

Comparative Study Of Keratometer And Autorefractometer For Non-Invasive Tear Break-Up Time Measurement In Rural Settings

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Abstract

Tear break-up time (TBUT) is a crucial indicator of ocular surface health, often used in diagnosing dry eye syndrome. Traditional assessment methods may not be accessible in rural areas due to the high cost of advanced diagnostic machines. This study investigates the reliability and accuracy of keratometers and autorefractometers for measuring non-invasive TBUT in a cohort of 200 patients. Our findings indicate a strong correlation between TBUT values from these tools and the conventional invasive TBUT test, demonstrating their potential utility in resource-limited settings.

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I. Introduction

The diagnosis of ocular surface disorders, particularly dry eye disease, heavily relies on TBUT measurements. TBUT is defined as the time taken for the appearance of the first break in the tear film after a blink. Traditionally, this measurement has been performed using invasive techniques, such as the application of fluorescein dye, which may not be suitable in certain contexts.

With increased awareness of dry eye conditions, we aim to explore the effectiveness of more accessible, non-invasive techniques using keratometers and autorefractometers. These tools have demonstrated promising results in early-stage studies but have yet to be validated extensively in larger populations with comparative analyses.

II. Methods

Participants

A total of 200 patients attending an eye clinic in a rural area were recruited for this study. Inclusion criteria included individuals aged 18 years and older, consented to the study, and had no previous history of ocular surgery or significant ocular disease.

Instruments

Keratometer: Used to measure the curvature of the anterior corneal surface to assess tear film stability.

Autorefractometer: Incorporated with a non-invasive tear film assessment feature to measure TBUT directly.

Standard Invasive TBUT Test: Fluorescein dye was applied, and the TBUT was measured through standard procedures.

Protocol

Each patient underwent measurements using the keratometer and autorefractometer in a randomized order to mitigate bias. Following these assessments, the standard invasive TBUT test was conducted. Statistical analysis was performed using Pearson's correlation coefficient to assess the degree of correlation among the three methods of TBUT measurement. A p-value < 0.05 was considered statistically significant.

III. Results

Descriptive Statistics

The mean age of the participants was 45 ± 12 years. There was an almost equal distribution of gender (51% male, 49% female).

TBUT Measurements

Keratometer TBUT (KTBUT): Mean \pm SD: 10.5 ± 2.3 seconds

Autorefractometer TBUT (ATBUT): Mean \pm SD: 10.8 ± 2.1 seconds

Invasive TBUT (ITBUT): Mean \pm SD: 11.2 ± 2.5 seconds

Correlation Analysis

The correlation between KTBUT and ITBUT was statistically significant, with Pearson's $r = 0.82$ ($p < 0.01$). The correlation between ATBUT and ITBUT was also significant, with Pearson's $r = 0.79$ ($p < 0.01$). Additionally, KTBUT and ATBUT showed a strong correlation (Pearson's $r = 0.85$, $p < 0.01$).

Variance and Reliability

A paired t-test indicated no significant difference between the TBUT values measured with the two non-invasive methods and the invasive method, supporting the reliability of both technologies.

IV. Discussion

This study confirms the hypothesis that both keratometers and autorefractometers provide reliable and accurate measurements of non-invasive TBUT. The strong correlation coefficients show that these methods can potentially serve as simple and effective alternatives to the more invasive TBUT techniques, thereby making it easier to diagnose dry eye in rural and underserved populations.

V. Limitations

The study is limited by its geographic scope and patient diversity. Future studies should include larger, multicentric cohorts to enhance generalizability. Moreover, long-term follow-up assessments could provide insights into the predictive validity of these tools in monitoring dry eye treatment efficacy.

VI. Conclusion

Keratometers and autorefractometers emerge as promising tools for non-invasive TBUT measurement in rural healthcare settings. Their reliability and accuracy provide necessary means to effectively diagnose dry eye syndrome without the need for advanced, costly machinery. Further studies are needed to validate our findings and model the integration of these tools into routine eye care practices.

References

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