Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Telemedicine distance and near visual acuity tests for adults and children

Joseph M. Miller, MD, MPH,[a,b,c] Hyun Soo Jang, MD,[a] Divya Ramesh, BA,[a] Maria Sandra Gonzalez Marshall, RN, PhD,[a] Selenne Yescas, BA, BS,[a] and Erin M. Harvey, PhD[a,b]

We describe a set of distance and near, adult and child, visual acuity tests for home use. The five charts are packaged in a PDF document and are also available as JPEG images that can be printed on standard letter paper or displayed on a monitor or handheld device. Adult distance visual acuity is tested using a modified ETDRS Chart R; child distance vision is tested using a similarly formatted HOTV logMAR chart. Testing distance is 5 or 10 feet, appropriate for home use. Near visual acuity is displayed in the range of J16 to J1 using random words (for adults) or in HOTV matching format (for young children). An Amsler Grid and HOTV matching card are included. The charts include a calibration circle. For those without a printer, sending a JPEG image as an email attachment initiates onscreen testing with a single click. Devices with smaller screens require an assistant to scroll through the display. The test can performed without assistance from a printed page.

The ETDRS logMAR chart represents the gold standard in visual acuity testing,[1] but the testing distance (20 feet) and large chart size (approximately 24 × 24 in) are impractical for display on either ANSI letter-size paper (8 ½ × 11 inches) or conventional electronic displays. Linear optotype presentation of five symbols per line requires a large display. Visual acuity testing of young children is best performed with symbols that are left-right symmetric. For shy or preverbal children, using a matching card avoids requiring the child to name the symbol.[2]

Our charts were developed for a shorter testing distance (5 or 10 feet), appropriate for home use. This presents a line of 5 20/200 optotypes in landscape mode on letter paper. Conventional laser printers and flat screen displays found on mobile phones, tablets, laptop or desktop computers have sufficient pixel density for legible 20/16 symbols to be displayed at a testing distance of 5 feet.

The 5-foot testing distance does have the disadvantage of being "in from infinity" approximately 1.5 meters, which can result in an individual with uncorrected myopia of 0.75 D being able to read the 20/20 line. At a testing distance of 10 feet, this potential for error drops to 1/3 D. At a testing distance of 20 feet, the error drops to approximately 1/8 D. Thus, a longer test distance decreases the potential for error, whereas a shorter distance improves testability of young children.[3]

The design of the HOTV logMAR chart follows the design principles of the ETDRS chart: one letter is duplicated per line, duplicate symbols are not adjacent within a line, and all four letters appear as duplicates an equal number of times throughout the chart. The optotypes for the ETDRS and HOTV charts were rendered using rasterizing software developed for electronic displays[4,5] then converted to scalable vector graphics to allow for device-independent rendering across screen and printer devices. The letter distance chart was printed full size from the PDF file using a 600 dpi laser printer, and a micrometer was used to measure the line heights. Similarly, a commercial ETDRS chart (Precision Vision, Woodstock, IL [Cat 2197US]) was measured with a micrometer. Measurement deviations from the theoretical line height averaged 0.096 ± 0.137 mm (standard deviation) for the printed chart, and averaged 0.093 ± 0.131 mm for the commercial chart. The charts include a calibration circle that when viewed should be 1 inch (25 mm) in diameter (the size of a US quarter dollar coin).

Near charts are presented using the size recommendations of Jaeger.[6] For adults, we present three random words at each Jaeger size, and for children we present HOTV letters in logMAR format for use with the HOTV matching card. Holding the chart at the AMA-recommended test distance of 14 inches (the diagonal length of letter-sized paper) provides a Snellen fraction. A limitation of both the near and distant charts is that there is no random variation or presentation of the optotypes, even when displayed electronically. Therefore, the tests could be affected by familiarity with the stimuli when testing is repeated (for example, when testing right and left eyes monocularly).

The Amsler Grid, used for monitoring macular function, is presented with a black background as described by Amsler rather than with a white background (appearing as a piece of graph paper) as is frequently presented.[7] Augustine and colleagues[8] has shown that Amsler's original design is superior to the more commonly seen black line on white background. Therefore, the original design is presented here.

Our goal was to make reliable, home-based acuity measurements available to all our patients, not only the most technologically savvy. English and Spanish Language versions of the tests are available for download at jaapos.org (eSupplement 1 [English]; eSupplement 2 [Spanish]; eSupplement 3 [JPEG files]. The COVID pandemic is increasing the need for tele-ophthalmology. The most

Author affiliations: [a]Department of Ophthalmology and Vision Science, [b]The Mel & Enid Zuckerman College of Public Health, and [c]James C. Wyant College of Optical Sciences, The University of Arizona, Tucson, AZ

Financial support: National Institutes of Health grant EY029657 (JMM/EMH).
Submitted May 7, 2020.
Revision accepted June 5, 2020.
Published online July 30, 2020.

Correspondence: Erin M. Harvey, PhD, Department of Ophthalmology and Vision Science, The University of Arizona, 655 N. Alvernon Way, Suite 204, Tucson, AZ 85711 (email: emharvey@arizona.edu).

J AAPOS 2020;24:235-236.

1091-8531
https://doi.org/10.1016/j.jaapos.2020.06.003

basic ocular vital sign is visual acuity; we hope that this set of charts facilitates this measurement at home.

References

1. Ferris FL III, Kassoff A, Bresnick GH, Bailey I. New visual acuity charts for clinical research. Am J Ophthalmol 1982 Jul 1;94:91-6.
2. Sheridan MD. Vision screening of very young or handicapped children. Br Med J 1960;2:453-6.
3. Vision in Preschoolers Study Group. Preschool vision screening tests administered by nurse screeners compared with lay screeners in the Vision in Preschoolers Study. Invest Ophthalmol Vis Sci 2005;46:2639-48.
4. Beck RW, Moke PS, Turpin AH, et al. A computerized method of visual acuity testing: adaptation of the Early Treatment of Diabetic Retinopathy Study testing protocol. Am J Ophthalmol 2003;135:194-205.
5. Moke PS, Turpin AH, Beck RW, et al. Computerized method of visual acuity testing: adaptation of the Amblyopia Treatment Study visual acuity testing protocol. Am J Ophthalmol 2001;132:903-9.
6. Runge PE. Eduard Jaeger's test-types (Schrift-Scalen) and the historical development of vision tests. Trans Am Ophthalmol Soc 2000;98:375-438.
7. Amsler M. Earliest symptoms of diseases of the macula. Br J Ophthalmol 1953;37:521-37.
8. Augustin AJ, Offermann I, Lutz J, Schmidt-Erfurth U, Tornambe P. Comparison of the original Amsler grid with the modified Amsler grid: result for patients with age-related macular degeneration. Retina 2005;25:443-5.

The early gut microbiome could protect against severe retinopathy of prematurity

Dimitra Skondra, MD, PhD,[a,b,*] Sarah Hilkert Rodriguez, MD, MPH,[a,*] Anukriti Sharma, PhD,[b,c] Jack Gilbert, PhD,[b,c] Bree Andrews, MD, MPH,[d] and Erika C. Claud, MD[b,d]

In this study, 6 infants with type 1 retinopathy of prematurity (ROP) were compared with 4 high-risk preterm neonates without any ROP but similar baseline neonatal comorbidities. The infants with type-1 ROP showed significant enrichment of *Enterobacteriaceae* at 28 weeks' postmenstrual age. Several metabolic pathways, including several amino acid metabolism pathways, were enriched in gut microbiota of infants without ROP. Based on these findings, we posit a possible association between early gut microbiome profile and ROP pathogenesis. Furthermore, it is possible that absence of *Enterobacteriaceae* overabundance, in addition to enrichment of amino acid biosynthesis pathways, may protect against severe ROP in high-risk preterm infants.

Author affiliations: [a]Department of Ophthalmology, University of Chicago, Chicago, Illinois; [b]Microbiome Center, University of Chicago, Chicago, Illinois; [c]Department of Surgery, University of Chicago, Chicago, Illinois; [d]Department of Pediatrics, Neonatology, University of Chicago, Chicago, Illinois

Funding support: National Institutes of Health grants HD083481 (EC) and UG3OD0232281 (EC); Duchossois Family Institute (EC).

Disclosures: Bree Andrews is a cofounder of Preeme+You.

**These authors contributed equally to this work.*

Submitted January 14, 2020.

Revision accepted March 14, 2020.

Published online July 21, 2020.

Correspondence: Erika C. Claud, MD, 5841 S Maryland Ave, Chicago, IL 60637 (email: EClaud@peds.bsd.uchicago.edu).

J AAPOS 2020;24:236-238.

1091-8531

https://doi.org/10.1016/j.jaapos.2020.03.010

Gut microbiota may play a role in several ocular diseases, but their role in retinopathy of prematurity (ROP) has not been explored.[1] In addition to traditional risk factors for ROP, such as low birth weight (BW) and gestational age (GA), early-onset sepsis[2] and poor postnatal weight gain (as a marker of insulinlike growth factor [IGF-1] deficiency) may also play a role.[2] We have previously demonstrated the association of gut microbiota and brain development through the IGF-1 pathway in premature infants.[3] Based on the relationship of microbiota to the IGF-1 pathway, which also plays a key role in ROP, we aimed in this study to determine whether a possible association exists between early gut microbiome composition and ROP development by comparing the gut microbiome in high-risk preterm infants with type 1 ROP and high-risk preterm neonates without any ROP.

Subjects and Methods

This study was approved by the University of Chicago Institutional Review Board and conformed to requirements of the US Health Insurance Portability and Accountability Act of 1996 and the tenets of the Declaration of Helsinki. Written consent was obtained for all patients.

As part of a larger neonatal intensive care unit study by the senior author (ECC), fecal samples were collected weekly, from birth through discharge, from high-risk preterm neonates (≤27 weeks' GA or BW of ≤750 g) who underwent ROP screening at a single level III neonatal intensive care unit. All patients born before 37 weeks were offered inclusion in the larger microbiome study. Subjects were excluded if they had severe genetic or congenital anomalies, such as major congenital heart disease, major kidney disease, gastrointestinal, and lung or brain malformations. Subjects were stratified into two groups: (1) high-risk preterm infants with type 1 ROP and (2) high-risk preterm infants without any ROP. The following data were collected: BW, GA, delivery mode, postnatal weight gain rate, days of antibiotics, days on mechanical ventilation, severe intraventricular hemorrhage, necrotizing enterocolitis, and bronchopulmonary dysplasia. Bacterial DNA was extracted from fecal samples followed by amplification of the 16S rRNA V4 region using MiSeq sequencing (Illumina Inc, San Diego, CA). For 16S rRNA analysis, 16 million paired-end reads were joined and demultiplexed with QIIME 1.9.1, and exact sequence variants (ESV) were selected using the Deblur pipeline. Alpha and beta diversity were analyzed using QIIME 1.9.1 and phyloseq. Bacteria-encoded pathways were predicted using PICRUSt (PICRUSt- version 1.1.4; https://picrust.github.io/picrust/install.