Digital-Use in the Occurence of Adult-Onset Diplopia: A Preliminary Study

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ABSTRACT

Adult-onset diplopia due to acute acquired comitant esotropia (AACE) is an increasingly recognized condition characterized by sudden-onset inward deviation of the eyes and persistent binocular diplopia in individuals with previously normal ocular alignment. Although historically considered rare, recent evidence suggests rising incidence across multiple adult age groups. Proposed mechanisms include excessive activation and increased tonicity of the medial rectus muscle during sustained near work, potentially causing convergence imbalance and disruption of binocular fusion. Prolonged use of handheld digital devices, such as smartphones and tablets, has been suggested as a contributing factor, though systematic data in adults are limited. This observational, cross-sectional study aims to characterize digital device use patterns in adults with chronic diplopia consistent with AACE. Participants will complete a structured survey assessing daily screen time, device type, viewing distance, nighttime use, and frequency of device interactions, alongside demographic and refractive information. Findings may clarify associations between digital device behaviors and adult onset diplopia, providing hypothesis-generating data for future research and evidence-based patient counseling.

PURPOSE

- To characterize patterns of digital device use in adults with chronic diplopia.
- To evaluate the association between digital device use metrics (screen time, viewing distance, pickup frequency) and adult-onset diplopia.
- To generate hypotheses regarding potential behavioral or environmental contributors to adult-onset strabismus.

METHODS

This study was designed as an observational, cross-sectional analysis of adult patients presenting with diplopia of greater than six months' duration, consistent with acute-onset comitant esotropia. Eligible participants were identified based on predefined inclusion and exclusion criteria to ensure diagnostic consistency. After providing informed consent, participants completed a structured electronic survey developed to quantify digital device use patterns. Survey domains included average daily screen time, primary device type (e.g., smartphone, tablet, laptop), estimated viewing distance, nighttime device use, occupational versus recreational use, and frequency of device pickups per day, obtained via smartphone settings where available. Participants also provided demographic and refractive information. The survey required approximately 10 minutes to complete, and no clinical interventions, behavioral modifications, or experimental procedures were performed. Participants were free to withdraw at any time, and incomplete surveys were excluded from analysis.

Descriptive statistics were used to summarize participant demographics, clinical characteristics, and device use behaviors. Continuous variables were reported as means with standard deviations or medians with interquartile ranges, depending on data distribution. Associations between digital device use variables and group status (control vs diplopia) were analyzed using nonparametric statistical tests, including Mann–Whitney U tests for continuous variables and chi-squared or Fisher's exact tests for categorical variables, as appropriate. This study was exploratory and hypothesis-generating in nature; therefore, formal power calculations were not performed.

RESULTS

Figure 1a and 1b: Age distribution of participants in the control (n = 100) and diplopia (n = 30) groups, demonstrating similar distributions in terms of age.

Figure 2a, 2b, + 2c: Comparison of daily phone screen time average (a), daily phone pickups (b), and device holding distance (c) between control and diplopia groups. A Mann–Whitney U test demonstrated a significant difference in device holding distance (U = 640, p = 0.00032), with the control group holding devices farther away. No significant differences were observed for daily screen time (U = 383.5, p = 0.064) or phone pickups (U = 196, p = 0.27), although screen time showed a trend toward higher values in the diplopia group.

Figure 3. Proportion of participants reporting breaks longer than 20 minutes in control and diplopia groups. Chi squared testing revealed a significant association between the control group and responding "Yes" to taking a break longer than 20 minutes (p = 0.0064).

Figure 4. Average hours spent on near vision activities in control and diplopia groups. A Mann–Whitney U test showed no significant difference between groups (U = 970, p = 0.18), indicating similar near vision exposure.

Image 1: This image shows the anatomy of the eye and extraocular muscles. One potential mechanism for AACE involves increased activation and tonicity of the medical rectus muscle, leading to excessive adduction of the eye for prolonged periods of time.

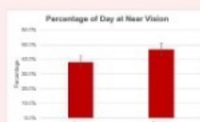

Figure 5. Comparison of the percentage of a 24-hour day spent on near vision activities between control and diplopia groups. No significant difference was observed (Mann–Whitney U = 1260, p = 0.74), suggesting comparable near vision exposure.

DISCUSSION

Participants with diplopia demonstrated distinct device-use behaviors compared to controls. Device holding distance was significantly shorter in the diplopia group ($p < 0.001$), suggesting a tendency toward closer viewing, which may reflect compensatory strategies to maintain visual clarity or single vision. Screen time was higher in the diplopia group and approached statistical significance, indicating a potential association that may become clearer with increased sample size. Interestingly, phone pickups were lower in the diplopia group, possibly reflecting longer usage duration per session. A significant association was also observed between diplopia and the removal of glasses during device use (χ^2, $p = 0.021$), which may indicate reduced tolerance to spectacle correction or attempts to alleviate visual discomfort. While total daily close-device use appeared higher in the diplopia group, further statistical testing is needed to confirm this observation. No significant differences were found in near vision hours or phone pickups, although these results should be interpreted cautiously given the limited statistical power, particularly in the smaller diplopia cohort. Age distributions were comparable between groups, minimizing confounding effects, although the inclusion of participants with a history of head injury may introduce variability and should be considered in future analyses. Overall, these findings suggest that diplopia is associated with altered visual behaviors, particularly reduced viewing distance and changes in glasses use, while other differences may exist but require larger samples and more objective measurement methods to confirm.

CONCLUSION

Patients with diplopia demonstrate altered digital device–use behaviors, including significantly closer viewing distances and increased removal of glasses during near tasks, suggesting compensatory strategies to manage visual symptoms. While screen time trended higher in the diplopia group, other measures were not significantly different, likely due to limited statistical power. These findings indicate a potential relationship between visual behavior and diplopia, though causality remains unclear. Future studies should stratify by age, given the potential impact of age-related changes in extraocular muscle function, and further investigate compensatory mechanisms such as viewing adaptations and prism use. Larger, longitudinal studies with objective measurements are needed to better understand these associations and inform clinical management.

REFERENCES