



## Quiet eye training improves throw and catch performance in children



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### ARTICLE INFO

#### Article history:

Received 10 June 2013

Received in revised form

28 March 2014

Accepted 24 April 2014

Available online 15 May 2014

#### Keywords:

Skill acquisition

Fundamental motor skills

Visuomotor coordination

### ABSTRACT

**Objectives:** To compare quiet eye training (QET) and 'traditional' technical training (TT) interventions for a throw and catch task in children.

**Design:** This pilot study adopted a between groups randomized control design.

**Method:** Sixteen, 10 year-old typically developing children performed 10 pre- and 10 post-test trials before and after QET or TT, while wearing a Mobile Eye gaze registration system. Both interventions consisted of three video demonstrations (focusing on the throw, the catch, and linking the throw and catch) followed by a series of practice trials. QET videos emphasized gaze strategy instructions whereas TT videos emphasized traditional primary school throwing and catching instructions.

**Results:** Significant interaction effects for performance and quiet eye durations revealed that only the QET group significantly lengthened QE durations, which contributed to significant improvements in catching from pre- to post-test.

**Conclusions:** QET may be an effective method for improving throwing and catching skills in typically developing children.

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### Introduction

It is well documented that children's motor skill competence is an important factor for a healthy and active lifestyle (Haga, 2008). Indeed, significant inverse correlations have been reported between children's motor coordination abilities and their body mass index (D'Hondt et al., 2013). Effective interventions that help children improve their performance in the fundamental motor skills underpinning physical activity, playground games, and sport may therefore have clinical health benefits. The current study seeks to apply a novel, brief intervention approach – quiet eye training – to the learning of a particular fundamental motor skill; throwing and catching.

Children have generally learned the skill of ball catching by age 10, however, some children still find this task difficult (e.g., Przsucha & Maraj, 2010). Wilson and colleagues (Wilson, Miles, Vine, & Vickers, 2013) recently examined the gaze behavior of children of varying motor coordination abilities in a throw and catch task in order to better understand the causes of these difficulties. The authors used Vickers' (1996) quiet eye (QE) concept, which has reliably been shown to differentiate skilled performance

in both targeting and interception tasks (see Vickers, 2007). The QE is defined as the final fixation or tracking gaze to a target before the initiation of a planned motor response and has been proposed to reflect a critical period of cognitive processing during which the control parameters of a motor skill are programmed (Vickers, 1996, 2007).

Wilson et al. (2013) found significant group differences in both the duration of the targeting QE (preceding the throw) and the tracking QE (preceding the catch attempt); with more coordinated children having significantly longer targeting and tracking QE durations and better catching performance than less coordinated children. The authors suggested that the targeting and tracking QE durations represented the time needed to organize the neural networks underlying the throw and catch actions respectively. By extending the targeting QE duration, more coordinated children made more accurate throws, which in turn meant that they were able to initiate an earlier (and hence longer) tracking QE duration to support the catch attempt.

The aim of the current study is to develop and pilot test the efficacy of a quiet eye training (QET) intervention for throwing and catching in children, based on the findings of Wilson et al.'s (2013) cross-sectional study. While QET has not previously been used with children, previous research has demonstrated that it can expedite the skill learning process of novice adult performers (see Vine, Moore, & Wilson, 2014 for a recent review). For example, Vine

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and Wilson (2011) demonstrated that novice basketball players who were taught to use a long QE fixation on the hoop prior to free-throw shooting had a greater increase in free throw accuracy (pre- to post-test) than those trained using biomechanical cues. In line with these findings, we hypothesize that the QET children in the current study will reveal longer QE durations following training than their TT counterparts. Additionally, we hypothesize that although both groups of children are likely to improve their catching performance following training; this effect will be greater for the QET group.

## Method

### Participants

Thirty eight children (mean age, 10.32 years,  $SD = .57$ ) were recruited from two year-five (4th grade) classes in two primary schools and were randomly assigned to a QET or TT intervention group. The study received ethical approval from a local ethics committee prior to testing and the children and their parents provided informed written consent.

### Task

The catching task from the validated Movement Assessment Battery for Children (2nd Edition; MABC-2; Henderson, Sugden, & Barnett, 2007) was used to assess throwing and catching ability (as Wilson et al., 2013). Participants stood behind a line 2 m from a blank wall, at which they threw a tennis ball using an underarm action; attempting to catch the ball after it had rebounded, but before it struck the floor. To score a successful catch, the participant had to control the ball using only their hands, and once the ball had been thrown, the participant could step forward to catch the ball in front of the line. In accordance with Henderson et al. (2007) performance was assessed over 10 trials.

### QET and TT training interventions

Table 1 provides a summary of the content of the QET and TT instructional videos for the three phases of training. The QET videos were based on training the key QE behaviors uncovered by Wilson et al. (2013) for this task, and emphasized focusing gaze on an imaginary target on the wall prior to the throw, then continuously

tracking the ball as it came towards them prior to the catch. The TT instructional videos were based on 'best practice' for learning throwing and catching and emphasized a smooth arm swing through to the release of the ball when throwing, followed by assuming a readiness position and holding the hands in front to cushion the ball during the catch (Bunker, Hardy, Smith, & Almond, 1994).

Both sets of videos used a split-screen, vision-in-action approach (Vickers, 2007), presenting a synchronized view of an individual performing the task (right half of the screen) and concurrent footage from the eye-tracker revealing momentary point of gaze (left half of the screen). For the TT videos, the movement video was highlighted with a red border and the gaze footage dimmed (to make it less noticeable). For the QET videos the gaze data was highlighted and the motor data dimmed.

### Procedure

Testing and training sessions took place during the school day in a classroom that was dedicated to the study. Participants were tested individually and on arrival were fitted with an Applied Science Laboratories (ASL; Bedford, MA) Mobile Eye XG gaze registration system. Once calibration was complete, the gaze data were recorded wirelessly at 30 Hz onto a laptop (Lenovo R500 Thinkpad) using Eye Vision Software (ASL). The throw and catch task was first explained and demonstrated by the experimenter, and then participants were allowed five practice attempts (as per MABC-2 instructions; Henderson et al., 2007). Participants then completed ten pre-test trials before being randomly assigned to their training group.

The process was the same for both groups across the three phases of training. After watching each training video, the participants were asked to summarize the key points in order to check their understanding, before completing a number of practice trials. For the throw phase, participants completed 30 practice trials against the wall. For the catch phase, the experimenter delivered 30 throws from 2 m. For the final phase, participants completed 20 trials of the full MABC-2 throw and catch task. After every five attempts the researcher reviewed the QET or TT instructions related to that phase. Following a brief rest, participants completed 10 post-test trials of the MABC-2 task with no instructions (as pre-test). Total time for the testing and training was approximately 40–50 min.

**Table 1**

A summary of the instructions provided in the training videos for the quiet eye training (QET) and technical training (TT) interventions.

	QET video	TT video
1. Throw	(General introduction) "See how the girl takes her time to aim at a spot on the wall before she throws? For a good throw, you'll need to pick a spot or target to aim at. To aim, focus your eyes on this target and count to two before you start to throw. Remember; aim at your target, count to two and throw."	(General introduction) "See how the girl pauses before she starts a smooth even swing of her arm as she releases the ball. For a good throw, pause for the count to two in order to prepare. Then your arm needs to swing smoothly right through your release. Remember; pause and count to two, then use an even swing with a smooth release."
2. Catch	"Can you see how the girl keeps her eye focused on the ball tracking it all the way as it flies back into her outstretched hands? It's really important that you focus very hard on watching or tracking the ball as it comes back to you. When catching, track the ball right back into your hands. Remember; track the ball from as soon as you see it, until it's into your hands."	"Can you see how the girl watches the ball right into her outstretched hands? It's really important that you watch the ball into your hands. Focus on the ball as it comes into your outstretched hands. Remember; watch the ball all the way into your hands."
3. Link	(Reemphasize the first two training points) "The girl keeps her eye on the ball throughout its bounce off the wall. This is an important part in linking the throw and the catch. To link the skills you need to look right at the ball as it hits the wall as if trying to read the writing on it. This is very important to improve your catching. Remember; look right at where the ball is hitting the wall. Concentrate on watching it bounce." (Final summary of all three points)	(Reemphasize the first two training points) "After throwing the girl puts her hands together and reaches out in front of her as the ball approaches. This is called the ready position. To link the skills, you need to have your palms stuck together so there are no gaps for the ball to creep through. Then hold your hands out in front of you to cushion the ball safely back in. Remember; get your hands out in front of you with your palms stuck together in the ready position." (Final summary of all three points)

Total runtime of QET video = 179 s; TT video = 167 s.

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