: High and significant linear correlations were observed between the subjective findings and the other four techniques, meaning retinoscopy, two commercial auto refractors, and SVOne are in general agreement with phoropter

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Smart Vision Labs

SVOne

- In a different study a retrospective chart review on the 608 Major League Baseball players evaluated during the 2016 Spring Training Season was performed. But only included those in a subset of players who had both manifest refraction and autorefraction.
- The data showed more minus in myopic subjects.
- Smart Vision recommended strongly a more careful subjective refractive correction for those with less than average vision.

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SVOne

- Benefits:
 - There is no need for chairs or stands
 - Portability is a useful feature for nursing homes, school students, onsite refraction for office staffs: "Bring the refraction to the patients"
 - Its small and portable are great features for an auto refractor
- Drawbacks:
 - Have not shown clinical data that have definitely satisfies the passing grade in the accuracy and visual acuity standards of a phoropter
 - A hand held wavefront aberrometer is typically not as reliable as a desktop aberrometer, such as Zeiss Profiler, or Nidek 3D OPD.
 - Smart Vision did not make a direct comparison with the more established aberrometers in the market
 - The company added the subjective element to its auto refraction using Telemedicine

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Telemedicine by Opternative

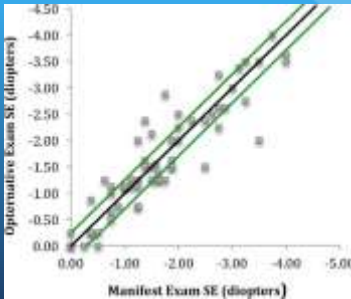
Online Refraction from Home



- The test will take 20 to 35 minutes and patients get their prescription within 24 hours
- The refraction does not need any optical lenses.
- By walking towards a computer screen, a patients decides at which distance the vision becomes clear sufficiently clear to resolve a line pair, etc.
- The corrective power is then related to the distance
- Patient's previous prescription is required, most of the time
- Opternative is approved in 45 states and they have made their service available in 33 currently

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Telemedicine



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Opternative Patient Requirements and Restrictions:

- Be 18-55 years old.
- Have a prescription range that is:
 - Emmetropic
 - Myopic (nearsighted) with spherical power between "-0.25 and -10.00"
 - Hyperopic (farsighted) with spherical power between "+0.25 and +3.50"
 - Astigmatic with cylinder power between "Cyl "-0.25 and -3.00"
 - Presbyopic with ADD power between "+0.25 and +4.00"
- Have no history of amblyopia, diabetes, hypertension, glaucoma, cataracts, retinal detachment, brain injuries, neurological issues, etc.
- Have no recent discomfort or symptoms of acute eye pain, flashes and/or floaters in eyes.

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Discussion

- Consumers are attracted to online refraction for
 - Convenience
 - Lower costs
- How is this going to impact your practice?
 - Brick and Mortar practices stands to lose refraction, and likely also the sales for frame, lenses and contacts.
 - Online services can never provide in person exam on eye health issues
 - Optometrist is best to position their practices to focus on medical
 - Consumers need education about importance of eye health
- A poll on Healio.com/Optomtry showed that, at press time, 79% of respondents believed that online eye exams would prevent people from seeking a comprehensive exam from an eye care provider.
- Twenty-one percent of respondents said they believe online exams would provide more benefit than harm — motivating more people to seek a comprehensive eye exam, addressing the growing need for eye care services or making vision correction more easily accessible to more people.

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VASR - A Voice Active Subjective Refraction

- Utilizes a PSF target
- Patient fixates on its own eye image
- Wavefront auto is captured; analyzing up to 50 image data points within 1 second.
- Subjective refraction ensues, taking between 0.5 min to 1.5 min
- Multiple reference Rx's can be input and compared with the touch of a button
- Substantially less dependent on technician skills than using a phoropter
- It takes a few hours for a layperson to learn to perform subjective refraction



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Self Refracting Technology

VASR (Vmax Vision)

- Can be run by anyone with little training
- It is best suited with a Doctor to verify RX
- Can compare Old RX vs. New RX
- Check V/A with Old and New RX
- Check Near Point for PALS



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How VASR PSF Generates A Rx

- PSF refraction eliminates subjectively high order aberrations when a point image is refined to the sharpest level.
- Less likely to over-minus compared to phoropter.
- Each eye is subjectively optimized, It eliminates the need for binocular balancing
- With the unique built in 4 JCC, Patient visio optimized to 20/12 visual acuity



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Vmax Vision VASR Results- Which is better, Vmax vs. Phoropter

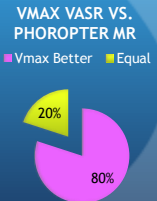
- Vmax performs better than phoropter refraction, if Vmax under minus, and with equal and better acuity.
- Vmax is equal to phoropter accuracy Vmax spherical equivalence (SE) is within 0.25D of those of manifested phoropter refraction.
- Vmax is worse than phoropter, if Vmax SE is over minus as compared to phoropter, unless Vmax may have better VA, then over minus is adjusted by 0.25D with one line of better VA.

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Vmax Clinical Study at Nvision Center

In a Patient Group which consisted of 26 eyes with BCVA of 20/30 or better

- One eye of which is amblyopic with V/A of worse than 20/100
 - That eye is excluded in the accuracy analysis
- Vmax better than phoropter: 80%
- Vmax Equal to phoropter: 20%
- Vmax worse than phoropter: 0%



Study Performed at Nvision LASIK Center, Las Vegas, NV

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Vmax Study with Keratoconus Patients

- 34 patients (67 eyes were evaluated)
- Age ranges 24-83

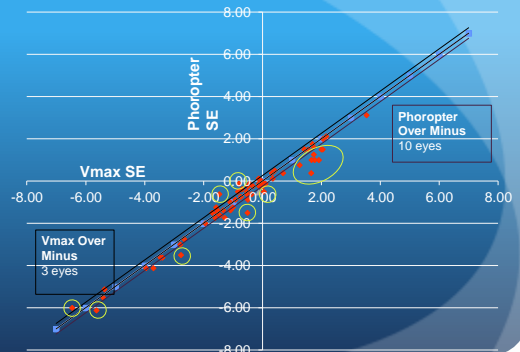
Characteristics of Patient group and Subjective Refraction Results:

- Average SE +/- Standard Deviation
 - Phoropter: -0.68D +/- 1.89D
 - VASR: -0.51D +/- 1.82D
- Difference in the SE (VASR – Phoropter) of each eye again in Average and +/- Standard Deviation:
 - 0.09 +/- 0.40D
 - Phoropter is more minus as a whole (by -0.17D)

Study Performed at Center for Excellence in Eye Care by William Trattler, MD

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Patient Data with +/- 0.25D Guidelines



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Discussion on Clinical Data - Keratoconus

From the plot in last slide:

- Two guide lines indicating +/- 0.25D bracket was shown, as reference.
- Of the 67 eyes, 54 eyes are on or within the +/- 0.25D bracket.
- 3 eyes were slightly over minused, of which only one eye over 0.35D.
- 10 eyes were over minused in the phoropter results.

When visual acuity is also compared, VASR has a total of 40 eyes (60%) with better VA compared to the phoropter

Comparative Visual Acuity of VASR Vs. Phoropter



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Summary of Vmax clinical

- Compared to the phoropter refraction results it produced:
 - 91% equal or better within +/-0.25D
 - 6% between -0.25D and -0.35D
 - 3% were more than -0.35D over minus



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Conclusion (Continued)

- VASR shows potential of using a novice technician instead of an experienced refraction technician to operate a phoropter, while still producing highly accurate refraction results.
- This study demonstrates that a computer driven voice guided patient self refraction instrument can greatly eliminate the steep training curve of learning subjective refraction with a phoropter.

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How can Vmax Vision technology impact your business

- Decreased time spent refracting allows for increased time for medical testing
- See more patients and sell more optical
- Subjective nighttime refraction brings in additional pair
- 20/16+ is routine in a majority of patients (without over minus)
- Reduced training time for new staff
 - Alleviate the stress of training new staff and high staff turnover
 - Between 4 hours and 2 days depending on device
- Patient experience
 - Faster and less confusing - even for low vision, medical, and senior patients

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Continued

- VASR is NOT a telemedicine based technology
- VASR is NOT JUST another WF autorefractor
- VASR is NOT an objective ONLY device
- VASR is NOT an unsteady handheld device that causes inaccuracy and instrument myopia (over minus)
- VASR refraction does NOT take 20 - 30 minutes per patient
- VASR refraction does NOT have restriction on patient selection
 - No limit on age
 - Not as limited on sphere and cylinder (Vmax sphere is +/- 12.00D and cylinder +/- 6.00D)
 - No existing prescription required
 - Not limited to selling a specific brand of lenses or frames

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Which Technology May have Immediate impact on You?


- Ask these questions
 - Is the technology accurate enough to be acceptable
 - Does the technology provide equal or better refraction outcome
 - If a technology is indeed performing equal or better than phoropter, embrace it rather reject it
 - In the same way, we delegate technicians to perform tasks that they can do better than we can, and if they can do refraction as well, why not?
 - With the time saved, you can do more with medical, which will never be replaced by any online technologies

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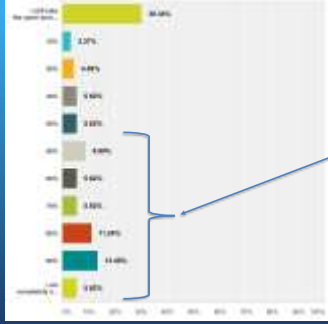
EyeGraine: Subgroup of Chronic Daily Headache

Symptoms

- Primary Symptoms
 - Frequent Headaches
 - 3+ days per week
 - Neck Pain/Stiffness
- Secondary Symptoms
 - Dry eyes
 - Fatigue with near work
 - Photophobia, especially at night
 - headlights



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70% off of at least some medications at 90 days

52% of patients off of 50% or more of their headache medications

No reported side effects

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Research confirmed


- Pursuits and Saccadic eye movements
 - Sends it proprioceptive signal via the trigeminal nerve
 - Ophthalmic branch
- Trigeminal Nerve (V) :
 - Stimulation of Ophthalmic branch
 - Frontal headaches (sinus headaches)
 - Terminates in lower brain stem (back of head headaches /neck pain)
 - Cornea sensation (Dry Eye)

We call these eyeGraines

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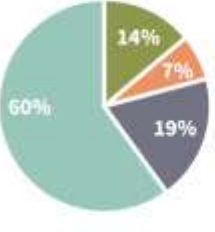
The Solution (neuroLens)

- Synchronizes binocular vision at all distances, eliminating need for compensating eye movements.
- Progressive prism technology, using measurements from SightSync
- Built into spectacle lenses with patient's Rx



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Patient-reported symptom reduction with neuroLenses:

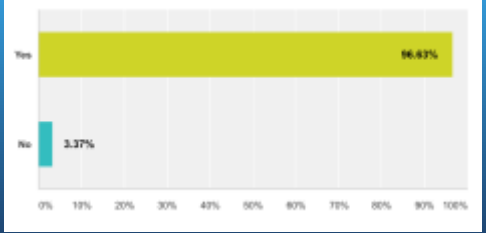


- Basically gone (14%)
- Decreased substantially (60%)
- Decreased slightly (19%)
- No change (7%)
- Increased (0%)

n = 279

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Based on your experience in the first 90 days of the eyeGraine Treatment Plan, would you be willing to recommend eyeBrain Medical to your friends and family?



Yes: 96.63%

No: 3.37%

n = 89

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