Fitness and Injury Screen for Adolescent Climbers

2015-2016

Introduction

The purpose of this pack is to provide instructions and guidance in the delivery of a performance and injury prevention programme to be delivered by coaches within climbing walls.
This pack supports a specific training course the attendance on which should be considered essential before attempting to apply the tests described herein.

There is plenty of evidence to support screening (go to dannybrownclimbing.com/my-articles/ for a full review of the evidence).

The tests as described have been selected according to the following criteria:

- Assesses overall stability and function of the musculoskeletal system to best judge its propensity to injury.
- All tests are easily performed and replicable between practitioners.
- Requires minimal equipment and can be carried out within a normal climbing wall environment.

All data should be stored securely on a suitable database (an Excel version is easy to create). It might be easier to collect the information using a paper based system which is then attached to a clipboard and collected by each individual throughout the process

Initially it is important to collect simple anthropometric data:

- Gender
- Age
- Height
- Weight

The group assessments can be carried out en-masse with individuals recording their own scores. The individual tests should ordinarily be carried out by 1 coach per-person with the full protocol taking 100 minutes per 20 participants to complete.

Upon completion participants are encouraged to engage in a 10 minute cool down such as 5 minutes on a bike or gentle rowing and some static relax positions.

Equipment required

- Measuring scales and tape measure/height measure.
- Marking tape
- Benches/steps
- Cones
- Water bottle.
- Stopwatch

Overview

Testing phase	Timings	Specifics
Phase 1 – Anthropometric Data Collection	10 minutes Group Session	
Phase 2 – Warm up	10 minutes Group Session	Warm up
Phase 3 – General Physical Bench marking	20 minutes	Plank
		5 step hop
		Box jump
		Water bottle bear crawl
		Blind Single Leg Stand
Phase 4 – Climbing Physical Bench marking	20 minutes	Assorted
Phase 5 – Physiological measurements	20 minutes	Grip strength
		Beighton score
		Ape index
		Standing SLR
Phase 6 – Special Tests	20 minutes	Single Knee dip
		Empty can/full can
		Latissimus test

Recording the data

It is possible to easily produce an Excel analysis package similar to below

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Fitness and Injury Screen for Adolescent Skiers							Name of Athlete:							
2															
3	Athlete det	Gender	M	Anthropometric data				Physical Benchmarking							
4	Date of test	Test number		Age	Height (cms)	Weight (kgs)		Plank (time in seconds)	5-hop distance test	(total distance)	Box jump (total number)	Water bottle bear crawl (tot dist)	Blind single leg stand	(secs)	
5									LEFT	RIGHT			LEFT	RIGHT	
6	05/10/2015	1		14	160	60		50	12	10	9	30	120	80	
7	05/12/2015	2		14	162	62		60	14	13	9	32	120	90	
8	Analysis 1				2	2		20	16.7	30	0	6.7	0	12.5	
9		3													
10		4													
11	Analysis 2														
12		5													
13		6													
14	Analysis 3														
15		7													
16		8													
17	Annual Analysis														

Phase 1 – Anthropometric data collection

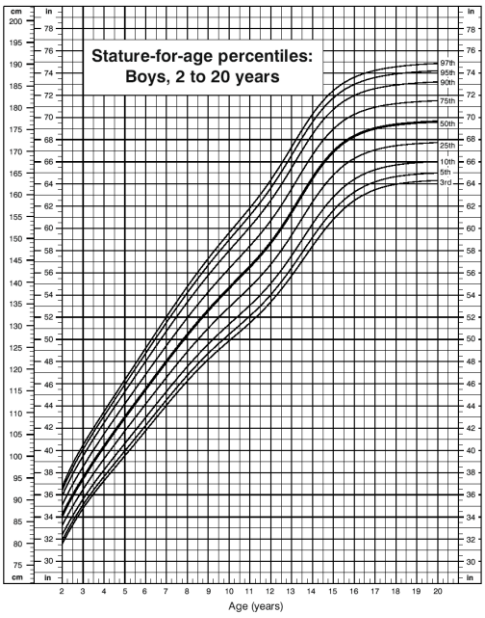
Age and gender are essential to allow comparison to statistical norms.

Height and weight: these can be taken as a once yearly measurement but are not, on their own particularly revealing but can provide us with some statistical norms from which to compare other measurements.

Using Growth Charts

Most parents are familiar with them but they are not sensitive enough to be of use in the short term and should only be introduced to your climbers under the age of 10 years who you think may be with you for some years. On the whole they will only show a change in growth in the long term and after it has happened. Looking out for significant slow-downs in growth is important but probably beyond the remit of a coach. As a coach you need to be able to identify a growth spurt. This is when the growth plates in a child's body are most vulnerable to damage and they should reign in their training. The most effective way to do this is to have a wall mounted measure and use it weekly. A significant jump in their height should mean the start of a growth spurt and therefore the commencement of a maintenance and mileage programme.

These measurements can also be used to calculate BMI (body mass index – a standard measurement of health. However BMI for children is not as straightforward so a specialist BMI calculator of children should be used (http://www.weightconcern.org.uk/node/9).
The risk for climbers is not becoming overweight but *underweight* and this should be carefully monitored. Correct coaching and providing good role models are important.



Phase 2 – Warm up

Prior to testing the participant should be adequately prepared by warming up and mobilising all joints for at least 10 minutes. Static stretching should also be included prior to the tests as some will require taking the joints to end of range.

Phase 3 – General Physical Benchmarking

This is a test of the athletes overall preparedness for activity and not a specific series of tests. It should be done as a group and should be fun with athletes measuring themselves or each other.

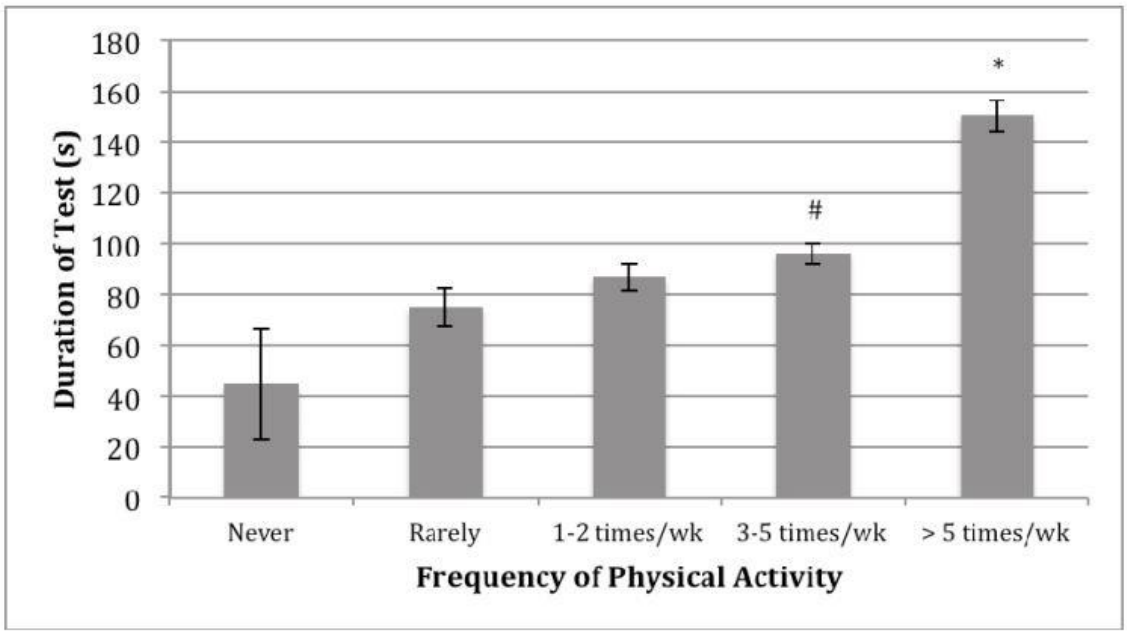
The physical benchmarking tests address issues of core and overall strength and fitness specifically but it is important to note that there are other tests which are just as good and the ones used should be based upon the coaching team's preference.

Each test has a specific aim:

- Plank – core strength
- 5-hop – overall strength, balance and coordination
- Box jump – cardiovascular ability
- Bear crawl – body tension and control
- Blind single leg stand – proprioception and balance

1. **Plank**

The length of time a person can hold a plank correlates directly to their exercise levels:



It is a simple test and can be carries out en-masse.

Fig 1: The Plank

2. 5-hop test

Apparatus: Tape measure

Component tested: Stability; power

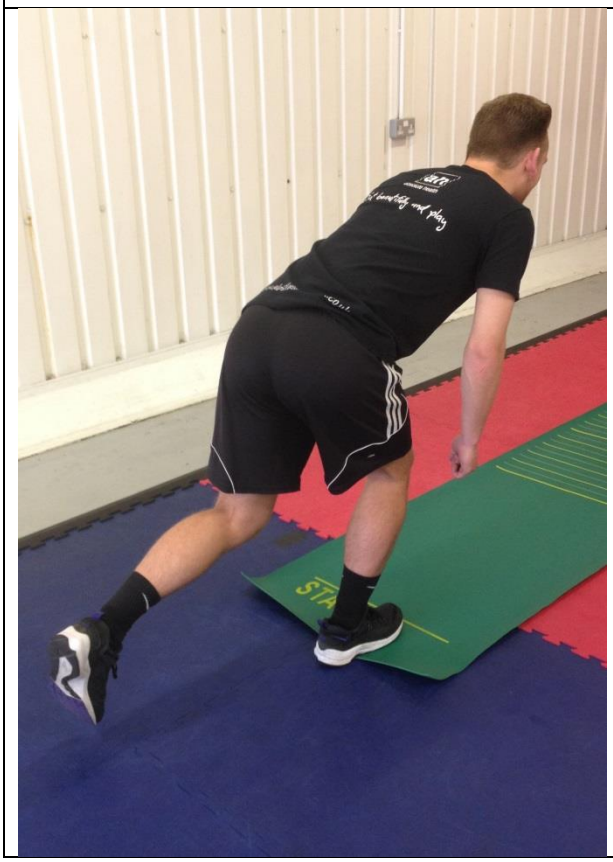
This test is conducted by measuring out a distance of approximately 15 meters (this is sufficient distance for most adult athletes…few will exceed this).

The athlete gets 2 attempts at each test for each leg:

The athlete starts with both toes behind the line, standing on the both legs. The athlete then hops onto one leg performing 5 consecutive hops on one leg. The athlete must land on the same leg following the 5th jump with the foot firmly planted in position for measurement (the athlete may touch down the other foot to gain balance.)

Measurement is taken from behind the heel. Repeat for the opposite foot. Athlete gets 2 attempts on each side. The jumps must be in a straight line and performed in a continuous motion.

Fig 2: 5 step hop. A special jump mat may can be used



3. Box Jump

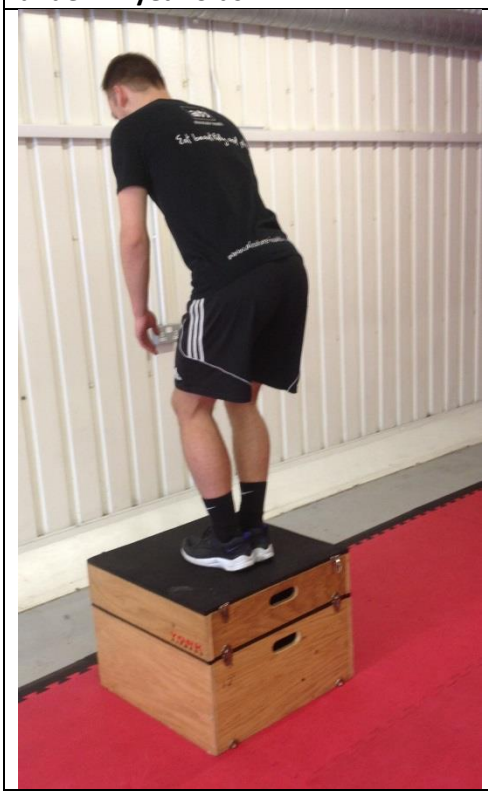
Apparatus: Standard step aerobics box 40cm or 60cm, 4 spotters

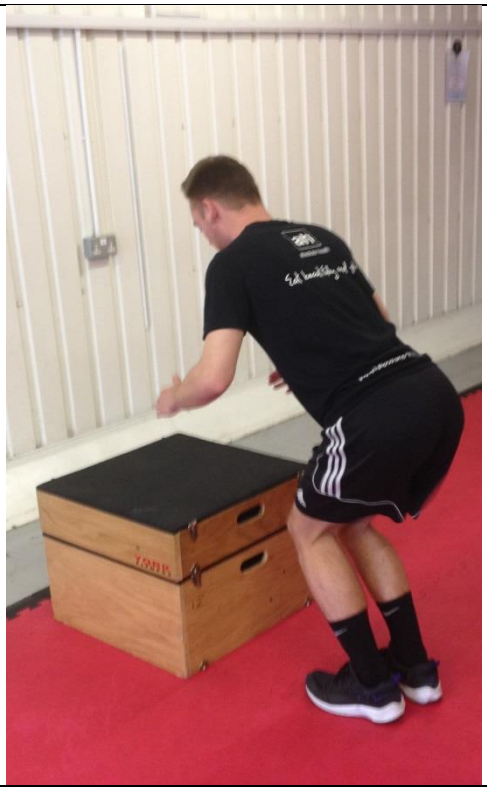
Component tested: Anaerobic lactic endurance

This test uses a step box. Spotters are recommended for safety in case the athlete falls forward during the test (this is quite common). 2 spotters cover the athlete as they perform the test. The aim is for the athlete to complete as many jumps on and off the box as possible in 90 sec's. It should be noted that this is an exhausting test – consider when the best time is to do it.

Note, both feet must take off and land at the same time and both feet should land completely on the box – only these efforts should be counted.

Fig 3: Ensure you encourage the participant to land in the middle of the box. Use the 40 cm box for under 14 year olds.





4. Water Bottle Bear Crawl

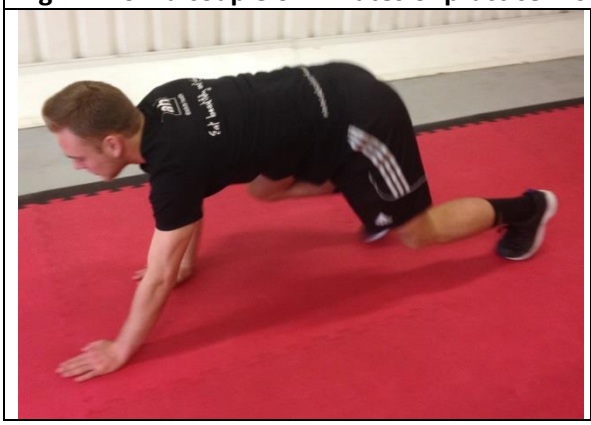
This test measures the ability to maintain dynamic control at the shoulder, trunk and hips, whilst completing forward and reverse crawling patterns.
For over 14 yr olds (only) a filled water bottle should be rested on top of the athletes' lumbar spine (low back) in a horizontal, across body position (as pictured). The use of a water bottle can be done as a training exercise and learning tool for younger athletes.
The water bottle serves as constant feedback to the athlete that crawling reps must be completed with a neutral spine and good pelvic positioning. If a neutral posture is lost the water bottle will drop to floor indicating distance travelled (marked at the hands) and the limit of the athlete's dynamic control and capacity.

How to conduct the Bear Crawl evaluation:
First measure a 5m straight line marked with a single cone at the start and end points.

- Begin by setting up on all fours with hands behind the start cone, (for over 14's) place a full 2 Litre sized bottle across the low back region
- Then crawl 5m to the next cone by simultaneously lifting opposing hand and foot, reach forward and place down on the floor ahead of the body, continue this motion with opposite hand and foot repeatedly.
- When both hands arrive at the end cone crawl in reverse until both feet reach the 5m start cone, and repeat.
- Dragging or sliding of hands and feet are not allowed.
- Crawling is performed continuously until the water bottle drops to the floor, or the athlete cannot complete further distance.

Athletes under the age of 14yrs should complete this evaluation over the same distance without a water bottle on their back. A score is obtained by measuring crawling distance until *either loss of form* or fatigue occurs.
Should an athlete 'rest' by putting down a knee they are then excluded.
After practicing crawling technique a couple of times, the athlete is permitted 2 attempts to log a total score with a 30minute rest period permitted between attempts.
Total distance covered in forwards and backwards directions is summed as the 'total score' this should be logged in metres (m) and taken from where the hands finish

Fig 4: Allow a couple of minutes of practice first. Use a water bottle only with over 14 year olds.



5. Blind Single Leg Stand

This is a test of stability, balance and proprioception.
There are normative values for all adult age ranges but it is felt that a 10 year old child should have acquired a comparable level of balance as that of an adult.
Hopping is not permitted – the standing foot should not move save for minor changes in position. Athletes are excluded when they begin to hop to maintain balance.

A fit healthy 18 yr. old should manage between 15 seconds and 1 minute.

Fig 5: Blind single leg stand

Phase 4 – Climbing Physical Benchmarking

The exercises here can and should be determined by the coaching team. The ones below are good examples but are not, by any means the only possibilities. Whatever exercises are used they should be safe, suitable for the athletes and easily deliverable within the environment i.e. an L-hang is only possible with an appropriate appliance.
Some exercises should be altered to suit girls (muscular and biomechanical differences combined with growth means this is essential. 'Girl press-ups' are exactly that; press-ups appropriate for girls).
4 exercises should be chosen. They should be done for a period of 30-90 seconds or to fatigue; make sure it is recorded correctly.

As a guideline exercises that could be considered are:

- Press-ups
- Sit-ups
- Pull-ups
- L-hangs
- Half L-hangs
- Lock offs
- Dead hangs
- Burpees
- Corner bridge

Phase 5 – Physiological measurements

This phase is for establishing some simple values from which comparisons can be made, evidence collected for possible research purposes and which can be compared directly with statistical norms.

This is not to say that all children should fit a specific 'type' merely that only by measuring is it possible to sport outliers i.e. someone who is radically different and may need further investigation or more importantly, the generation of a more athlete focussed coaching regimen.

As an example someone might not know that they are hypermobile (test 2) but this wouldn't necessarily affect their climbing and apart from acknowledging it no further action need be taken apart from suitable strengthening exercises**.**

As the coaching team produce more information it is then possible to track significant changes and correlate this with performance and injury rehabilitation.
It is important not to get too bogged down with information as it then becomes difficult to analyse. There are a multitude of specific tests that a physiotherapist might perform and many of the results are subjective – the ones listed below are easy to measure, record and analyse.

1. Grip Strength

This seemingly innocuous test has recently been linked to intelligence and longevity (in adults) and as well as this it is always fun. However it doesn't correlate strongly with climbing ability i.e. some climbers who can climb above 8a have relatively weak grip (i.e. women) and men who have strong grips do not necessarily climb hard. There is a direct correlation with size and grip strength so you can see that a big, 20 stone, non-climber could have (and probably does) a stronger grip than a 10 stoner who climbs.
However, that said climbers *do* have, on average a 12% stronger grip compared with their demographic equals who do not climb.
Climbers also have a more equal grip between left and right and a stronger 'inner range' grip i.e. the ability to hold onto something overhanging (the easiest description I could think of).

In kids none of this is adequately measured or analysed to be able to draw conclusions however it is still a valid test. Why? If you have two climbers, ostensibly the same climbing the same grade and one has a stronger grip than the other then this would be a significant factor informing your coaching.

For this test you need a dynamometer – approximately £20 for a 'non-scientific' one from Amazon. £300 for a proper one.

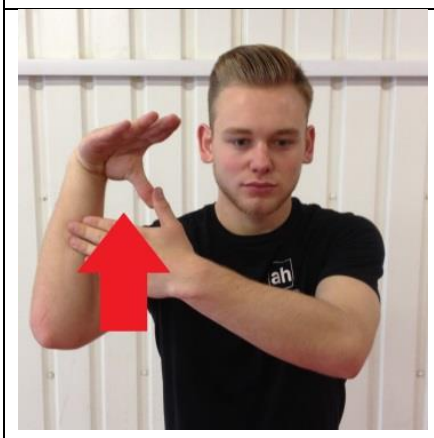
Method

Hold the device by the side, squeeze hard for 1 second and repeat for 3 times and take an average.

2. Beighton Score: or hypermobility score out of 9.

The Beighton score is a test for hypermobility and uses 9 signs, 4 which are repeated left to right and the 5th is bilateral.

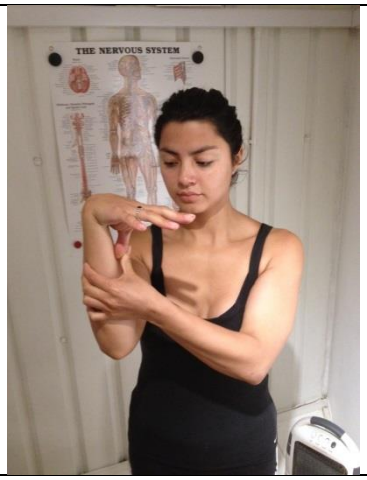
Fig 6: 2 examples of relative joint laxity – low and high

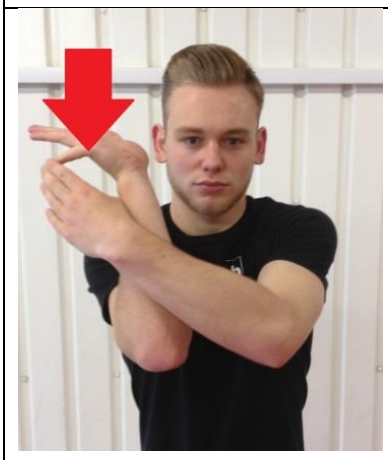


Score 1 point for each thumb that touches the wrist easily in this position.

←Harrison scores zero

Natali scores 2→

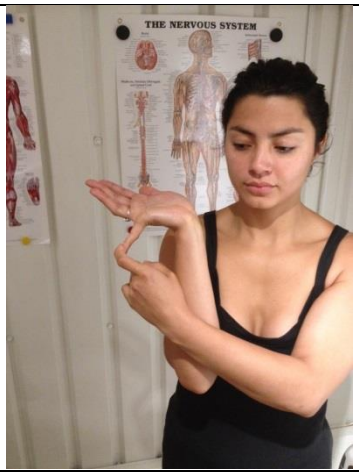


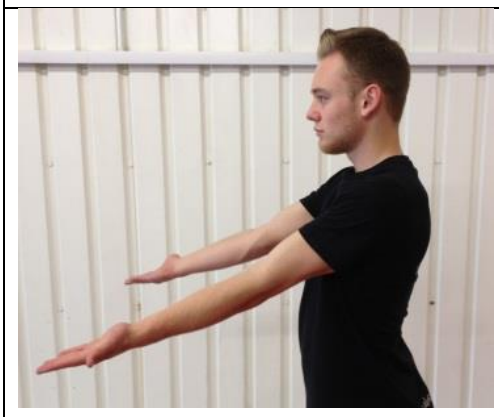


1 more point for each pinky that can be bent to 90 degrees easily

←Harrison zero

Natali also zero, but close→



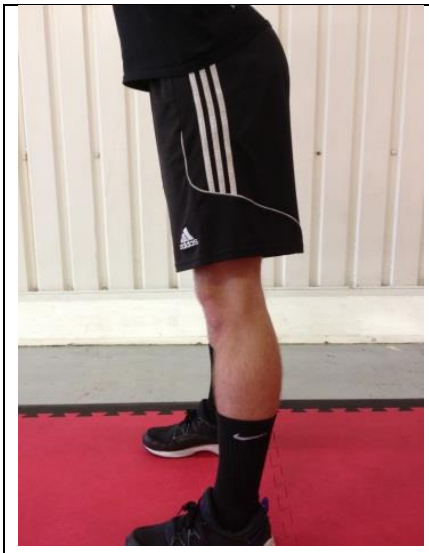
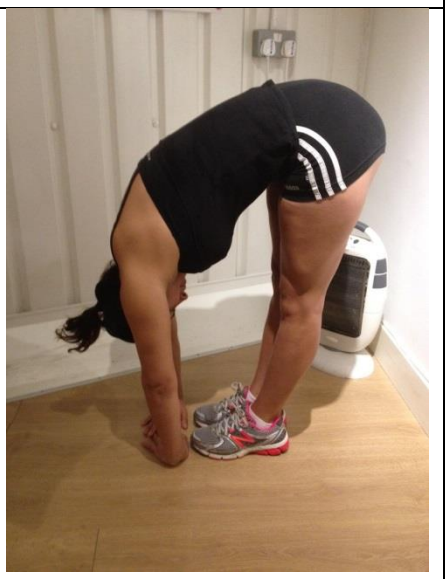


Do the elbows hyperextend?

←Harrison 0

Christina 2 →

Beighton Score – 2

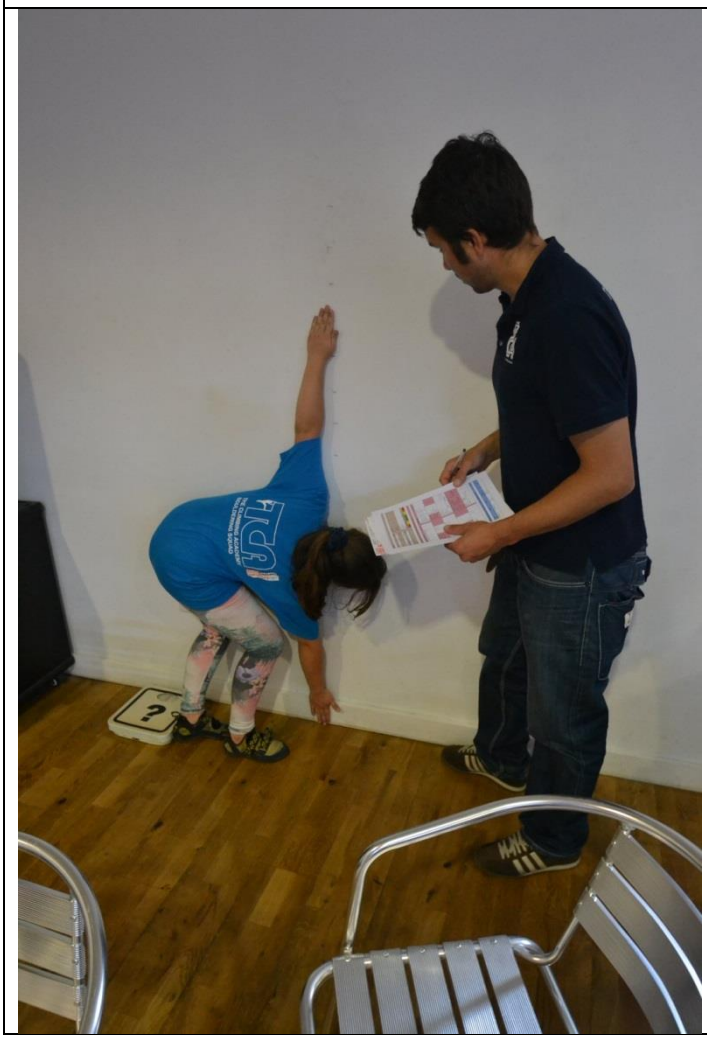
	**1 point for each knee that hyperextends** **🡐 0 for Harrison** **To the left we can clearly see the angle of a 'normally' hypermobile knee →**	
	**And finally 1 point for being able to press your hands on the floor with your knees locked out.** **🡐 Harrison 0** **Natali 1 → (worth noting here that Natali's knees and elbows do not hyperextend)**	

Only a score of 9/9 is considered hypermobility syndrome – lower but significant scores should also be referred to the physiotherapist.

3. Ape Index

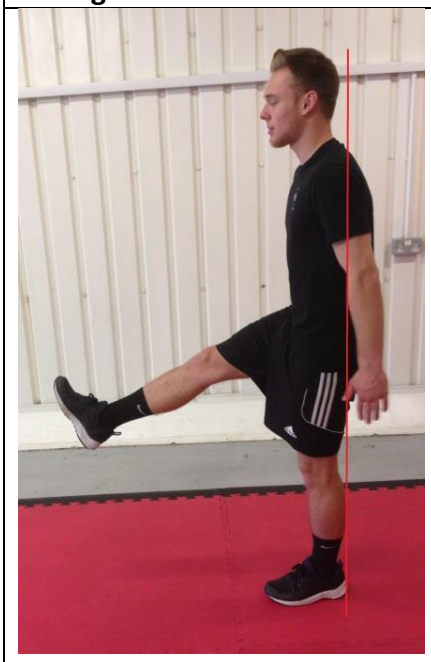
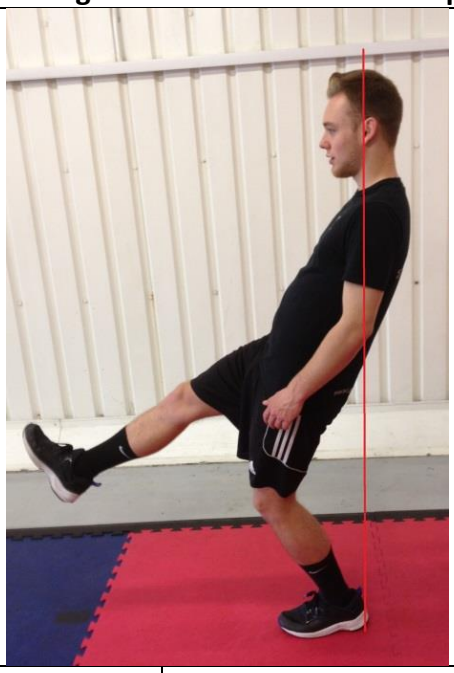
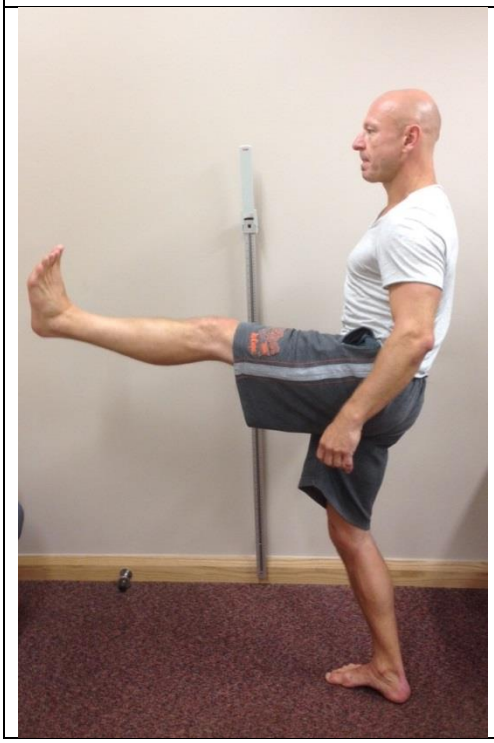
The ape index is well known to all climbers; the difference between height and span. Here we measure in cms. The easiest way is for a climber to stand against the wall and put their hand against the wall at the crown of their head and then turn around, reach the ground and see how far over or under they are.
A more accurate way it to work in pairs and use a measure of some descripton.

Fig 7: Measuring ape index



4. Standing Straight Leg Raise (SSLR)

This is an excellent test of strength, control, core strength, stability, hamstring length and balance

<table>
<tr><th colspan="2">Fig 8: Although the measurement is in degrees of lift there is more to analyse</th></tr>
<tr><td>Normal upright posture – approx 70 degrees.</td><td>Tight hamstrings force Harrison backwards when asked to lift higher with no discernable improvement in the lift</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Mark has excellent control, stability and strength as well as flexibility – a martial artist and 58 years old.</td><td>Here we can see Steven has poor core strength causing his trunk to collapse</td></tr>
<tr><td>  </td><td>  </td></tr>
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Phase 6 – Special Tests

These are a series of simple, easily replicable tests which can be incorporated into an injury screen safely. No end of range testing or excessive force is used and done properly can help the coach analyse all the data more carefully.

Scoring the tests should be done simply and allows for repeated analysis by the coaching team and doesn't allow for mis-interpretation of the data.

- ✓ - the test is performed perfectly – no follow up required
- X – there is instability or imbalance and should be addressed in their training
- (p+) Pain positive outcome – refer to medical team

Importantly these tests can be mis-interpreted so this is not a 'right/wrong' outcome, merely further evidence to contribute to an overall analysis. Should any of the tests show a pain positive outcome the candidate should be referred for further testing to the medical team.

1. Single knee dip

This is a test of hip stability. Things to look for during the test that suggest hip instability include:

- A dropping of the hip
- Leaning over the planted foot
- The knee on the planted foot moving inwards
- The other knee being pulled outwards

Fig 9: Single Knee dip

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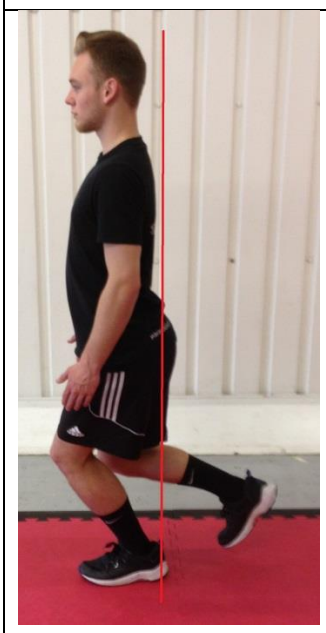
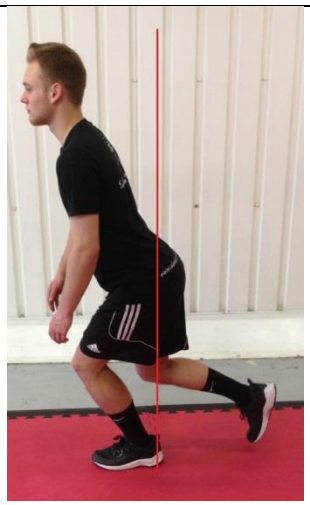
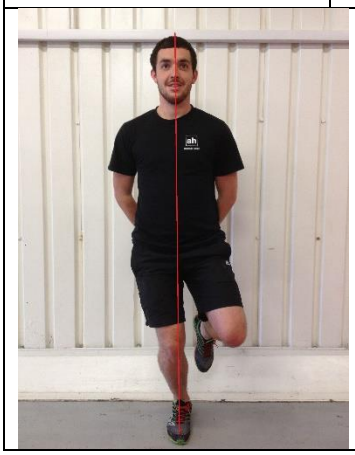
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Here Harrison is struggling to maintain an upright stance with a marked lower back curve, forward tiliting pelvis and very little ham activation</td><td>This is how he ‘normally’ moved when asked to do the test. Note that the lower back arch is still present</td><td>From the front Harrison demonstartes has good hip stability but his core does collapse a little with the effort</td><td>Aaron, however has obvious instability as his knee crosses his midline when dipping. He does demonstrate excellent core stability however</td></tr>
<tr><td>  </td><td colspan="3">Here Steve has a good single leg dip with nice mid-line and an upright position</td></tr>
</table>

2. Full can/empty can

This tests looks at the overall stability of the shoulder and specifically the strength of the supraspinatus muscle – frequently weak and/or damaged in climbers

Fig 9: Remember to position the arm in the 'scapula plane'; not straight in front or out to the side	
Full can	**Empty can**
	
Gentle and consistent pressure is applied downwards to an outstretched hand held as though it was holding a can of pop; arm at 45 degrees from the horizontal and front with elbow slightly bent.	**The arm is then turned inwards as though emptying the can of pop and then the steady downwards pressure I reapplied.** **Observe the movement at the shoulder during the 'emptying' process – do they lift?**

3. Latissimus Dorsi Test

Latissimus dorsi tightness; this can be done in lying or against a wall. An increase in the arch of the back suggests tightness.

Fig 10: Latissimus test

This is an easy way to test for tight lats but not as reliable

Here Steve can be easily seen as having tight lats as my hand and arm go a long way behind his back. This test is more reliable