How do we Climb?

A long time ago this was a question that we all had to face along with how to walk, talk and whether it was possible to put that stickle brick in our mouths. We developed the ability to move and therefore climb without the need for training articles and performance DVDs but most of us still managed it (with differing degrees of ability).
This article explores how our bodies work and applies physiology and bio-mechanics to our everyday business of teaching others how to climb.

Our skeleton provides a frame to hang everything else onto and protection for vital organs.
We can look at it slightly differently; *it generates all movement.* The length of a limb and the relative position of the muscle attachments determine the ability of the climber. For power, shorter levers are more effective and if the insertion point of the muscle is further away from the joint then this shortens the lever even further giving a significant mechanical advantage. Have a look at your own brachioradialis muscle (your drinking muscle) – hold your arm as though tightly gripping a pint glass and it should be clear across your forearm. I have put in a comparison with mine (Fig 1) and a climber known for achieving E10 (Fig 2).

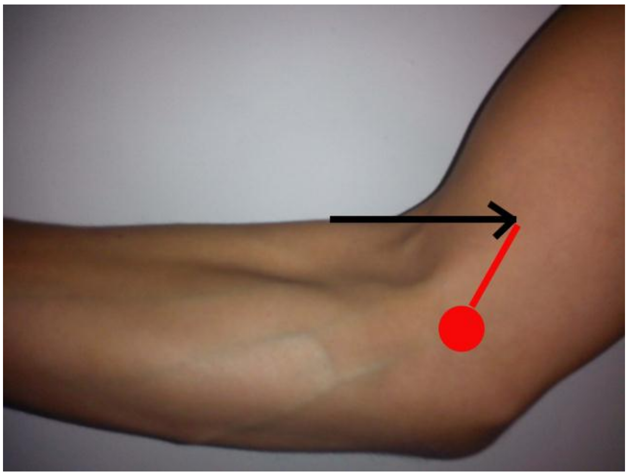


Fig 1

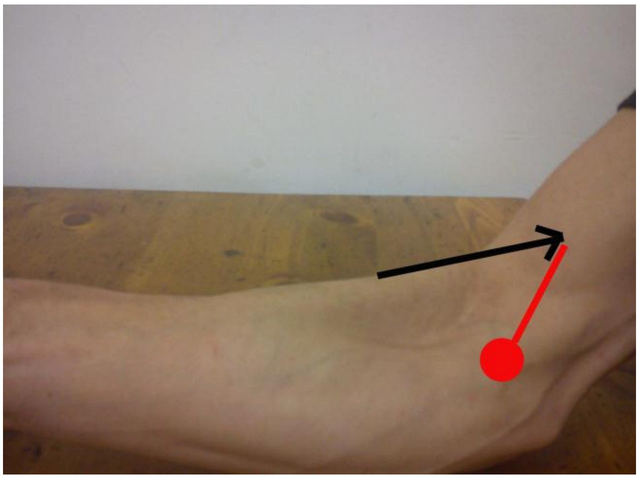


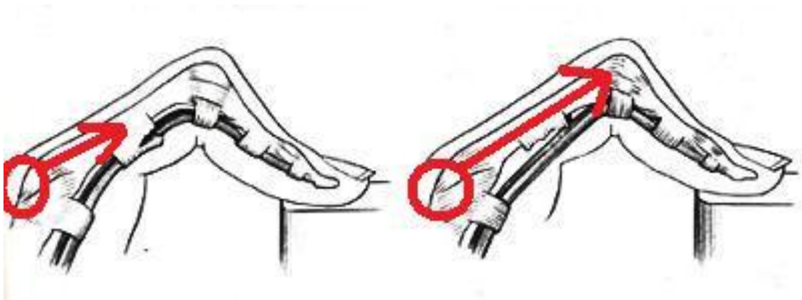
Fig 2

Bones become stronger the more we use them – bone tissue develops density across the site of pressure and accidents aside our skeleton is generally pretty robust. A few things to be mindful of however are the growth plates of children (Fig 3), stress fractures in your foot and shin splints (look them up).
Our skeleton changes shape with time; as we grow older and in response to training. A visit to your local physio will highlight some 'mis-alignment' or impingement which can be easily corrected but often just needs pointing out in the first place. Be especially careful teaching teenagers and pay attention to what your clients are saying.

Please see the section about climbing with performance youths – very instructive.

Our bones are held together by ligaments. These are strong, inflexible cartilaginous tissue with a poor blood supply (with a few exceptions). Think about their role in terms of a dead hang – your fingers, wrist, elbow, shoulder and all the way down to your toes would just fall apart without strong ligaments. In fact, many people *do fall apart* (become injured) because their ligaments are not strong. It takes eighteen months to two years of regular conditioning to significantly increase the strength of ligaments and finger ligament injuries are by far the most common cause of complaint in climbers.

'Climber's Finger' was unheard of before the '90s and was coined by Steve Bollen, an orthopaedic surgeon who identified a rupture to the A2 pulley of the ring finger as being specific to pulling hard on a climbing wall. It is interesting to note that after a full recovery from such an injury the relative size of the lever has been reduced in the finger and that joint should be stronger (Fig 4). When beginners complain of their fingers being tired you may have observed that they are massaging their fingers and not the muscles of the forearm. This is because it is their ligaments that have been tested.
Damaging a ligament is *a bad thing.* Even partial sprains can take months to heal and things to watch for include finger pain – particularly your ring finger, elbow pain and knee pain.



The next thing to consider is the nervous system – this controls what we do and how we do but in a number of ways.
Recruitment is how many muscle fibres an individual nerve controls. Where precision is required a 'motor unit' might innervate as little as three muscle fibres but in larger muscles each motor unit might control between three and eight hundred. To improve strength we need to recruit more muscle fibres. We can do this by exerting maximal loads when training – so yes, climb harder.
This sort of training also reduces what is termed our *strength deficit* – or the amount of strength we possess but don't use. On average the strength deficit is about 45%, in athletes it can be as little as 5%. If you have ever heard stories of mothers miraculously lifting cars off their trapped offspring you will know what I mean. This is dis-inhibition – you can train for it and this will increase your strength but not necessarily your muscle size. And it is important that it is often unexpected inhibition that causes injuries – popping off a hold or desperately maxing out to make the move. Fear is a big factor and if your clients are scared they are more likely to become injured.
Our nervous system also learns good movement and becomes more efficient. By regularly repeating the same movement the body stops activating unnecessary muscles which would, ordinarily provide resistance to a movement. This training technique has been proven to improve results by up to 200% despite only a 20% strength gain.

So now, muscles. How they contract is very important. When you move a muscle there is not one contraction but millions of different contractions occurring consecutively to change the size of the muscle. This occurs whether the muscle is shortening, lengthening or staying still. We call these *concentric, eccentric and isometric* contractions respectively.
The order in which muscles contract to achieve maximum performance is also important. Nearly all muscles, prior to shortening (concentric contraction) are eccentrically loaded – or stretched. For example, if you reach above your head you stretch your bicep before you pull on it. If you mantle you stretch the tricep before straightening your arm. This is essentially stored energy – but it is only stored for a short time.

Efficient, flowing movement will improve overall performance. Hold a position too long and the subsequent energy requirement might be too great to overcome.
When we climb we are always balancing concentric pulls at one end with eccentric lengthening at the other end in order to maintain the tension between the holds and thus our position in space. When you are observing your client, try to work out if they are maintaining this tension by looking at the limbs controlling their position and not at the limb doing the pulling. Encourage the right muscles to activate by applying pressure (feedback) as the movement is performed.

If you are lucky enough to teach in an environment where you can make a difference to someone's performance then try to remember it is never a case of 'holding tighter and pulling harder'. We owe it to our clients to understand what they want and how they can improve. This takes knowledge as well as observation and feedback skills.

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