Stroke rehabilitation using the SVT

Sports vision optometrist **Colin Moulson** looks at the use of the Sports Vision Trainer in helping post stroke rehabilitation

Early in 2009, a friend of mine had the unfortunate experience of suffering a cerebrovascular accident (CVA), or stroke as it is commonly known. A stroke is the rapidly developing loss of brain function(s) due to disturbance in the blood supply to the brain. This can be due to ischaemia (lack of glucose and oxygen supply)[1] caused by thrombosis or embolism or due to a haemorrhage. As a result, the affected area of the brain is unable to function, leading to inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or inability to see one side of the visual field.[2]

I later learnt that this had left him with some debilitating after-effects. These were predominantly related to right-sided weakness affecting his arm and leg movement (walking) but not affecting his facial muscles or speech (this suggests the left side of the brain was affected). We discussed his symptoms at length and I was curious to see whether there was anything I could do to aid his rehabilitation.

Patient history

The patient in question is a 51-year-old customer services manager. A former amateur cricketer, he has a history of raised cholesterol but at the time of the CVA was on no medications. He now takes aspirin and an anti-coagulant. He has been a heavy smoker for many years. From an ocular standpoint, he is a long-standing amblyope. His latest refraction results are as follows:

R: +3.00DS Balance (<6/120)
Add + 2.00 <N48
L: +3.25/ -0.75 x 170 (6/5)
Add + 2.00 N5

The SVT board contains 80 touch-sensitive LED lights

His ocular history was otherwise unremarkable prior to the CVA. Following the stroke, he now has a right-sided relative afferent pupillary defect (RAPD). This was not present prior to the accident, so a letter was sent to his consultant to highlight this ocular change. There were no visual field defects noted. As you might expect, the patient is strongly left eye dominant and left handed.

Aims

The use of hand-eye coordination as part of a stroke rehabilitation programme is not a new one. There is some evidence in the literature[3] to suggest that it can be successful. However, I am unaware of any work specifically using the Sports Vision Trainer – SVT (which I now use predominantly in my clinic) in this way. I was keen to discover whether this was possible, so suggested it to my friend. He was equally keen to do anything he could to improve his movement and coordination following the stroke, so we decided to plan a rehabilitation programme.

Testing protocol

The SVT consists of a large electronic board, which is wall mounted. This is connected to a laptop or desktop computer using a cable to its printer port. The board contains 80 touch-sensitive LED lights. There are 10 vertical lines and eight horizontal lines of lights. It is usually used to enhance the hand-eye coordination of elite athletes.

Ordinarily, lights are illuminated on the SVT panel one at a time and the athlete uses either hand to extinguish the light by touching it. However, in this scenario, as we were looking to improve right-sided movement and coordination, the drills would be done predominantly using the right hand only. By way of a control (to estimate the effects of learning by repeated use) a two-handed drill would be undertaken at each session and the results recorded.

The manufacturers of the SVT recommend that training should consist of sessions of approximately half an hour up to three times per

week. A block of training should consist of 10-15 sessions. This would provide the broad framework for this rehabilitation programme, with the caveat that it may change if at any point it appeared unsuitable.

Adaptations

Almost as soon as testing and training began, some issues showed themselves. As mentioned earlier, one of the great advantages of the SVT is that it is software driven. This is great when dealing with athletes as it allows accurate comparisons and benchmarks to be set. It also allows accurate logging of a patient's progress. However, one issue here was that the pre-programmed assessment and training functions were just too fast for the non-athlete CVA patient. Fortunately, the SVT does allow customisation of each programme, so a new (slower) testing and training regime was designed.

The second issue was a simpler (and much more obvious) one. It was simply a matter of patient fatigue. Whereas an athlete can quite happily go through a 30-minute session without tiring, the CVA patient had to regularly stop for recovery and could only sustain sessions of approximately 20 minutes at a time.

Results

The SVT has three main modes of operation – proaction, reaction and reaction random. In this experiment, only the first two were used. In the proaction mode, the lights are lit one at a time and will only change location once the patient has touched the light. In the reaction mode, the lights are again lit one at a time but they only stay illuminated for a set period of time. If the patient does not touch the light within this time, the light will go out and another location will become illuminated. In either scenario, a lower score is better, with the patient looking to lower his times. Also of note, improvements in scores are usually small in magnitude (improvements in reactive scores of as little as 0.04 seconds are significant).

At initial testing, the patient's responses were much lower than usually seen when working with athletes (an average proaction time for an athlete is 11.22 seconds for 20 lights, albeit using both hands). Here the responses were 14.11 seconds for the right hand and 13.97 seconds for the left hand. As expected, there was a difference between the left and right hands, with the left hand 0.14 seconds faster than the right.

When measuring the reactive times, the difference compared to athletes was much greater. Our patient achieved scores of 0.73 seconds for his right hand and 0.72 seconds for his left hand compared to an average of 0.44 seconds for an athlete.

As detailed above, training was undertaken using the right hand only. Initially drills were undertaken utilising 10 lights per drill. This is easier for the patient and allows them to build familiarity with the equipment. Once a significant improvement had been made, the patient progressed onto drills of 20 lights. A steady improvement can be seen during the training period.

During the course of the programme the patient achieved the following results:

- Right hand only proaction scores (20 lights) improved from 14.11 seconds down to 9.43 seconds at its peak
- A faster score was achieved with his right hand at completion (9.43) than with his dominant, left hand (9.77)
- Reaction scores also improved markedly from 0.73 (with right hand only) to 0.51 seconds
- Reaction scores were equal for right and left hands at the end of the programme.

When considering the control measurements (using both hands together) a learning curve is evident as the patient gets better at using the equipment. Even taking this into account, a significant improvement in eye-hand coordination is measured.

As well as the clinical data, to try to gauge the patient's feelings on the rehabilitation programme, a questionnaire was issued, the results of which are shown in Figure 3.

Conclusions

Although not specifically designed for this purpose, there is enough evidence to suggest that the Sports Vision Trainer (SVT) could be useful in the rehabilitation of CVA patients. In this case study, the patient achieved significant improvement in coordination and confidence following its use. Further studies are required to ascertain the best ways to provide this service to patients.

References

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