



THE INTERNATIONAL MOUNTAINEERING AND CLIMBING FEDERATION
UNION INTERNATIONALE DES ASSOCIATIONS D'ALPINISME

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Growing pains

Children and adolescents are not mini-adults. Audry Morrison has some recommendations for monitoring the training of dedicated young climbers.

Climbing can be addictive, and climbers are often guilty of overtraining. In adult climbers this can lead to niggling injuries and a lack of progression, but the consequences for those still growing can be more serious.

It's well established that a youngster's physiology is completely different from that of an adult. Children and adolescents are not mini-adults, and just because talented adolescent climbers can now give older climbers a run for their money does not mean that they are ready for an adult's training regime.

- **Growth potential**

A young person's growth is a complex biochemical and biological process, and can only be fully realised when favourable conditions operate throughout the entire period of growth. A child reaches full skeletal maturation to adult proportions and biological function at approximately age 19-20 in females, and 22-23 in males. Failure to reach full growth and height potential can be the result of number of causes including inadequate nutrition, injury, illness and inappropriate training.

- **Bone growth**

Different bones grow at different times. Pre-pubertal bone growth generally occurs below the waist (legs mostly) and post-pubertal growth is dominated by growth above the waist (trunk and arms mostly). Site-specific bone growth deficits in these areas can occur for a wide variety of reasons, including the combined effects of intensive training and inadequate nutrition. For example, a competitive gymnast generally will mature later than average, and normally not achieve their full height potential. As their high-impact sport-specific training begins before puberty, and they can show marked stunting in leg-length growth. If their training load is reduced (i.e. they stop whilst still a teenager) there can be a period catch-up growth, but this may not be enough to make up their full genetic potential.

- **Climbing and growth**

In one study of 90 male and female junior competition climbers, whose average age was 13.5 (a range of 10.5 to 16.5 years), the climbers were found to be at or below the 50th centile on growth velocity charts when measured for height, weight and amount of body fat. Even when these climbers were compared to athletic control subjects of identical age and gender, they were still found to be shorter, leaner and have less body fat. What was not clear was whether these competitive climbers were simply that size and shape because of selection in the first place, or from inappropriate training and dietary habits.

- **Body fat**

The effects of high intensity training and inadequate nutrition in a lean athlete can delay their pubertal growth spurt and sexual maturation, or in severe cases, ensure that it doesn't occur properly. Predictable hormonal changes that trigger pubertal developmental and growth cannot fully take place in an adolescent without enough body fat. It's well known that in sports in which a



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thin body is thought to be advantageous, that there is a high risk of developing the 'female athletic triad'. This triad is characterised by menstrual cycle abnormalities, eating disorders, and premature osteoporosis (brittle bone). Excessively lean males will not produce enough testosterone essential for strength and health among other problems.

Load bearing sports like climbing promote strong bone growth, which is good. However, too little body fat is independently associated with reduced bone growth and stress fractures, especially in females. There are no charts stating how much body fat a growing youngster should have, but regularly plotting their height and weight on growth charts will show how they compare with normal developmental growth. In adults we know that the minimum amount of body fat compatible with health is 12% in females, and 5% in males.

- **Climbing shoes and foot growth**

It's not surprising that the majority of foot injuries and deformities in climbing are the result of wearing climbing shoes that are too small. There's a good health warning on boxes of Five Ten shoes that states, 'Pain is Insane', and that climbing shoes should fit your foot with no dead space or hot spots. Scientific literature on climbing shoes states that they should facilitate the ability to stand on friction with straight toes, and on edges with bent toes, with precision and proper contact.

With respect to children, we know that foot length and width increase in a linear fashion from the age of 3 to 12 years in girls, and to 15 years in boys, after which growth plateaus. Foot length and width are significantly correlated to body height in children aged 3 to 18. So it is strongly recommended to wear climbing shoes that fit foot size and shape, until the age of 15 at a minimum, to ensure full foot growth is achieved. Don't buy shoes sized too small for growing feet.

- **Final growth spurt**

Puberty is a known time frame where there is an increased incidence of epiphyseal fractures, often coinciding with the final growth spurt. Physeal plates are located at the ends of growing bones, and this is where the lengthening and widening of bone growth takes place. During growth spurts, these physeal plates are 2 to 5 times weaker than the supporting connective tissue. Training intensity, rather than volume, should be reduced during this time.

In the final of three key growth spurts, more than 20% of a youngster's genetic adult height potential is achieved. Sexual maturation is associated with the phenomenon of 'outgrowing one's strength'. In this final growth spurt that normally occurs between the ages of 13-17, bone growth will increase approximately twofold, with the most critical period usually between 14-15 years. So suddenly a teen is heavier due to the increased weight of their recent bone growth that was accompanied by increased muscle mass size. This weight increase is generally much higher in males as they are taller and have more muscle.

Unfortunately the connective tissue, ligaments and tendons have not yet increased their capacity proportionately to support this heavier weight load or newly lengthened bone - especially the fingers in young climbers around this critical period.

- **Fingers**

This final growth spurt is no time to begin campus boarding, intensive bouldering or any intensive finger strength training. In fact, the UIAA's medical advisors have suggested that climbers aged under 16 should not undertake any intensive finger strength training, and have stated that they



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cannot participate in international bouldering competitions.

Fingers stop growing at around age 16.5 years. There is growing body of evidence to suggest that the repeated micro traumas that can result from over-training, or inappropriate intensive climbing, can damage finger growth and function. For example, the inability to lay your hand completely flat (hand palm side down) on a table suggests that you may have Dupuytren's contracture. This is when the finger tendons shorten so that finger/s can't be straighten. It typically occurs between the ages of 40 to 60, is associated with those who work hard using their hands, alcoholism, or have some genetic predisposition to it (Northern European descent). Of 561 UK climbers surveyed (mostly veteran male climbers), 19.5% had developed early onset of Dupuytren's.

If a young climber delays reporting joint pain, ignores medical advice and continues to train intensively, they can experience permanent deformity of the affected finger/s with some loss of range of motion. Any pain a young climber speaks of should be noted and acted upon.

By regularly plotting a young climber's height and weight on growth velocity charts, training can be suitably adapted around growth spurts, and normal developmental growth can be observed. If a youngster's height and weight drop two lines below their normal growth line, then clinical investigation is suggested to identify underlying causes.

These growth velocity charts are the same ones included in the red child health record booklets that all parents receive when a child is born in the UK. They can also be downloaded online, or ask your GP or nurse. Ideally, these charts should be filled in at least every three months until adulthood.

Audry Morrison has a BSc(Hons) in Human Nutrition. Her main area of interest is how to improve climbing through metabolic adaptations, although she has also worked on public health issues. She recently co-authored a paper with Volker Schoffl to provide evidence-based guidelines to inform the training programmes for dedicated young climbers. This was published online 22/05/07 in the British Journal of Sports Medicine, and favourable received by UIAA Medcomm, and The World Congress in Mountain & Wilderness Medicine in October 2007.

*By Audry Morrison
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