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COMPARISON OF SMARTPHONE BASED PEEK VISUAL ACUITY WITH SNELLEN VISUAL ACUITY

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ABSTRACT
Purpose: To test an alternative method of visual acuity assessment by comparing habitual and best-corrected visual acuity by Snellen and Peek (a visual acuity testing smartphone application). **Methods**: A prospective study comparing visual acuity using Snellen's and Peek's visual acuity charts (smartphone-based applications). 162 eyes were assessed in this hospital-based setting by a single observer. Patients with gross ocular pathology and visual acuity less than 6/60 were excluded from the study. **Results**: There was no statistically significant difference between best corrected visual acuity by Snellens and Peeks'. Snellen's mean best corrected visual acuity was 0.9902 (±0.075), and Peek acuity was 0.9875 (±0.080). **Conclusion**: The visual acuity assessment by Peek is comparable to that of Snellen's; hence, it can be used as an excellent alternative to Snellens' visual acuity testing.

INTRODUCTION

Measurement of visual acuity is the most precise test in terms of evaluation of the integrity of the visual system. It also has an essential role in diagnosing and prognostic evaluating various ocular disorders [1]. Visual acuity measurements help us estimate changes in central vision over time and prove the need for further clinical investigation. Around 2.2 billion people are visually impaired globally, of which 50% is preventable [2]. Unfortunately, most of these live in rural areas of developing countries with limited access to proper healthcare, leading to inadequate diagnosis and treatment [3].

Snellen's chart is the most frequently used method of visual acuity assessment since it is user-friendly, efficient, and cost-effective [4,5]. However, it is limited because there are inconsistent numbers of letters per line [6], and the letter sizing progresses non-geometrically from line to line. Hence, measurement bias arises due to secondary effects such as the crowding phenomenon, so the patient cannot identify letters correctly. These limitations of Snellen's chart have been overcome mainly by the ETDRS (Early Treatment of Diabetic Retinopathy Study) chart, which uses LogMAR (Logarithm of the Minimum Angle of Resolution) specifications [7]. Nevertheless, the Snellen chart remains the predominant method for acuity testing in clinical practice [8]. In this era of globalization, telemedicine has evolved. It has proven helpful in various medical conditions, but a dependable way to measure patients' visual acuity is the most significant concern for an eye

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care clinician [9]. Several mobile-based applications (apps) are available to measure visual acuity by smartphone [10]. These mobile-based apps provide an effective way to measure visual acuity function. They also proved a boon in remote locations of low and middle-income countries by providing an easy method for assessing visual acuity, facilitating early detection, and appropriate referral of eye disease for prompt action [11]. Peek visual acuity is a mobile-based application wherein visual acuity can be assessed quickly. In this study, a comparison of visual acuity by Snellen's chart was made with the Peek visual acuity assessment app to see if it can be used as an alternative to Snellen's vision assessment in a remote setting.

METHODOLOGY

This is a hospital-based cross-sectional study based on comparing visual acuity measured by Snellen's chart (drum-based) at a distance of 6 meters and Peek's visual acuity chart using an Android smartphone at a distance of 3 meters. The study was conducted on 162 eyes of 81 patients. The study protocol was strictly in accordance with the tenets of the Declaration of Helsinki. The Snellen visual acuity was converted to decimal values for study. The objectives of the study and examination process were explained to the patients and their attendants, and informed consent was obtained from those willing to participate.

Inclusion criteria:

- The age group of 18-65 years
- No ocular pathology

Exclusion criteria:

- Patients having gross ocular pathology
- Visual acuity less than 6/60

Peek Visual Acuity

Peek Acuity follows the standard ETDRS chart design with a 5x5 grid optotype letter "E" displayed in one of four orientations (90°, 180°, 270° and 0°). It displays a single letter per screen and then moves on to the next one with each correct response. The peek visual acuity application was installed on the smartphone, which was used for the study, and the screen brightness was set to 100% within the app. The participant points in the direction they perceive the "arms" of the E to be pointing, and the tester uses the touch screen to swipe accordingly, translating the gestures from the patient. The tester is masked to the presented optotype and unaware of whether the participant responds correctly.

The standard functioning of the Peek Acuity chart offers alternatives to "count fingers", "hand movements," and "light perception. For "count fingers", it randomly presents either one or four bars, and the response (whether correct or incorrect) is recorded on the screen. For "hand movement", a solid black box, half the width of the screen, moves backward and forwards across the screen. For "perception of light", the app switches on the phone's LED flashlight and the subject is asked to identify if they see the light come on and off, also giving the option to assess for projection of light's direction. A sound and vibration alert indicates test completion. Visual acuity results can be displayed in LogMAR, metric, or imperial Snellen based on user preference. For this study, we included the test results in Snellen-based preference, which was converted to decimal values.

RESULT

A total of 162 eyes of 81 patients were assessed in this study. A comparison between habitual and best-corrected visual acuity between Snellen and that of Peek visual acuity was made.

The compilation of results was done on a proforma designed in a Microsoft Excel spreadsheet (Microsoft, Redmont, WA). The entries were rechecked for human error while typing. Statistics for Windows version 21.0 (SPSS Inc. Chicago, IL, USA) was used for statistical analysis. The quantitative data were recorded by mean±Standard deviation. A paired t-test was used to compare visual acuity by both charts. A p-value of <0.005 was considered for the significance of the results. The mean habitual visual acuity by Snellen was 0.9004 (±0.204), and that of Peek was 0.9175 (±0.177). There was a statistically significant difference between habitual visual acuity measured by Snellen and Peek acuity (p=0.003) (Table 1). The mean best corrected visual acuity by Snellen was 0.9902 (±0.075), and Peek acuity was 0.9875(±0.080). There was no statistically significant difference observed between the best corrected visual acuity measured by Snellen and that of Peek acuity (p=0.117) (table 2)

DISCUSSION

The prevalence of visual impairment in economically developing countries is four times higher than in high-income regions. With this burden of visual impairment, a smartphone-based vision assessment app can be a boon in early detection and prompt referral. These apps provide the potential for delivering high-quality, unprejudiced, repeatable, and admissible vision testing tools.

Table 1: Habitual visual acuity comparison between Snellen and Peek

	Mean	N	SD*	SEM**
Snellen VA	0.9004	162	0.20448	0.01607
Peek VA	0.9175	162	0.17703	0.01391

Table 2: Best corrected visual acuity comparison between Snellen and Peek

	Mean	N	SD*	SEM**
Snellen VA	0.9902	162	0.07509	0.00590
Peek VA	0.9875	162	0.08096	0.00636

*Standard deviation **Standard error mean

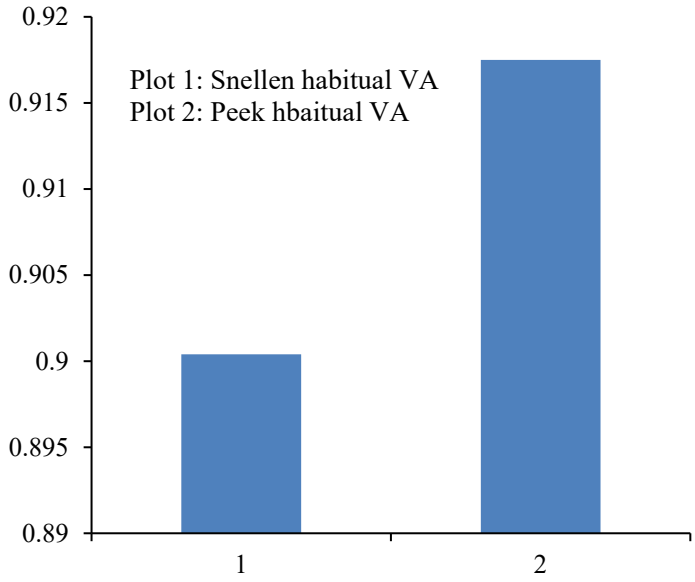

Figure 1: Mean habitual visual acuity between Snellen and Peek

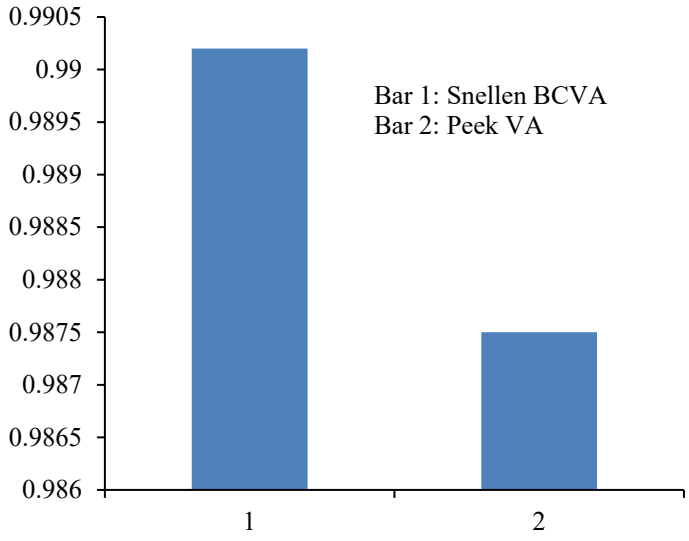

Figure 2: Mean best corrected visual acuity between Snellen and Peek

In this study, we hypothesized to corroborate a smartphone-based visual acuity test appropriate for use in demanding and challenging circumstances as well as its authenticity by making a comparison with the conventional method of visual acuity assessment (Snellen chart) and to know if it can be put to use in routine clinical practice in a well-established health system. On comparing the visual acuity in all the participant eyes using the standard Snellen chart and smartphone application- Peek Acuity in the Android platform, no statistically significant difference was observed regarding best corrected visual acuity (P=0.117) (figure 2). Although a statistically significant difference was observed between the two on comparing habitual visual acuity (P=0.003), clinically, there is no such significant difference between the two (Figure 2).

Similar to our study, a Kenyan study by Bastawrous et al. revealed the mean difference between Peek Acuity and the Snellen chart as 0.08 logMAR (95% CI, 0.06–0.10) [12]. Another study by Perera et al. showed the mean difference between the two methods as 0.02 logMAR (95% CI, −0.33–0.37). Overall, there was no statistically significant difference between the mean logMAR acuity values of both charts [13].

Literature on a similar comparative study by Bhaskaran et al. showed a strong correlation between Peek's visual acuity and the Snellen chart. They also did a subgroup analysis for eyes with refractive error and cataracts, yielding a strong correlation in this study [14]. The significant advantage of our study is that it was done on patients attending the outpatient department. Hence, observer bias was minimized. The limitation of our study is that we did not include eyes with gross ocular pathologies and those with visual acuity lesser than 6/60. Nevertheless, in a setting where ophthalmic instrumentation or ophthalmic trained personnel are limited, the ability to measure a definitive change in vision or detect abnormal vision with a smartphone-based application has potential in the long run.

CONCLUSION

This work discusses the importance of visual acuity testing in evaluating the visual system and diagnosing ocular disorders, particularly in regions with limited healthcare access. It highlights the limitations of traditional methods like Snellen's chart and introduces the Peek visual acuity assessment app as a promising alternative, especially in remote areas. A study involving 81 patients and 162 eyes compared the two methods.

The results indicated a significant difference in habitual visual acuity between Snellen and Peek charts but no significant difference in best corrected visual acuity. This suggests that smartphone-based vision assessment tools like Peek could be valuable for early detection and referral in areas with limited access to healthcare.

The text emphasizes the potential of smartphone-based applications for visual acuity testing, particularly in settings with scarce ophthalmic resources and trained personnel, contributing to improved detection and monitoring of visual impairment and ocular disorders.

FINANCIAL ASSISTANCE
Nil

CONFLICT OF INTEREST
The authors declare no conflict of interest

AUTHOR CONTRIBUTION
Nisha Dulani conceptualized the work. She investigated and collected the data. Harish Dulani and Nisha Dulani contributed in writing the whole draft and manuscript thereafter. Tapas Kumar De collected and analysed the data. Nisha Dulani contributed in reviewing of the manuscript. All authors approved the final draft of the manuscript.

REFERENCES
[1] Levenson JH, Kazatsky A. Visual acuity. In: Kayaker WD, Hall Hurst JW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd ed. Boston: Butterworths; 1990.

[2] Steinmetz JD, Bourne RRA, Briant PS, Flaxman SR, Taylor HRB, Jonas JB *et al*. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to VISION 2020: the Right to Sight: an analysis for the Global Burden of Disease Study. *Lancet Glob Health* **9**, e144-e160 (2021)

[3] Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol* **96**, 614-8 (2012)

[4] Tewari HK, Kori V, Sony P, Venkatesh P, Garg S. Snellen chart may be preferable over early treatment diabetic retinopathy study charts for rapid visual acuity assessment. *Indian J Ophthalmol* **54**, 214 (2006)

[5] Hetherington R. The Snellen chart as a test of visual acuity. *Psychol Forsch* **24**, 349-57 (1954)

[6] Laidlaw DA, Abbott A, Rosser DA. Development of a clinically feasible logMAR alternative to the Snellen chart: performance of the "compact reduced logMAR" visual acuity chart in amblyopic children. *Br J Ophthalmol* **87**, 1232-4 (2003)

[7] Bailey IL, Lovie JE. New design principles for visual acuity letter charts. *Am J Optom Physiol Opt* **53**, 740-5 (1976)

[8] Kaiser PK. Prospective evaluation of visual acuity assessment: a comparison of snellen versus ETDRS charts in clinical practice (An AOS Thesis). *Trans Am Ophthalmol Soc* **107**, 311-24 (2009)

[9] Patel S, Hamdan S, Donahue S. Optimising telemedicine in ophthalmology during the COVID-19 pandemic. *J Telemed Telecare* **28**, 498-501 (2022)

[10] Onnela JP, Rauch SL. Harnessing Smartphone-Based Digital Phenotyping to Enhance Behavioral and Mental Health. *Neuropsychopharmacology* **41**, 1691-6 (2016)

[11] Bastawrous A, Armstrong MJ. Mobile health use in low- and high-income countries: an overview of the peer-reviewed literature. *J R Soc Med* **106**, 130-42 (2013)

[12] Bastawrous A, Rono HK, Livingstone IA, Weiss HA, Jordan S, Kuper H, Burton MJ. Development and Validation of a Smartphone-Based Visual Acuity Test (Peek Acuity) for Clinical Practice and Community-Based Fieldwork. *JAMA Ophthalmol* **133**, 930-7 (2015)

[13] Morjaria P, Bastawrous A, Murthy GVS, Evans J, Gilbert C. Effectiveness of a novel mobile health education intervention (Peek) on spectacle wear among children in India: study protocol for a randomized controlled trial. *Trials* **18**, 168 (2017)

[14] Bhaskaran A, Babu M, Abhilash B, Sudhakar NA, Dixitha V. Comparison of smartphone application-based visual acuity with traditional visual acuity chart for use in tele-ophthalmology. *Taiwan J Ophthalmol* **12**, 155-63 (2022)