10-metre Shuttle Run Test

Description

The 10-metre shuttle run test is an adapted version of the 20-metre shuttle run test to accommodate children with cerebral palsy (CP) classified at Level I or Level II on the Gross Motor Function Classification System (GMFCS) (Verschuren et al 2006). Separate protocols were designed for each level (SRT-I and SRT-2). The course is 10 metres long; the end is marked with 2 cones and measuring tape. Subjects should wear regular sports clothing and shoes, and orthoses, if applicable. Each child should also wear a heart rate monitor. Children walk or run between the 2 markers at a set incremental speed. These runs are synchronised with a pre-recorded CD, which plays beeps at set intervals. As the test proceeds, the interval between each successive beep reduces, forcing the child to increase speed over the course of the test, until it is impossible to keep in sync with the recording. There are 2 protocols available for the shuttle run test. The Level I shuttle run test (SRT-I) is for children classified at GMFCS Level 1 (ie, able to walk indoors and outdoors without restrictions). The SRT-I starts at 5 km/h. The Level II shuttle run test (SRT-II) is for children classified at GMFCS Level 2 (ie, able to walk indoors and outdoors with restrictions). The SRT-II starts at 2 km/h. Speed is increased 0.25 km/h every level (minute) for both tests.

Reliability, validity and sensitivity to change: The test-retest reliability for exercise time (ICC coefficients of 0.97 for the SRT-I and 0.99 for the SRT-II) and reliability for peak heart rate attained during the final level (ICC coefficients of 0.87 for the SRT-I and 0.94 for the SRT-II) are good. High correlations were found for the relationship between data for both shuttle run tests and data for the treadmill test (both $r = 0.96$). The test has also been shown to be sensitive to change in children with CP (Verschuren et al 2007). Change in a child’s performance of more than 0.84 minute (one level) for the SRT-I and of more than 0.50 minute (half level) for SRT-II can be attributed to real change with 95% confidence.

Commentary

Field tests of aerobic capacity can provide valid, reliable outcome measurements without the burden of expensive equipment in a sophisticated laboratory setting. Although they were developed almost 30 years ago, shuttle run tests are the most widely used field tests to estimate aerobic capacity (Leger and Lambert 1982). For children who are able to walk independently, the most functional way to assess their aerobic capacity would be a walking- or running-based exercise test. The treadmill protocols that are often used in clinical practice are not appropriate for children with CP. For most children with CP who have problems with movement co-ordination and an equinus position of the foot, the increasing speed and inclining floor are problematic.

For many children, adolescents, and adults with physical disabilities, the 20-m shuttle test is not suitable, because the starting speed (8 km/h) and increase (0.5 km/h) every minute are beyond their capabilities. A continuous progressive exercise lasting between 6 and 17 minutes is optimal for achieving a maximal effort. Both 10-m protocols might be an alternative test to measure aerobic capacity. To choose between the two protocols the 6 minute walk test can be used. If a person walks less than 350 m (< 3.5 km/hr) the SRT-II protocol should be used. If a person walks more than 350 m (> 3.5 km/hr) the SRT-I should be used.

Some people may encounter difficulty in pacing their running speed with the audio signal. Therefore, it is recommended that during the first stages of the test, a ‘pace’ might assist the test subject. Once the person understands the instructions, he or she can continue the test without assistance.

Shuttle run tests can be administered easily in a clinical setting. The only requirements are a set of pre-recorded CDs, a 12 metre corridor or exercise room, four cones, measuring tape, a stop-watch, a heart rate monitor, and preferably two test leaders. The heart rate is read from the wrist monitor at the end of the test and noted on a recording sheet. This heart rate can be used to check whether a person has performed maximally (heart rate > 180 bpm).

In summary, shuttle run tests are non-threatening, safe, and can be performed easily. The subject can terminate the test at any point, however the person should be encouraged to produce maximal effort. Moreover, as shuttle run tests require a person to either run or walk between 2 lines, the test does not require acquisition of new skills. Shuttle run tests can be widely used, and seem to be a useful field test for evaluating the aerobic capacity of patients.

Olaf Verschuren
Rehabilitation Centre De Hoogstraat, and
University Medical Centre, Utrecht, The Netherlands

Tim Takken
University Medical Centre Utrecht, The Netherlands

References

The Pain Catastrophising Scale

Description

The Pain Catastrophising Scale (PCS) (Sullivan et al 1995) consists of 13 items related to thoughts and feelings about pain. Patients are instructed to rate the degree to which they experience each item when they are in pain on a five-point scale. Responses range from 0 (‘Not at all’) to 4 (‘All the time’). Items are summed to give a total PCS score. Subscale scores of rumination, magnification, and helplessness can also be calculated. It is readily available from websites (eg, www.tac.gov.au).


Asymptomatic volunteers scoring highly on the PCS (≥ 24) report significantly higher pain during the cold pressor test and painful medical procedures than patients with lower scores (Sullivan et al 1995). Total PCS scores have been reported to be able to discriminate between randomly selected healthy volunteers and patients recruited from pain and rehabilitation centres in 77.1% of cases (Osman et al 2000).

Reliability: Cronbach’s alpha in healthy volunteers for PCS total scores and subscale scores range from 0.60 to 0.90 in two large sample studies (D’Eon et al 2004, Sullivan et al 1995). Data for internal consistency in symptomatic studies have varied from acceptable (ICC = 0.63–0.71) (Lame et al 2008) to excellent (alpha = 0.91–0.94) (Papaioannou et al 2009).

The test-retest reliability of the PCS has not been investigated widely. Sullivan et al (1995) reported moderate to good test retest reliability (r = 0.70–0.75) in healthy controls over a 6–12 week interval. However these data refer to the total score only and not to subscale scores.

Gender effect: Females score higher than males on PCS total scores and subscale scores for rumination and helplessness (Osman et al 2000, Osman et al 1997). Despite this, factor analysis has shown that the three-factor solution is consistent across genders (Van Damme et al 2002).

Predictive capacity: PCS total scores and gender have been reported to explain 81% of the variance in resting pain in patients scheduled for lumbar fusion surgery. PCS was a significant predictor of post-operative pain on activity and total analgesic use (Papaioannou et al 2009). Total PCS scores have also been found to significantly predict physical functioning in patients with FM (Karsdorp and Vlaeyen 2009) and ongoing pain following total knee arthroplasty at two year follow up (Forsythe et al 2008). Contrasting results were reported by Meyer et al (2009) who found that PCS scores did not significantly predict average intensity of pain in patients with CLBP.

Commentary

Catastrophisation is defined as an elevated negative cognitive response to painful stimuli (Sullivan et al 1995). There is a growing body of evidence suggesting that catastrophisation contributes significantly to the development of ongoing pain and disability, particularly in musculoskeletal pain patients (Smeets et al 2006). Active treatment programs including cognitive behavioural therapy (CBT) and general physical activity have been found to have a beneficial effect in patients with CLBP and appear at least in part to work through reducing levels of catastrophisation (Smeets et al 2006). The identification of patients with high levels of catastrophisation may thus be important in directing patients with musculoskeletal pain to appropriate rehabilitation strategies.

This tool provides a means through which to assess those patients who may be at risk of ongoing pain and who may benefit from management strategies which challenge negative cognitive responses to pain. However there are currently little data available regarding the test-retest reliability, sensitivity to change, and clinically meaningful change of the PCS. Further research investigating these dimensions of the PCS would significantly increase the clinical utility of this tool.

References