QUIET EYE AND EYE QUIETNESS
Electrooculographic methods to study ocular activity during motor skills

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1 | INTRODUCTION

Quiet Eye (QE) is the final ocular fixation on the target of an action (e.g., the ball in golf putting), prior to and following movement initiation. Eye-tracking research has revealed that experts have a longer QE than novices. Remarkably, the reason why a longer quiet eye aids movement has yet to be established. The aim of this study was to assess the utility of EOG to reveal expert-novice differences in ocular activity.

2 | METHODS

Participants: 10 experts (handicap $M = 1.5$) and 10 novices (no handicap).
Task: Putt 60 balls to a 2.4 m distant hole.
Measures:
1. QE, measured through multiple thresholds applied to the EOG signal
   - $QE_{pre}$: before backswing initiation
   - $QE_{post}$: after backswing initiation
   - $QE_{tot}$: $QE_{pre} + QE_{post}$
2. Eye Quietness (EQ) as $SD$ of the EOG in twelve 0.5 s intervals, from –4 to +2 s ($0$ s = backswing initiation)
3. Swing duration, as time from backswing initiation to putter-ball impact

3 | RESULTS

$QE_{tot}$ did not differ between groups (TABLE 1); however, experts had shorter $QE_{pre}$ and longer $QE_{post}$ than novices. There were no thresholds for which experts had longer $QE_{tot}$ than novices (FIGURE 2). Compared to novices, experts had less EQ before and greater EQ after backswing initiation (FIGURE 3). Experts had longer swing durations than novices (TABLE 1). Swing durations correlated positively with $QE_{post}$ ($r = .52, p = .02$) and negatively with EQ from $0.5$ to $1$ s ($r = -.63, p = .003$).

TABLE 1. Mean (SD) durations of the QE periods and swing for experts and novices, with the results of t-tests.

<table>
<thead>
<tr>
<th></th>
<th>Experts</th>
<th>Novices</th>
<th>$t(18)$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$QE_{tot}$ (s)</td>
<td>1.96 (0.48)</td>
<td>2.54 (1.69)</td>
<td>1.04</td>
<td>.31</td>
</tr>
<tr>
<td>$QE_{pre}$ (s)</td>
<td>1.02 (0.44)</td>
<td>2.00 (1.61)</td>
<td>1.86</td>
<td>.08</td>
</tr>
<tr>
<td>$QE_{post}$ (s)</td>
<td>0.94 (0.21)</td>
<td>0.55 (0.21)</td>
<td>4.17</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Swing (s)</td>
<td>0.90 (0.15)</td>
<td>0.71 (0.14)</td>
<td>2.87</td>
<td>.01</td>
</tr>
</tbody>
</table>

FIGURE 2. Mean durations of the QE period as a function of Group and Threshold (°). The shaded areas represent the SE of each group. The grey bar below the x-axis indicates $p < .05$ for indepent-sample t-tests.

4 | DISCUSSION

This study demonstrates the utility of EOG in motor control research and validates EQ as an index of ocular activity. These findings provide new evidence that expert-novice differences in ocular activity may reflect differences in the kinematics (e.g., movement duration) of how individuals execute skills.