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Visual Acuity Testing Beyond Traditional Chart: A Narrative Review of PEEK Acuity and ETDRS Chart

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Abstract

The ETDRS (Early Treatment Diabetic Retinopathy Review) card is gold standard in visual acuity tests, was the prototype for the logMAR (Logarithm of the Minimum Angle of Resolution) card. A logMAR style smartphone-based application called Portable Eye Examination Kit (Peek Acuity). This review aims to compare the PEEK Acuity application with the ETDRS chart in assessing visual acuity and refractive error, focusing on time efficiency, patient satisfaction, ease of use and comfort. A narrative review was done by digital searching from PubMed, Google Scholar, PEDro, Science Direct, and EBSCO. Two applications applied Peek acuity and ETDRs chart assessment. Both were applied on all participants. Outcome measurement tools were the Patient Satisfaction Questionnaire Short Form (PSQ-18) and topic related questions were added from these two Ease of Care (EOC) questionnaires for assessment of ease and comfort level and Comfort Questionnaire (GCQ). Both methods were effective in enhancing patient outcomes. However, the ETDRS chart was associated with superior performance in terms of visual acuity accuracy and patient satisfaction, while Peek Acuity demonstrated advantages in reduced testing time and improved patient comfort and ease of use.

Introduction

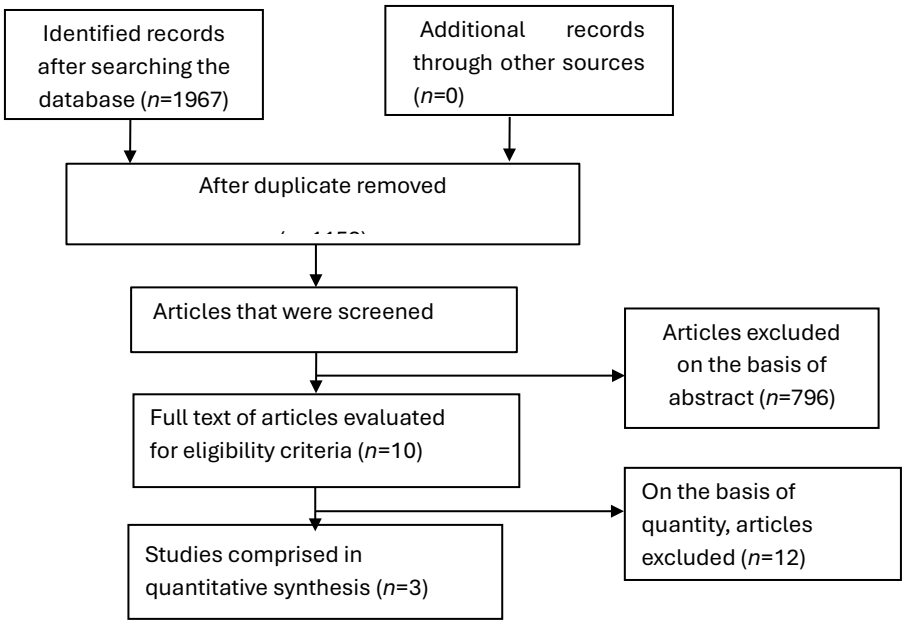
A basic human sense, vision is crucial for comprehending the beauty and complexity of the cosmos and our immediate environment. As a tiny but precise organ, the human eye is vulnerable to a number of diseases and disorders. Assessing visual acuity status is an essential first step in clinical practice that helps eye care professionals identifies refractive challenges or other ocular abnormalities. In therapeutic practice, visual acuity is a crucial measure of visual function, a predictor of outcome, and a sign of how well therapy is working.(1) The refractive power of the

cornea and lens divided by the axial length of the eyeball is called refraction, and it influences how light is focused on the retina. Blurred vision results from refractive error, also known as ametropia, which is caused by an imbalance between the axial length of the eye and the cornea's and lenses focusing capabilities.(2) Visual impairment substantially affects a person's life, generating both practical and psychological concerns. The ETDRS (Early Treatment Diabetic Retinopathy Review) card, which is today the gold standard in visual acuity tests, was the prototype for the logMAR (Logarithm of the Minimum Angle of Resolution) card.(3) Visual acuity testing with the ETDRS chart generally requires a 4-meter distance and its use may be limited by its relatively high cost, large chart size, poor availability and applicability. (4) Each line of the chart contains five optotypes and the optotype size is changed on each line by a constant proportion. However, its use in clinical practice has been limited due to factors such as cost, longer testing times, and the chart's larger size. Clinical medicine's use of technology is expanding at an exponential rate.(4, 5) In order to satisfy the demands of the expanding patient population, which bring new obstacles, mobile applications hold great promise for assisting healthcare personnel. (6)The Peek Acuity app (Portable Eye Exam Kit), created by Peek Vision Company and freely accessible on the Play Store, is one of the smartphone apps that has been tested to help with eye exams, particularly visual acuity. Smartphones' availability and mobility give healthcare professionals a significant edge when treating patients in places with limited facilities or in isolated locations where resource scarcity is a major issue.(7) The Portable Eye Examination Kit (Peek Acuity), a smartphone software in the logMAR format, is already well-known for being user-friendly, dependable, and accessible. The distance needed to evaluate visual acuity with Peek Acuity is only two to three meters, which is significantly less than what the Chart calls for. The logMAR measuring feature is integrated into Peek Acuity. (7, 8) The scores was automatically transformed into logMAR, which speeds up the assessment. The cost of visual acuity screening can be further decreased by making the most of Peek Acuity. The program expedites the examination by instantly converting results into logMAR. The cost of visual acuity screening can be considerably decreased by maximizing Peek Acuity, providing a practical way to evaluate eye health. A mobile phone-based screening tool with a low false positive referral rate is offered by Peek Acuity, which is available in low-income communities. (9) When utilized by community members in patients' homes, this application has shown high accuracy, with 85% sensitivity and 98% specificity, when compared to the gold standard of an optometrist using the logMAR ETDRS chart. Its potential resides in providing visual acuity assessment to marginalized groups, particularly in areas with limited access to eye care. Peek Acuity exhibits great potential in school-based initiatives, which are less expensive than conventional primary care settings.(10)

These initiatives can lessen vision-related handicap by assisting in the early detection of refractive defects. To evaluate visual acuity in a quick and easy way, PEEK Acuity (Portable Eye Examination Kit) is an Android-based application. During the screening process, the Peek Acuity's cell phone's screen is set to 100% brightness. It displays a Tumbling E single line of six optotypes with a visual acuity level of 20/40. One eye is covered at a time while the subject moves through the optotypes while seated two meters away from the phone.(11) The visual acuity is calculated by the application, and if it is less than the 20/40 threshold, a referral is flagged. It is advised that the individual be evaluated further if the test results show that a referral is necessary. Because of the application's low false positive referral rate, fewer people are referred needlessly, and only those who need more testing are chosen. This simplified procedure offers a quick and easy way to do visual screening. The ETDRS chart is regarded as the gold standard for worldwide clinical narrative review.(4, 12) Ferris created it, and the National Academy of Sciences National Narrative review Council recommended it. With a total of 14 lines and five SLOAN letters of the same size and reading level on each line, it complies with the Bailey-Lovie chart's design specifications.

According to the Weber-Fechner rule, the letter size rises at a steady 10 increment rate. One letter separates each letter, and the distance between adjacent lines is the same size as the letters on the line below. The test involves the subject standing 4 meters away from the chart and reading it line by line, from top to bottom, until a line contains more than two errors. When a person can properly recognize three out of five letters on the smallest line, their visual acuity is rated. There are three ways to record visual acuity on the ETDRS chart: logMAR, fractional, and decimal. The logMAR range is 1.0 to -0.3. The Patient Satisfaction Questionnaire Short Form (PSQ-18) as an adaptable, reliable tool for use in various settings.18-item instruments (PSQ-18) Patient Satisfaction Questionnaire Short Form (PSQ-18) a concise, validated tool. Topic related questions were added from these two Ease of Care (EOC) questionnaires for assessment of ease and comfort level and Comfort Questionnaire (GCQ).(13)

Prisma Chart



Discussion

The purpose of review was to compare the efficacy of peek acuity and ETDRS chart for assessment of visual acuity and refractive error. For this purpose ETDRS Chart and PEEK acuity app were used. In addition subjects completed post intervention questionnaire (PSQ-18, EOC and GCQ) to determine the difference between patient's levels of comfort. The results of this review have shown that the both methods were effective in enhancing patient outcomes. However, the ETDRS chart was associated with superior performance in terms of visual acuity accuracy and patient satisfaction, while Peek Acuity demonstrated advantages in reduced testing time and improved patient comfort and ease (p-value<0.05) for analysis. The studies conducted by Anitha et al. (2023), Noordin et al. (2023), and Aritonang et al. (2022) collectively highlight the growing utility of the smartphone-based Peek Acuity app as a reliable alternative to conventional visual acuity (VA) testing methods such as the LogMAR and Snellen charts, particularly in settings where access to standard clinical tools is limited.(14) This positions the app as a viable solution for remote and resource-constrained environment. Noordin et al.'s narrative review expanded the evidence base

to pediatric populations, revealing that Peek Acuity offered significantly better visual acuity scores than the traditional Snellen chart in children aged 3 to 13. This might reflect differences in the testing interface or children's attention spans, which could influence outcomes. Aritonang et al., on the other hand, concentrated on Peek Acuity's effectiveness in a school-based screening setting. Additionally, because of its speed and simplicity of use, it is particularly attractive in settings like schools or during public health emergencies like pandemics where rapid, contactless testing is preferred. (15) These studies demonstrate how Peek Acuity can be used in a variety of contexts and age groups. Although the app's practical benefits (such as portability, simplicity, and the lack of trained personnel) and correlation with traditional methods are generally strong, the app's sensitivity may still be limited based on the population and testing conditions. Morjaria et al. (2020), Rono et al. (2019), and Naqaish et al. (2023) each focus on an aspect of service delivery, specifically pectacle adherence, referral systems, and diagnostic accuracy. In contrast, Rono et al. explored the system-level integration of Health tools to improve community eye health delivery in Kenya. (16)Their customized Peek Community Eye Health system facilitated real-time referrals, service tracking, and SMS communication via community health workers. Unlike Morjaria's focus on individual behavior change, this intervention targeted systemic efficiency and referral uptake. The findings showed the potential of such digital platforms to enhance service delivery and reduce the burden on secondary care facilities. This review underscores how mHealth tools can be effectively embedded within existing health systems to streamline workflows and extend reach, especially in rural or under-resourced areas. Meanwhile, Naqaish et al. focused on the diagnostic performance of the Paxos Checkup app in measuring visual acuity compared to the traditional Snellen chart. With strong Pearson's correlation coefficients ($r = 0.71$ for left eyes and $r = 0.66$ for right eyes, $p = 0.001$), the review provides convincing evidence of the app's accuracy and reliability for adult users (mean age ~30).(17) These results align with findings from other studies on digital acuity tools and reinforce the feasibility of using smartphone-based testing in clinical and non-clinical environments. Such tools are especially relevant in remote or low-resource settings where conventional equipment may not be available. Together, these studies reflect the breadth and potential of mHealth innovations in eye care, though each highlights different challenges. Morjaria et al. exposed the difficulty of translating digital interventions into behavior change without sufficient engagement. Rono et al. demonstrated how strategically integrating Health systems at the community level can improve access and efficiency.(18) Naqaish et al. validated the technical reliability of smartphone-based diagnostic tools, a fundamental step for widespread adoption. The studies from Zimbabwe, Kenya, Indonesia, and Paraguay provide valuable insights into the effectiveness, usability, and limitations of mobile eye health technologies particularly the Peek Acuity app in diverse, low-resource settings. Together, they underscore the promise of digital tools in improving access to vision screening, while also highlighting critical challenges related to accuracy, infrastructure, and implementation.(19)

Conclusion

This review concluded that Peek Acuity showed benefits in shorter testing times and enhanced patient comfort and usability, the ETDRS chart was linked to better performance in terms of visual acuity accuracy and patient satisfaction.

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