PlenOptika

WHITE PAPER

Achieving accurate autorefraction with a handheld wavefront autorefractor *QuickSee technology overview and review of clinical results*

The QuickSee handheld autorefractor

Takeaways in Focus

- **Limited availability of adequate autorefraction equipment contributes to the global burden of uncorrected refractive error.**
- **Wavefront aberrometry technology, in handheld format and combined with other key usability features, demonstrates accuracy equal or superior to desktop autorefractors.**
- **QuickSee helps perform clinically accurate autorefraction in clinical and low resource settings alike.**

The global need to dramatically expand eyeglass prescription access

Uncorrected Refractive Error (URE) is a top cause of poor vision worldwide, with more than an estimated 2.5 billion people lacking access to glasses they need, and 650 million people considered visually impaired due lack of adequate refractive error correction[1]. It can be easily diagnosed and corrected with a pair of prescription lenses—such eyeglasses can cost as little as US$2.00 per pair—but in many parts of the world people have limited or no access to eye care facilities where a trained professional can conduct sight measurement and write eyeglass prescriptions.

The accessibility of eye care services is also uneven in developed countries like the United States. People living in rural areas and low-income communities are at higher risk for vision problems compared to urban and wealthier people. Geographic isolation and life in medically underserved areas also add to the issues of financial barriers and lack of insurance coverage[2].

Improving access to eye care services with autorefraction tools

Autorefractors, medical instruments that provide an objective measurement of the refractive errors in a patient's eyes, are a critical tool that help eye care providers to make the subjective refraction more reliable and efficient (e.g., by providing an accurate starting point for subjective refraction).

A key limitation of desktop autorefractors is their accessibility, which hinders the potential impact of autorefraction outside of well-equipped clinics. As a result, in many community and global health settings, such as health centers, elderly home care, workplace screenings, and schools, eye care providers must rely on visual acuity charts or perform retinoscopy to assess a patient's refractive errors. The former is useful only for screening and the latter requires years of training for proficiency. Autorefraction could be particularly useful in these set-

tings because it provides an accurate estimation for cylinder and axis, saving substantial time for the eye care practitioner and the giving them the confidence to make prescriptions patients need.

Furthermore, fast, accurate autorefraction could be useful in a range of other common settings, such as optical retail shops, pre- and post-operative surgery, and high-volume clinics where throughput is critical.

For an autorefractor to have the desired impact in such settings, it must have key performance and usability features.

Required features for a handheld autorefractor

Accurate and reliable
- Provide an accurate point for subjective refraction
- Age independent, works with patients as they are

Easy to use
- Works fast
- Simple training
- Doesn't require patient feedback

Works anywhere
- Calibration free and durable
- Any lighting condition
- Not dependent on constant electrical supply

Optical techniques for autorefraction

Photorefraction is the easiest technique—it is "point and shoot" and takes only a few seconds—but it is highly dependent on distance from the patient and ambient lighting conditions, so it tends to suffer from inaccuracy. Photorefraction is used mainly for screening and not as an accurate starting point for subjective refraction.

Eccentric refraction is typically not as accurate as wavefront aberrometry for cylinder and axis measurements, which are the components of refraction that take the longest to manually measure. Eccentric refraction is negatively affected by blinking and patient eye movement because only a few measurements are taken.

Wavefront aberrometry provides the most comprehensive method to measure ocular aberrations and refractive errors. Until development of QuickSee, wavefront aberrometry was not available in a compact, widely-affordable format.

The PlenOptika Wavefront Refraction Engine (WRE)

To dramatically expand access to prescriptions for eyeglasses with high quality autorefraction, especially outside a well-equipped exam room, PlenOptika developed the QuickSee handheld autorefractor. QuickSee's combination of the open view binocular design, wavefront aberrometry, and robust measurements produce clinically accurate autorefraction measurements, in a durable handheld format suitable for use in a wide range of eyecare settings.

The patented PlenOptika Wavefront Refraction Engine™ performs continuous data analysis to precisely determine low-order refractive errors, making QuickSee as accurate as the high-end clinical desktop autorefractors and demonstrating excellent agreement with subjective refraction[2].

Binocular, open view
QuickSee's open view design provides a natural viewing experience and a verified minimization of accommodation and anisometropic effects[3, 4, 5]. This is of particular importance when measuring young people with high accommodation capabilities.

Robust measurements
QuickSee completes measurements in 10 seconds, during which patients are able to blink, allowing them to refresh their tear film and feel more comfortable. In comparison to conventional autorefractors, which typically take a single or a few measurements, QuickSee's advanced algorithms achieve strong agreement with subjective refraction. The QuickSee software is specifically designed to detect changes in the eye (such as movement, focusing, and blinking) during measurements, increasing the measurement's accuracy.

Wavefront aberrometry versus eccentric autorefraction and photorefraction
Wavefront aberrometry captures additional refractive information that is unavailable to traditional autorefractors and photoscreeners. This optical technique assesses both low- and high-order aberrations, thereby achieving a more comprehensive measure of refractive errors.

QuickSee: Accurate autorefraction anywhere

QuickSee is a handheld, open-view autorefractor that uses wavefront aberrometry to precisely determine refractive errors. It enables vision care professionals and their supervised technicians to conduct the objective refraction measurements faster than with a traditional desktop autorefractor (binocular measurements are made in 10 seconds) and it provides an easy transition to subjective refraction. It is an FDA Class 1 510(k) exempt (low risk) and CE marked medical device commercially available internationally.

QuickSee objectively measures the refractive errors by shining a light into the patient's eyes then measuring the wavefront pattern reflected back through the eyes' lens and cornea. Distortions in the light waves represent specific vision errors of patients' eyes, such as nearsightedness, farsightedness, and astigmatisms.

QuickSee has been tested by teams at Johns Hopkins University, New England College of Optometry, Aravind Eye Care System (India), Harvard School of Public Health, Two-BillionEyes (non-governmental organizations), and others. Over 3,000 patients participated in the studies with the use of the device. Studies published in peer-reviewed journals demonstrate its high specificity and sensitivity, showing QuickSee measurements comparable to traditional autorefractors and optometric exams (see Clinical study results: highlights, below).

QuickSee at a Glance	
Device Dimensions	11x6.5x3.25 in (28x16.5x8.25 cm) / 2.3lb (1kg)
Accommodation Control	Open view
Spherical Range	-10D to +10D, increments of 0.01D, 0.125D, 0.25D
Cylindrical Range	-6D to +6D, increments of 0.01D, 0.125D, 0.25D
Axial Range	0-180°, increments of 1, 5, 10 degree
Interpupillary Distance Range	47–78 mm continuous
FDA Status	Class I
Dilation / Cycloplegic Requirements	None
Ambient Illumination Requirements	None

For complete technical and clinical specifications, visit https://plenoptika.com/technology/

For research findings, visit https://plenoptika.com/publications/

Clinical study results: highlights

QuickSee is within < 0.5 D of subjective refraction for 80-90% of adult patients

QuickSee provides the same accuracy as a desktop autorefractor. Desktop autorefractors measurement range is -25 to +25 diopters; QuickSee covers -10 to +10 diopters, which addresses the needs of over 95% of adult populations. QuickSee is within < 0.25 D (excellent agreement) and < 0.5 D (good agreement) of subjective refraction for 70-75% and 80-90% of adult patients, respectively, whereas desktop autorefractors are usually within < 0.25 D and < 0.5 D of subjective for 50-60% and 80-90% of these patients, respectively[2, 5].

Table 1 (below) provides published data of QuickSee's agreement with subjective refraction, and Table 2 provides highlights of the published research.

Prescription quality[4, 7, 8, 13]

- QuickSee accuracy enables effective and impactful outreach service.
- Accurate starting point for subjective refraction.
- Eyeglass prescriptions provided by QuickSee provided a visual acuity as good as subjective refraction[4, 8].
- Eyeglasses prescribed from QuickSee measurements are accepted equally to those prescribed from subjective refraction[13].
- QuickSee has high sensitivity and specificity for refractive error-based risk factors for amblyopia[7].

Validation of handheld autorefraction accuracy[2]

- Excellent agreement between the measurements obtained with QuickSee and the prescriptions based on subjective refraction in an adult population.

Comparing handheld autorefractors[9]

- QuickSee had the shortest learning curve for both practitioners and subjects and demonstrated the most accurate measurements of the three handheld devices tested.

Assessment of a wavefront aberrometry-based handheld autorefractor[5]

- The collective high order aberration (HOA) measurements from QuickSee showed no significant difference from the commercial desktop wavefront aberrometer, and the contribution of HOA to the total wavefront error showed good inter-device reliability.

Refracting children[6]

- QuickSee is superior to the Topcon KR-8800 at measuring children without cycloplegia.
- Cycloplegic free autorefraction with QuickSee was more accurate than desktop autorefraction, which means QuickSee better for pediatric vision exams because accommodation is reduced.
- The spherical equivalent refraction obtained by QuickSee agreed within 0.5 D of the subjective refraction in 71% (NC) and 70% (C) of the cases. The high level of agreement with subjective refraction turns the device into a useful autorefraction tool for school-age children.

The QuickSee handheld autorefractor is equally suitable for objective measurement in modern clinical settings and mobile care / global health care initiatives.

Table 1: Agreement of QuickSee measurements with subjective refraction

Study	*QuickSee* Agreement with Subjective refraction ≤0.25D	*QuickSee* Agreement with Subjective refraction ≤0.5D	*Desktop Autorefractor* Agreement with Subjective refraction ≤0.25D	*Desktop Autorefractor* Agreement with Subjective refraction ≤0.5D
QuickSee versus Grand Seiko WR-5100K [3] *Non-cycloplegia, adult population*	SE: 71%	SE: 82%	SE: 63%	SE: 89%
QuickSee versus Topcon KR-8800 [4,*] *Non-cycloplegia, pediatric population*	–	SE: 71%	–	SE: 61%
QuickSee versus Topcon KR-8800 [4,*] *Cycloplegia, pediatric population*	–	SE: 70%	–	SE: 77%
QuickSee versus WaveScan 3.68 VIX [6] *Non-cycloplegic, adult population*	–	SE: 84%	–	SE: 70%

** Published thresholds were <0.5 D and <1 D*

Table 2: Highlights of published results

Study	Study design	# Patients (Age range)	Main conclusions
Ophthalmology® **"Investigation of the Accuracy of a Low-Cost, Portable Autorefractor to Provide Well-Tolerated Eyeglass Prescriptions"[13]**	Objective: To compare patient preferences for eyeglasses prescribed using a low-cost, portable wavefront autorefractor versus standard subjective refraction (SR). Device: Monocular, commercial version Methods: Participants underwent SR followed by autorefraction (AR). Participants (masked to refraction source) were randomly assigned to use SR- or AR-based eyeglasses first, followed by the other pair, for 1 week each. At the end of each week, participants had their vision checked and were interviewed about their experience with the eyeglasses.	400 (28.4 ± 6.6 years)	Prescriptions from QuickSee autorefraction measurements showed strong agreement with prescriptions from subjective refraction. Eyeglasses prescribed from QuickSee measurements were preferred equally to those prescribed from subjective refraction. QuickSee can help expand access to eyeglass prescriptions where there is a shortage of professionals and traditional clinical equipment to meet the need.
OVS Optometry and Vision Science Journal of the American Academy of Optometry **"Validation of an Affordable Handheld Wavefront Autorefractor"[2]**	Objective: Evaluate the commercial version of the QuickSee Flip in an adult population Device: Monocular, commercial version Methods: Compare the accuracy of the device with a high-end desktop autorefractor and with subjective refraction. Compare the Visual Acuity achieved by subjective refraction and the QuickSee refraction.	54 (33.9 ± 14.1 years)	Visual acuity resulting from correction based on the QuickSee device was the same as that achieved by Subjective refraction in 87% of the eyes. This resulting improvement in visual acuity is comparable to that reported for clinically established benchtop systems. Agreement between the three refraction components (M, J_0, J_{45}) provided by the autorefractor and subjective refraction is within 0.5 D in more than 85% of the cases The results of this work suggest that the QuickSee provides measurements that agree more closely with subjective refraction than other handheld autorefractors (Netra, Smart Vision One, Retinomax 3).

Study	Study design	# Patients (Age range)	Main conclusions
iovs investigative ophthalmology & visual science an ARVO journal **"Assessment of wavefront measurements from a low-cost, portable, aberrometry-based autorefractor"[5]**	Objective: to assess the measurement of both low- and high-order ocular aberrations from a low-cost portable wavefront aberrometer Device: binocular, commercial version Methods: refraction, pupil size, and Zernike coefficients were recorded for each eye	41 (53 ± 17 years)	The QuickSee and the Wavescan measured 84% and 70% of all eyes within 0.5 D of M from manifest refraction respectively. The total HOA wavefront error and the percentage contribution of the HOA to the total wavefront error showed good inter-device correlation (ICC3=0.79 and 0.91, respectively). The collective HOA measurements from a portable, low-cost autorefractor showed no significant difference from the commercial desktop wavefront aberrometer.
iovs investigative ophthalmology & visual science an ARVO journal **"Investigation of the accuracy of a low-cost, portable, auto-refractor to provide well-tolerated eyeglass prescriptions"[8]**	Objective: to compare patient acceptance of eyeglasses prescribed using the QuickSee with that of eyeglasses prescribed via standard subjective refraction. Device: binocular, commercial version Methods: Participants were randomly assigned to use either the subjective refraction or QuickSee refraction-based eyeglasses first, followed by the other pair, and requested to wear each pair for a week.	400 (28.6 ± 6.5 years)	Strong agreement between the prescriptions from subjective refraction and QuickSee refraction was observed. Almost half the patients preferred glasses prescribed using QuickSee refraction only. This confirms the quality and effectiveness of QuickSee in prescribing accurate eyeglasses for refractive error corrections.
PLOS ONE **"Assesment of the QuickSee wavefront autorefractor for characterizing refractive errors in school-age children"[6]**	Objective: Evaluate the commercial version of the QuickSee in pediatric population Device: binocular, commercial version Methods: Compare the accuracy of the device with a high-end desktop autorefractor and with Subjective refraction with and without cycloplegia. Compare the Visual Acuity achieved by subjective refraction and the QuickSee refraction.	123 (9.9 ± 3.3 years)	In this study, it is shown that the QuickSee works similarly with patients with and without cycloplegia, while the desktop autorefractor used in this work performs significantly better with patients under cycloplegia than with patients without cycloplegia. This may indicate that the binocular open view design of the device is effectively helping to control accommodation problem in most of the patients. In the non-cycloplegic group, 77% of subjects achieved the same (59%) or better (18%) VA with QuickSee correction than that achieved with the standard clinical protocol. This was largely replicated in the cycloplegic group, in which 74% of patients achieved the same (57.5%) or better (16%) VA than that provided by standard clinical protocol.
PLOS ONE **"Comparing low-cost handheld autorefractors: A practical approach to measuring refraction in low-resource settings"[9]**	Objective: To compare and validate the accuracy and ease of use of handheld autorefractors against retinoscopic refraction by an ophthalmologist for assessing the visual acuity of older adults in India. Device: binocular, commercial version Methods: three different handheld devices were compared with cycloplegic retinoscopy and refraction done by an ophthalmologist.	190 (40 ± 88 years old)	The QuickSee device is inexpensive, had a short learning curve for both practitioners and subjects, and had the most accurate measurements of the three handheld devices tested. The QuickSee may be used successfully as refraction screening tools in epidemiologic studies of adults in India and as diagnostic tools in low-resource settings.

Study	Study design	# Patients (Age range)	Main conclusions
iovs investigative ophthalmology & visual science an ARVO journal **"Screening for refractive error in Kenya Schools with the QuickSee Handheld Autorefractor"[7]**	Objective: to evaluate the performance of the QuickSee for diagnosing refractive error in children under non-cycloplegic conditions and to determine the optimal referral threshold for the device. Device: binocular, commercial version Methods: the performance was evaluated comparing the agreement with MR and computing sensitivity and specificity.	250 (16 ± 5 years)	The QuickSee provided high sensitivity (87.5%) and specificity (71%) values. The measurements provided by the QuickSee agreed within 0.5 D of the MR in 80.1% (M) of the cases, indicating high correlation between both refraction methods under non-cycloplegic conditions.
BMJ Journals **"Quality of eyeglass prescriptions from a low-cost wavefront autorefractor evaluated in rural India: results of a 708-participant field study"[4]**	Objective: To assess the quality of eyeglass prescriptions provided by a QuickSee prototype operated by a minimally trained technician in a low-resource setting. Device: Monocular, 2nd prototype version Methods: Visual acuity (VA) and patient preference were compared between trial lenses set to two eyeglass prescriptions from (1) the QuickSee prototype autorefractor operated by a minimally trained technician and (2) subjective refraction by an experienced refractionist.	708 (35 ± 13 years)	Eyeglass prescriptions can be accurately measured by a minimally trained technician using a low-cost wavefront autorefractor in rural India. Data from 708 participants indicate a marginal difference in both prescription preference and resulting visual acuity between eyeglasses derived from subjective refraction versus QuickSee autorefraction (VA from QuickSee was on average only one letter worse). Among the 438 participants 40 years old and younger, there was no statistically significant difference in the preferences for eyeglasses derived from subjective refraction versus QuickSee autorefraction.

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Delivering personalized care with high quality and confidence
Mobile vision care service

Todd Winkler, OD
Eye on Convenience
Cincinnati, Ohio
eyeonconvenience.com

"It's gratifying that I am able to help people in such need with the skills I have, by making them accessible to people."

While performing eye exams in nursing homes, Todd Winkler, an optometrist practicing in Cincinnati since 1995, realized there was an unseen, underserved population and took action. In January 2019, Dr. Winkler started Eye on Convenience, a mobile service to provide high quality eye care to those patients who can't get to an eye clinic.

Dr. Winkler initially assumed his mobile business would be a mix of house calls for patients who simply wanted the convenience of personalized service, those of limited mobility such as the elderly, and people homebound by illness or injury. He quickly found the greatest demand was from this last group. "I have patients who are not only homebound, but bed-bound," he said. Moreover, they often have conditions like diabetic retinopathy worsening their vision, as well as age-related conditions like macular degeneration, glaucoma, and cataracts.

Dr. Winkler launched a website to attract patients but found that since the mobile vision care business is so new, people didn't even think to look for it. "It was like expecting people to search for flying cars—they either think there's no such thing, or if there is, it must be expensive." He quickly adapted to getting referrals from senior care agencies and physician practices that make house calls. Regarding affordability, Dr Winkler states that even those visits that are not covered by Medicare often cost less than the fees that would be incurred by hiring a transportation service to bring a patient to and from an eye clinic. It also relieves the burden on caregivers, like friends and family, who might otherwise also have to spend a lot of time getting their loved into the clinic, he noted.

Dr Winkler has a sedan filled with examination equipment and a selection of frames, so patients found to be in need of glasses can get their prescriptions fulfilled directly from a lab a few days after their exam. A big part of the visit, however, is the management of the equipment.

"From a physical standpoint, it can be hard. Some of it is quite heavy," said Dr Winkler. "And I've got to set it up and take it down...it takes time. For example, I carry an actual phoropter, which I mount to a custom-made tripod."

Among his instruments, Dr Winkler has a QuickSee binocular wavefront autorefractor. He knew he would need a tool for objective refraction so QuickSee was included from the beginning. QuickSee's portability and ease of use make it the best choice for autorefraction, given his mobility needs and the patient conditions he finds.

"QuickSee gives me a computerized prescription estimate," said Dr Winker, "so I can more quickly and accurately determine their final prescription. Without it, I would have to perform a retinoscopy which is time consuming and less accurate...just much more difficult. With QuickSee, once I align it, I press the button and it takes 10 seconds to measure."

New tools like QuickSee, combined with his personalized service, make a big impact on Dr. Winkler's patients. "The equipment gives them confidence that they're benefitting from cutting edge technology, that they're getting a very high-quality exam even without the office visit." ●

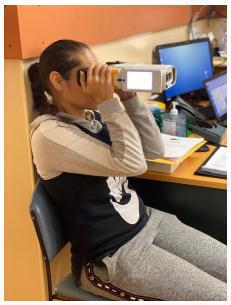
QuickSee in vision telehealth
Maintaining care during the COVID-19 pandemic

Jose Estevez Bordon, OD, Flinders University
Teleoptometry practice in remote Australia. To preserve the privacy of the community, the region and the nurse practitioner involved in the program are not identified by name.

In the spring of 2020, COVID-19 travel restrictions and quarantine requirements threatened to indefinitely suspend Dr Jose Estevez's vision care service to a remote Australian community. He and his nurse practitioner partner selected QuickSee to develop a new practice to maintain the community's access to vision care. "It was just what we needed for telehealth during the COVID peak," said Dr Estevez.

Prior to the pandemic, Adelaide-based Dr Estevez visited the community, which is almost 900km (560 miles) from the nearest tertiary hospital, twice a year to see patients and make prescriptions for glasses. "My local partner had a lot of people who needed glasses, and there was nothing

we could do. It could have been a year before I could go back, so we embarked on an intense search for a solution. I discovered QuickSee in a journal article and it showed good results." Reading the literature on QuickSee, he found the results "strong and convincing."



Patients being refracted with QuickSee. *Photos courtesy Dr Jose Estevez Bordon*

To reach patients, the local nurse practitioner packs all her equipment in a 4x4 and travels to clinics as far as 700km (400 miles). "She carries every piece of equipment we need, so the autorefractor had to be portable and durable," said Dr Estevez. PlenOptika, he said, "understood the challenges of working in difficult regions, with disadvantaged groups, and what we're trying to achieve." That goal: to give people the right glasses via telehealth using QuickSee for a starting point.

This step fit easily into the nurse practitioner's routine eye exam, and if QuickSee measurements showed the need for correction, she would call or videoconference with Dr Estevez to determine the best treatment for the patient.

According to a study Dr Estevez performed to evaluate the practice outcomes,

> "A hybrid teleophthalmology consultation (HTC) model of eye care delivery, which includes both asynchronous and synchronous methodologies...was reliant on three-way interactions using a videoconference platform between patient, healthcare worker and eye care provider. A series of tests occurred prior to optometrist-consultation and include vision assessments (distance and near visual acuities), autorefraction, intraocular pressure, pupil and motility functions and posterior eye imaging. Using a patient-centered framework the results were summarised and discussed with the patient and on-site health care worker, with therapeutic management and referrals made with local coordination support as required."

They implemented their new practice in June and operated into August. By September, travel restrictions had eased, and Dr Estevez was able to visit the region again. By late fall they had measured about 100 people with QuickSee ranging from school-age children to the elderly. To meet the backlog of patients, he made a few extra visits, but he notes, "we will probably keep going with this hybrid model we created, and that will include the QuickSee. You really need to be solving issues all year round." It helps, he also said, that Australia's leading optometry body quickly developed guidelines supporting telehealth practices.

His study concluded, "The implementation of the hybrid teleoptometry model allowed for timely access to eye health services for the population... Although further evaluation and improvements are needed, this model of teleoptometry shows promise for the future in servicing rural Australian communities in adjunct with face-to-face consultations."

Dr Estevez's practice innovation helps to fulfill PlenOptika's founding mission to make excellent vision care available to everyone—especially to those in low-resource settings. ●

Enabling self-determination with vision and compassion

Fast, accurate autorefraction in aid missions

Randall Thomas, OD & Robert Hillebrand
Mission Servants Ministry, Charlotte, North Carolina
missionservants.org

"There was no technology available" for refraction in the Ugandan village where Dr Randall Thomas, volunteering with Mission Servants Ministry in August 2019, provided aid to over 800 adults and children. "We took QuickSee because I am convinced it's spot on...we relied on its accuracy to render prescriptions*."

Dr Thomas, Bob Hillebrand (Mission Servants Ministry co-founder and CEO), and other volunteers from North Carolina travelled to collaborate with local organizations Child Redeemed Mission Home and Bwase Redeemed Church, 125 miles northeast of Entebbe, to provide a combination of aid services, including physical, practical, and spiritual support. Two days of air and ground travel, over 125 pounds of supplies per person—it was Mission Servants Ministry's 28th such trip. "Our goal is to empower the churches to reach out into their communities, and support projects they initiate," said Mr Hillebrand.

Dr Thomas brought the QuickSee handheld autorefractor because of its accuracy, speed, portability, and durability, all of which were critical for meeting his objective of treating as many patients as possible effectively outside a well-equipped clinical setting. Using wavefront aberrometry to make dynamic binocular measurments, Dr Thomas refracted patients to make prescriptions for glasses, and also examined them for eye health.

Dr Randall Thomas refracting patients in Uganda with QuickSee. Photo courtesy Mission Servants Ministry

"The beauty of QuickSee was that it allow us to get a baseline vision assessment to more accurately know what reading glasses people might need," said Dr Thomas. "We could efficiently quantify their visual status," especially among the adults. "So if a patient was a +1D they might need a +3.5D instead of a +2.5D...[QuickSee] let us be more exacting in delivering reading glasses." Eyeglasses were provided by National Vision, Restoring Vision, and others so patients could leave with correction immediately. On prior trips, without QuickSee and Dr Thomas's expert help, Mission Servants Ministry would do their best to match people with the donated readers they brought.

"These trips have created opportunities to help in ways we really didn't expect," said Mr Hillebrand, noting how often screenings and evaluations point to other things people need. "I think our future trips could be much bigger projects because people are beginning to understand how we can help. We probably could have handled more if people knew what we were able to do."

Mission Servants Ministry's contributions to the towns they visit haven't been limited to health services. With a background in mechanical engineering and having run a successful manufacturing company, Mr Hillebrand has led the group to take on other critical projects, from helping to rebuild homes to drilling wells for drinking water. And, being a faith-based initiative, they focus on human impact: joining the community in prayer, providing skills training to women, playing with children, and giving personal attention.

With that scope of service, Mr Hillebrand's measurement of impact goes beyond the numbers of people treated with vision or medical care. "The underlying reasoning behind what we do is spiritual and mission-minded," he says. "The churches there are doing more outreach of their own, and they feel not only the blessing of our help but also the blessing of helping others." ●

Conclusion

Uncorrected Refractive Error (URE) is a top cause of poor vision worldwide, with more than an estimated 2.5 billion people lacking access to glasses they need, and 650 million people considered visually impaired due lack of adequate refractive error correction. Though eyeglasses are affordable and accessible globally, the limited availability of trained personnel and adequate equipment to perform vision measurements, pre-requisites for corrective eyeglass prescriptions, are major contributors to the global burden of low vision.

QuickSee is an affordable, durable, handheld autorefractor using wavefront aberrometry and algorithmic analysis of measurements that can be used both in and outside clinical settings to perform accurate objective refraction comparable to desktop autorefractors in a fraction of the time. Peer-reviewed studies demonstrate QuickSee's accuracy compared to traditional autorefractors and its agreement with the gold standard of quality, subjective refraction.

NGOs and vision care professionals have used QuickSee to examine patients at high volume and to efficiently facilitate accurate prescriptions for corrective eyeglasses. In the US and other developed nations, QuickSee helps vision care professionals bring accurate vision exams to the communities in need such as schools, nursing homes, community health centers, and rural/homebound patients, as well as to perform fast, convenient, accurate care in their clinics.

QuickSee
Accurate autorefraction anywhere

Accurate binocular measurements in 10 seconds

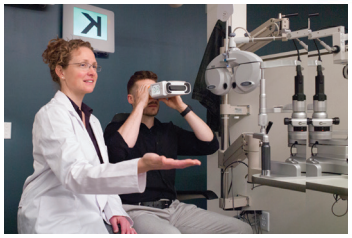
- Within < 0.25 D of subjective refraction for 70-75% of adult patients, and within < 0.5 D for 80-90%
- Accelerates subjective refraction accurate starting points
- Enables high throughput autorefraction

Accessible & easy to use

- Ideal for patients with mobility and/or physical challenges; ADA compliant
- Easy to learn
- Works anywhere
- Patient friendly

Handheld and field durable

- Calibration free
- Operates up to 8 hours on battery
- Can be used indoors and outdoors, in most light settings
- Operates in humid and dusty settings
- Includes hardened carrying case



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