# *TRAINING EYE HAND COORDINATION ON THE SVT™*

**This study was completed as part of an honours project in conjunction with the University of Western Sydney, The University of Sydney, Cumberland campus and the NSW Institute of Sport. For more information contact:**

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## Introduction

The aim of the proposed research is to determine if training with the Sports Vision Trainer (SVT™) will result in changes in eye hand coordination as ascertained by the Grooved Pegboard Test (GPT). This study will also establish if the SVT™ is a valid and reliable measure of eye-hand coordination. Eye hand coordination is an important variable in athletic performance. The development of a reliable and valid training tool will provide athletes and coaches with an effective tool for improving sports performance through improving eye hand Coordination. The SVT™ will also allow for valid reliable measurement presenting opportunities for improvements in general training. The SVT™ mimics the demands of many team sports including defence in netball or basketball, goal keeping in water polo or soccer and general passing and throwing movements involved in other ball sports. Testing and training on the SVT™ can identify weakness in visual-motor movements, and can also be used to assess any improvements in general or specific training periods/drills.

The SVT™ provides an alternative to traditional rehabilitation to assist in injuries where motor control is impaired, providing athletes with an alternative to physical activities during rehabilitation. In the wider community, the SVT™ may assist rehabilitation from cerebro-vascular and motor vehicle accidents and may assist in the development of fine and gross motor skills in children. Thus the development of a device that is a valid and reliable measure of eye-hand coordination is justified. Eye hand coordination is defined as a perceptual-motor skill involving the integration and processing in the central nervous system of visual and tactile information so that purposeful motor movements can be made. The Grooved Pegboard Test has been identified as an independent measure of eye-hand coordination improvement. The Grooved Pegboard Test is defined as a manipulative dexterity test where the individual is to pick up a peg, rotate and insert it into one of 25 randomly position slots. The objective is to insert all the pegs into the slots, one at a time, using only one hand. The aim is to do this as quickly as possible following a predetermined sequence.

### Testing and training eye hand coordination

Eye hand coordination as measured on the SVT™ is divided into 2 components, proaction (closed motor skill) and reaction (open motor skill). Proaction is a movement that is initiated by the individual, for example throwing a free throw in basketball. Reaction is a movement that occurs in response to another action initiated by another person, for example catching a pass from a team-mate. Proaction is tested and trained on the SVT by presenting lights that illuminate until the individual responds by hitting that light. The program waits until a response has been measured before proceeding to the next light. Reaction can be tested and trained by presenting lights at different speeds and if no response is measured in that time frame, no response is recorded for that light.

### Participants

The participants were 17 individuals who are affiliated with the University of Western Sydney, Macarthur. Of the 10 males and 7 females, the age range was 19 – 33 and the mean age was 23.47 years (SD = 3.79). The division into control or intervention group was reliant on the motivation and willingness of the participants. All participants were declared as active, and participated in sports including netball, basketball, rugby league, cricket, soccer, touch football and volleyball.

### Research tools

There were two devices used in this study. The first device that was used to test and train eye-hand coordination was the SVT™. The control device was the Grooved Pegboard Test.

### Procedure - Pre intervention testing protocol

All participants were tested on both the SVT™ and the Grooved Pegboard Test. The testing on the Grooved Pegboard Test involved the dominant hand and the non-dominant hand. The pre intervention testing session on the SVT™ tested proaction only. Proaction was measured on the SVT™ by the centre 16 lights (4 by 4 array) illuminating. Each light was selected twice, totalling 32 lights presented. Each participant completed two practice trials, followed by four test trials. There were two practice trials on the GPT for each hand, followed by two recorded trials on each hand. There was one minute’s rest between the practice and recorded trials.

**Training protocol**

The intervention group participated in five weeks of intensive training, three sessions per week for five weeks each session lasting approximately 30 minutes. The control group did not undergo any form of extra training. Throughout the training period, all sessions on the SVT™ were conducted in the reactive mode. An average of the participant's proaction trials was divided by 32, which gave an indication of average reaction time to the stimulus. This average time was set for training. Once the participant hits 80% or more of the lights presented, the time was decreased by 0.02 second.

**Post intervention testing protocol**

Post intervention testing followed the five-week training period. The testing on the SVT™ and GPT was repeated for both the control and intervention groups. The post intervention testing was identical to pre intervention testing.

**Results -Reliability**

The initial and final SVT™ data (four test trials) were analysed to determine if the SVT™ is a reliable tool for measuring eye-hand coordination. Correlations between the four trials on the SVT™ determined the reliability, or internal consistency.

The Pearson correlations (r) are presented in Table 1. The correlations identify that the initial trials on the SVT were significantly correlated ($p$ <0.01). Table 2 highlights the Pearson correlations (r) for the post intervention testing session. The correlations for the post intervention testing session were also significantly correlated ($p$ <0.01).

**Table 1**

Pearson Correlations (r) among SVT™: Pre Intervention Testing.

| | **Trial 1** | **Trial 2** | **Trial 3** | **Trial 4** |
|---|---|---|---|---|
| **Trial 1** | --- | 0.82** | 0.71** | 0.80** |
| **Trial 2** | | --- | 0.56** | 0.75** |
| **Trial 3** | | | --- | 0.80** |
| **Trial 4** | | | | --- |

* $p$ <0.05. ** $p$ <0.01.

**Table 2**

Pearson Correlations (r) among SVT™ : Post Intervention Testing

| | **Trial 1** | **Trial 2** | **Trial 3** | **Trial 4** |
|---|---|---|---|---|
| **Trial 1** | --- | 0.85** | 0.87** | 0.81** |
| **Trial 2** | | --- | 0.91** | 0.88** |
| **Trial 3** | | | --- | 0.94** |
| **Trial 4** | | | | --- |

* $p$ <0.05. ** $p$ <0.01.

**Validity**

All the pre and post intervention data was analysed, and correlations were determined comparing the SVT™ against the GPT. The average and fastest times were examined for the SVT™, the GPT dominant hand, and GPT non-dominant hand. The Pearson correlations (r) in Table 3 show that there was a significant correlation between the SVT™ and the GPT dominant hand regardless of session time, and for both average and fastest times ($p$ <0.01). There was a significant correlation between the SVT™ and the post intervention GPT non-dominant hand but only when measuring average time.

**Table 3**

Pearson correlations (r) among average and fastest times for the SVT™ and GPT dominant and GPT non-dominant hands.

| **SVT™** | **GPT Dom** | **GPT ndom** |
|---|---|---|
| **Average Times** | | |
| Pre Intervention | 0.60** | 0.39 |
| Post Intervention | 0.59** | 0.65** |
| **Fastest Times** | | |
| Pre Intervention | 0.84** | 0.30 |
| Post Intervention | 0.81** | 0.36 |

*$p$ < 0.05. ** $p$ <0.01

**Training effects**
A number of one-way analysis of variance (ANOVA), with group as the between subject factor, and time as the within subject measure was conducted on each measure: SVT™ and GPT. The ANOVAs attempted to identify changes in eye-hand coordination. Fastest and average times were analysed for all measures, and both dominant and non-dominant hands were measured for the GPT.

Pre and post intervention SVT™ average times were investigated. The main effect for the SVT™ was significant $F(1, 15) = 113.37$, $p<0.001$. There was also a significant interaction $F(1, 15) = 7.56$, $p = 0.02$. Similar results were found for the SVT fastest times, where there was a significant difference for the SVT™ $F(1, 15) = 123.25$, $p<0.001$ and interaction $F(1, 15) = 10.77$, $p = 0.005$. These results indicate training on the SVT™ altered the participant's eye-hand coordination measured by the SVT™ .

Post hoc comparisons were conducted to determine the significance of the interactions between group and time. Table 4 illustrates that the groups were only significantly different after the intervention on the SVT™ ($p<0.001$). Table 5 illustrates that both the control and intervention groups were significantly different between the pre intervention testing session and the post intervention testing session. These significant differences were found for both average and fastest times.

**Table 4**
Statistical Comparisons (p values) of average and fastest times between the Control group and the Intervention group.

| | **Average Times** | | **Fastest Times** | |
|---|---|---|---|---|
| | **GPT Dom** | **SVT** | **GPT Dom** | **SVT** |
| **Pre Intervention** | .864 | .674 | .472 | .798 |
| **Post Intervention** | .335 | .000** | .727 | .000** |

*$p < 0.05$. ** $p <0.01$

**Table 5**
Statistical Comparisons (p values) of average and fastest times between the Pre and Post Intervention Testing.

| | **Average Times** | | **Fastest Times** | |
|---|---|---|---|---|
| | **GPT Dom** | **SVT** | **GPT Dom** | **SVT** |
| **Intervention** | .031* | .000** | .033* | .000** |
| **Control** | .162 | .000** | .341 | .000** |

*$p < 0.05$. ** $p <0.01$

**Discussion**

This study established the SVT™ as a valid and reliable tool for measuring eye-hand coordination. Furthermore, it appears that training on the SVT™ significantly improves eye-hand coordination as measured by the SVT™. Training also significantly improved performance on the GPT dominant hand. The average and fastest times of the GPT non-dominant hand also improved, but this improvement was not significant. It is critical that Sports Vision practitioners and researchers continue to develop and assess the scientific validation of their equipment. This study has highlighted one such instrument in the complex area of vision and sports performance.