Original Article

# Outcome of Auto Refraction and Subjective Refraction Among the Patients with Age of 15 and Above: A Comparative Study

Auto and Subjective Refraction

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## ABSTRACT

**Objective:** To compare the outcome of the outcome between auto refraction and subjective refraction in patients.
**Study Design:** Cross-Sectional Study
**Place and Duration of Study:** This study was conducted at the Department of Ophthalmology, Al-Ibrahim Eye Hospital, Karachi from March 2019 to February 2020.
**Materials and Methods:** A cross-sectional study was conducted on 120 patients above 15 years of age. Topcon (RM8800) was the auto refractor used to determine auto refraction, whereas subjective refraction was carried out using a trial frame in which spherical lenses were inserted. Each eye was checked monocularly, and then binocularly, with all eye measurements carried out without cycloplegia. SPSS was used to evaluate data, and for comparison, a paired t-test was applied with a P-value set at ≤0.05.
**Results:** The mean spherical equivalent difference between auto refraction and subjective refraction of both eyes was (±0.17D±0.12D). The p-value of the right eye and left eye between auto refraction and subjective refraction was found to be (0.033-0.088), which is statistically significant.
**Conclusion:** Study confirms the variation between subjective refraction and auto refraction. Auto refraction is satisfactory for preliminary refraction but is not deemed satisfactory as substitutes for conventional subjective refraction.
**Key Words:** Auto-refraction, subjective refraction, refractive error

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## INTRODUCTION

Refractive error is said to be one of the most common causes linked to visual impairment and is the second largest cause of treatable blindness after cataracts[1,2]. The WHO has also further identified refractive error as the leading cause of blindness, addressing this in WHO Vision 2020 priority[3]. According to the International Classification of Diseases, 10th revision, refractive error defines refractive error as a defect in which light is focused in front of the retina. In contrast, hyperopia is when light is focused behind the retina[3,4]. However, refractive error is a widely prevalent condition; it can be easily corrected by using glasses, contact lenses, and surgery[5].

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Unfortunately, much of the refractive error remains uncorrected, resulting in reduced educational opportunities and employment options, ultimately resulting in and impacting individuals and the community[6]. This reduced productivity has a severe cost on the economy, estimated in the region of $269 Billion per year, all due to uncorrected refractive errors[7]. Therefore, it is essential to diagnose and correct refractive errors in the region. Refractive errors can be detected by manual subjective refraction (SR). SR is defined as the endpoint as the combination of lenses that provides the best-corrected visual acuity to a patient with refractive error. Subjective error is considered the standard for comparing new instruments that help assess refractive errors in clinical practice[8]. However, the procedure is subjective with many drawbacks such as patient variability in responses and inter and intra-examiner reliability, leading to limitations in preciseness and repeatability[9]. The technology could help in increasing the efficiency in optometric practice and also prevent issues such as patient reliability and examiner reliability. Auto refractors is a widely accepted, clinically valuable tool[10]. Auto refractors provide a rapid automated assessment of refractive errors and are now commonly used in ophthalmic practices, aiding technicians with minimal training to collect and refine refractive data.

Even though refractive error is relatively easy to avoid, the uncorrected refractive error still accounts for most of the disease burden in Pakistan[11]. An uncorrected refractive error must be diagnosed and corrected in the country using either subjective refraction or using Auto refractors. Therefore, a study was conducted to evaluate Auto refractors' outcomes and subjective refractors among people age 15 and above.

## MATERIALS AND METHODS

After taking approval from the ethical review board, a cross-sectional study was conducted in Al-Ibrahim Eye Hospital. One hundred twenty patients aged above 15 years were selected based on the non-probability sampling technique. A study took place for an entire year, in which patients with refractive errors were tested using both subjective refraction and Auto refractors. Patients were only included in the study after taking verbal consent from them. We measured the visual acuity of all the patients using the Snellen's eye chart. Measurement of auto refraction was measured using Topcon (RM8800) on 240 eyes and compared with subjective refraction. The subjective refraction was carried out using a trial frame, in which lenses could be inserted with the highest refraction posed to the eye, with a vertex distance kept at 12mm. Precise subjective refraction was undertaken by determining the best vision sphere and using Jackson's cross-cylinder technique. Changes to cylinder power were compensated by adjusting the sphere power. Each eye was checked for refraction monocularly, followed by binocular balancing. All refractive measurements were done without any cycloplegia. Refraction was recorded in written form on a patient prescription card and the filling of a structured questionnaire for the above variables for the study. Data, once collected, was analyzed using SPSS Version 21.0. All continuous variables were shown in mean and standard deviation, whereas categorical data were presented in frequency and percentage. For comparing results of auto refraction and subjective refraction, a paired t-test was used with statistical significance kept at P-value <0.05.

## RESULTS

Figure 1: Shows the age groups of the patients taking part in the study in this study the age range of patient 16 to 60 years, a total of 120 patients were examined during study. Out of total number of patients, the frequency of male was 64 and female was 56.

Figure 2: Shows the mean and standard deviation between auto refraction and subjective. The mean difference between the auto refraction and subjective refraction of the right eye was spherical equivalent ±.1728 (SD 0.879; p-value=0.033).The mean difference between the auto refraction and subjective refraction of the left eye was spherical equivalent ±0.1272 (SD 0.808; p-value=0.088)

Figure 3: Shows the age-wise comparison of Auto refraction and Subjective refraction. The Mean spherical equivalent difference of the right eyes between auto refraction and subjective refraction among the age groups of 15 to 25,26 to 35, 36 to 45, 46 to 55 and >55 years were ±0.4759D, ±0.6259D, ±0.0194D, ±0.1744D and ±0.0913D respectively. The Mean spherical equivalent difference of the left eyes between auto refraction and subjective refraction among the age groups of 15 to 25,26 to 35, 36 to 45, 46 to 55 and >55 years were ±0.5184D, ±0.3918D, ±0.1245D, ±0.4040and ±0.1167D respectively.

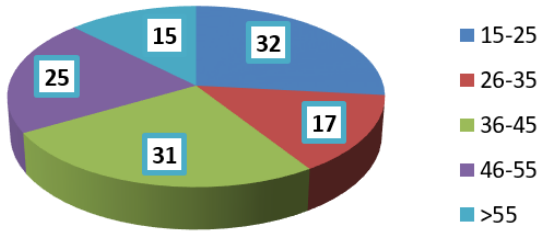


**Figure No.1: Shows Frequency of the patients in respect to age groups**

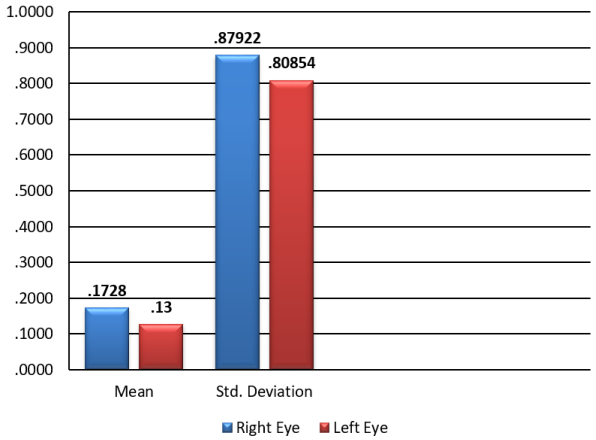


**Figure No. 2: Shows the Mean and standard deviation between auto refraction and subjective refraction of Right and Left eye**

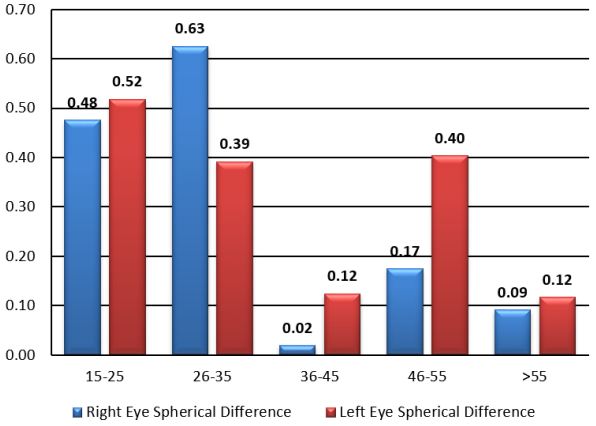


**Figure No. 3: Shows the Mean value of age-wise comparison between Auto refraction and Subjective refraction of Right and Left Eye**

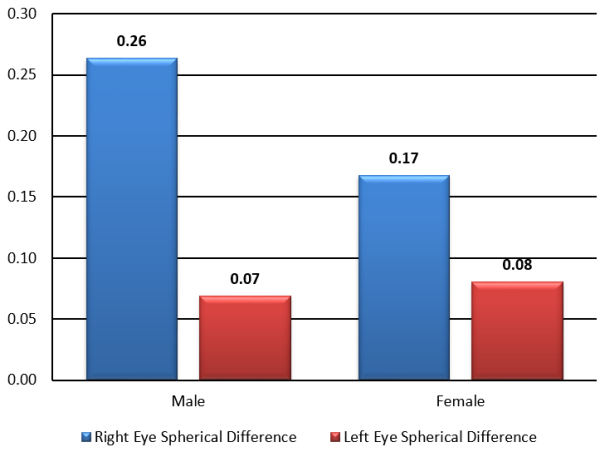


**Figure No.4: Shows the Gender based comparison between Auto refraction and Subjective refraction of Right and Left Eye**

Figure 4: Shows the Sex wise comparison between Auto refraction and Subjective refraction. The male patients had mean spherical equivalent difference of both, right and left eyes between auto refraction and subjective refraction of ±0.2636D and ±0.1678D respectively. The female patients had mean spherical equivalent difference of both, right and left eyes between auto refraction and subjective refraction of ±0.0691D and ±0.0807D respectively.

# DISCUSSION

Currently, the determination of refractive error of the human eye is done in 2 steps. The first step of measuring objective refraction is done using retinoscopy, auto refraction, or aberrometry. The next step is then subjective refraction, which is still the gold standard for measuring refractive errors. Retinoscopy is one of the oldest techniques used in clinical ophthalmology; unfortunately, this technique is slower than other objective refraction measurement techniques and requires years of experience to become proficient in its use. In contrast, refractors are faster, require less clinically experienced operators. Many publications have also supported refractors to be more accurate and repeatable than retinoscopy[12]. Our study used one of the ways to measure objective refraction, which is Auto refractors, and compared it to subjective refraction. Our study demonstrated spherical equivalent (SE) difference between auto refraction and subjective refraction of the right eye ((±0.17D p-value = 0.033) and of the left eye, which was statistically significant. A similar study conducted also showed that SE was found to be significantly different for different auto refractors, Retinomax K plus 2, Canon RF 10 compared with monocular subjective refraction. Furthermore, Mean SE was also significantly different for Grand Seiko WR5100K than binocular subjective refraction[13]. With cycloplegia, there was no significant difference in mean SE between the refraction methods. Additionally, it must be noted that Autorefractors are inadequate when it comes to measuring non-cycloplegic refractive errors, which was also seen in a study conducted by Zhao et al[14]. In this circumstance, other objective refraction measurement techniques or subjective refraction should be considered. Alternatively, cycloplegic Autorefractors are deemed highly beneficial[15]. The study also showed the mean difference between autorefraction and subjective refraction, which was obtained between ±0.370D to ±0.438. The result difference was mean ±0.1728, ±0.1272 there were 0.2 and 0.31 according to this study, a slight difference is eradicated. Another study results also showed that the standard deviation obtained for both subjective and objective refraction measuring techniques to be were +/- 0.14 and +/- 0.18 D, indicating 95% confidence limits of +/- 0.27 and +/- 0.35 D. it also concluded that with assessment technique, a change in refractive error of +/- 0.50 D must be adopted as the minimum significant shift in refractive status[16]. It was found that Auto refractors are an excellent way to provide an initial idea and are an excellent tool for preliminary refraction but are not satisfactory. Subjective refraction is still the gold standard, with the current results showing that there is variation in between auto refraction against subjective refraction. Furthermore, Auto refractors also have their drawbacks as they cannot assess the ocular media and, therefore, cannot be used for specific intents and purposes such as early diagnoses of cataracts keratoconus. However, retinoscopy and aberrometry can detect such findings[17,18]. Therefore, Auto refractors should only be used for preliminary diagnosis of refractive error. Subjective refraction should still be the go-to tool for measuring precise refractive error in patients. However, auto refraction measurement can still be used reasonably well for patient screening, as this can reduce the number of patients. Further studies can also be done on aberrometry and retinoscopy, the other two methods of objective refraction, and compare them with subjective refraction to evaluate how close they are in measuring refractive errors. We also advise that clinicians have relevant skills for using a subjective method to evaluate refractive errors among patients so that accurate measurements can be made. Our study does not indicate that refractors are a better tool in measuring refractive errors over subjective refraction.

# CONCLUSION

Subjective refraction is still a more accurate and reliable way to measure the refractive error in patients. However, auto refraction provides an initial idea and screening chance before commencing subjective refraction.

**Author's Contribution:**

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| Concept & Design of Study: | Israr Ahmed Bhutto |
| Drafting: | Saima Majid, Faiza Rameez |
| Data Analysis: | Attiya Zehra Rizvi, Umer Kazi, Bilawal Azam |
| Revisiting Critically: | Israr Ahmed Bhutto, Saima Majid |
| Final Approval of version: | Israr Ahmed Bhutto |

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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