FINGER STRENGTH TRAINING FOR CLIMBING: A BASIC GUIDE TO HANGBOARDING

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If you want to improve your climbing, you must train your finger strength. There are various ways to do this. Experienced climber Eva López-Rivera explains what you have to know when training with the hangboard.

When thinking about climbing the hands often come to mind first. The need for finger strength is one of those cases where common sense is backed by the evidence. Leaving aside the expected bias that climbers may have on this matter, there is an abundance of scientific literature on this topic. Should we train this ability specifically? Wouldn't it be enough to just climb? If the answer to the former is affirmative then we face an additional question: since grabbing small holds while climbing is risky enough, is it wise to submit them to further loads by using specialized means and methods? Let us try to answer these and other issues.

FINGER STRENGTH AND CLIMBING PERFORMANCE

According to research, maximum grip force is greater in climbers versus non-climbers [6], as well as in elite climbers with respect to lower-level climbers [2]. A positive relationship has also been found between maximum grip strength and climbing ability [13] also between increased resistance to fatigue in the finger flexor muscles and climbing performance [5], which led the authors to consider it among the most important predictors of climbing performance.

In a practical sense, a climbing route's difficulty depends in part on the shape and depth of its handholds, being frequently one phalanx deep or less. In other instances, holds that are not that small will still require a high percentage of maximum finger force to be applied when found on very steep or overhanging routes. There are other circumstances, as the size of the footholds or the distance between handholds that contribute to explaining the high prehensile capabilities needed for climbing.

FINGER STRENGTH AND INJURY PREVENTION

Finger injuries are the most common rock-climbing related injuries [18]. This statement, when put into context with the findings above, makes us wonder whether we can prevent them and how to do it. Up-to-date knowledge of this type of injuries, including the identification of risk factors, would be needed. Recent critical review research [7][14][16][17] has found that: a) chronic injuries due to overuse are more prevalent among climbers than acute injuries, b) risk factors include increasing age, years of climbing experience, and higher climbing intensity.

On the other hand, it has been found that the injury rate can go down between 54–65 % depending on the sport and type of intervention [15]. Among them, strength training has proved to be the most accessible, effective and efficient [11]. Habitual loading results in long-term adaptations [4], as found in experimented climbers' bones [8] and connective tissue of the flexor tendons, pulleys and joint capsules (collateral ligaments) [19]. In this line, it has been suggested that chronically using lower loads is an injury risk factor [10].

All things considered, it seems reasonable to say that providing high-quality knowledge about finger training methodology and periodization could help in preventing finger injuries.

HANGBOARDING: WHO IS IT RECOMMENDED FOR?

Dead-hangs or finger hangs on small edges from a device popularly known as a fingerboard or hangboard (▶ **Fig. 1**, ▶ **Fig. 2**) is likely the most popular specific training exercise used by climbers [20]. In this case it is with good reason,

▶ **Fig. 1** The Transgression training board was developed by Eva López. The edges have a width of 6–18 mm and thus enable systematic training of finger strength. (Picture by: © E. López)

since a maximum hanging test on an edge from a fingerboard has shown to be a predictor of hand-arm strength and endurance and therefore climbing performance [2][12][13].

Nonetheless, some conditions need to be met before recommending someone to train their fingers using such an intensive and specific method:

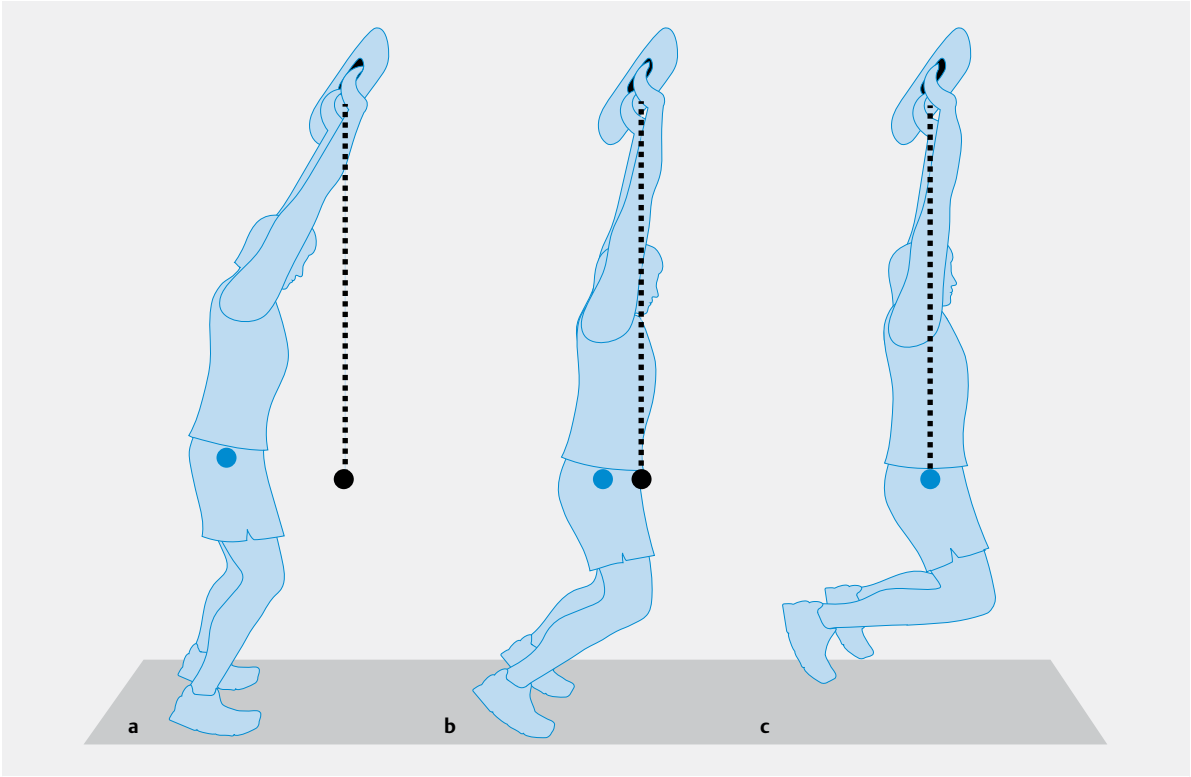
- **Having been climbing and training in a systematized fashion for more than 2 years.** Systematized means training or climbing 2–3 days per week with some consistency and order; especially for the last year, given that the first couple of years it is normal to have a less organized approach to the sport. This requisite also acknowledges the fact that while muscles can adapt to the sport in a matter of months, other structures like capsules, cartilages, tendons and ligaments take years to develop the adaptations [4] needed to safely perform dead-hangs. Based on experience and what the literature says a two to three years interval seems reasonable.
- **Having an average technical-tactical repertoire.** If someone doesn't have a lot of spare time for training there is a risk that specific finger training will detract from the much-needed technical gains that could be achieved by climbing in the gym instead, and that are so important in the early years.
- **Being 16 or older, beyond adolescent growth spurts.** There is a correlation between intensive finger training, the use of the crimp grip before puberty, and the incidence of severe injuries like epiphyseal fractures or early osteoarthritis [3][9]. The most dangerous period is the growth spurt that takes place at age 11–12 in girls and 13–14 in boys, but the risk remains until the growth plates are closed.
- **Being injury-free.** Less severe lesions take at least 2 months to heal, others can take 6 or more. In truth, once the subacute phase is over and reconditioning work starts, dead-hangs are not out of the question. An experienced physical therapist can guide an athlete through a routine of analytic exercises followed by assisted dead-hangs (with rubber bands or pulleys) on deep, rounded holds. In all cases the programs will NOT be the ones recommended here.
- **Finger strength level is low, but not 'very low'.** This can be checked performing a test on a 25 mm edge (one phalanx and a half): someone who can hang for 15 seconds could start doing dead-hangs as a method to develop grip strength. Scoring less than 15 seconds would suggest that actual climbing provides enough stimulus at this stage and such analytic methods as dead-hangs are not needed.

▶ **Fig. 2** Eva López training on the training board she developed. (Picture by: © Javipec)

GUIDELINES FOR AN EFFICIENT TECHNIQUE

There is no such thing as "perfect technique" for everyone. It will depend on both environmental and individual factors such as anthropometry, body posture, training experience and others. There are, however, general suggestions for a more efficient and safe hanging technique:

- **Width of grip:** shoulder width or slightly wider
- **Avoiding swinging:** standing below the hold or a short distance before it; contacting the hold and moving forward until the body's center of mass is right below the hold. Transferring weight from the feet to the hands, engaging the core – especially the transverse – and flexing the knees at a comfortable angle (▶ **Fig. 3**).



▶ **Fig. 3** To avoid swaying during the dead hang on the training board, first stand so that the body's centre of gravity is exactly below the handle. Then tense the core muscles and finally bend the knees as you feel comfortable. (Picture by: © E. López; graphic implementation: Thieme)

- **Keeping elbows extended and facing inward:** Hanging with flexed elbows is inefficient. Unless your goal is to work the elbow flexors, you would be needlessly stressing those muscles and joints.
- **Not splitting the elbows:** Losing external rotation and rising the elbows "chicken wing" style is a biomechanical trick to compensate fatigue or a load that is too hard. Making a habit of it instead of occasionally resorting to it can end in lateral tendinopathy, ulnar compression or neck pain.
- **Active hanging:** it means engaging specific scapular muscles, chiefly the lower trapezius, so that the passive structures like joint capsules and ligaments do not bear most of the weight. Core engagement and breathing control are important as well.
- **Head alignment:** Briefly looking up at the hands is safe but extending the neck for too long might have some consequences.

BASIC TRAINING METHODOLOGY

Initial assessment and Goal setting

Before choosing a training methodology and periodization for hangboarding some individual characteristics need to be judged, like training experience, age, past injuries, material means or baseline finger strength. The second step is defining training goals. Someone may want to improve their performance on just one grip type like the half crimp or the open hand; others will prefer to develop both abilities in a more balanced way. The latter will need to train longer and will not achieve the same gains in either grip type as the former.

Training load in dead-hangs

It is determined by the combination of volume, intensity and rest periods between sets for a particular exercise. In this context the volume is defined by the number of sets while hanging time and margin before muscular failure inform about intensity. Managing the interactions between these variables gives rise to several methods, like the following.

Maximum hangs method (MaxHangs)

For the development of maximum strength, mainly through neural adaptations induced by high mechanical tension. In traditional weight training the overload must be in accord to the number of repetitions per set. Every dead-hangs method is subject to those same constraints, but there are two ways of complying with them:

Maximum added weight (MAW). Intensity is adjusted by adding some amount of extra weight (usually attached to a belt), while the hold size or edge depth are fixed. The weight will depend on the prescribed hang duration and

▶ **Table 1** Description of methods.

Method	Load adjusting variant	Number of sets	Number of repetitions per set	Hold size [mm]	Hang duration [s]	Margin to failure (buffer in seconds)	Rest between repetitions [s]	Rest between sets [min]
Maximal hangs (MaxHangs)	Mmaximal added weight (MAW)	2–8	1	6–20	3–15	1–5	–	3–5
	Minimum edge (MED)	2–8	1	–	3–15	1–5	–	3–5
Submaximal hangs (SubHangs)	Maximal added weight (MAW)	3–8	1	6–20	18–45	almost 0	–	0.5–2
	Minimum edge (MED)	3–8	1	–	18–45	almost 0	–	0.5–2
Intermittent Hangs (IntHangs)	Maximal added weight (MAW)	3–8	4–5	10–20	5–15	almost 0, just at the last rep of the last set	3–30	1–3
	Minimum edge (MED)	3–8	4–5	–	5–15		3–30	1–3

margin before failure. In general, it is advisable to begin with an edge depth comparable to one finger pad (18–20 mm) and switch to smaller holds only when gains start to plateau or the amount of added weight gets uncomfortably heavy.

Minimum edge depth (MED). It is the size or difficulty of the hold what is altered, choosing an edge depth (or angle in the case of a sloper) that allows to observe the chosen hang duration and margin before failure.

Intensities for this method are typically high (80 % and more) and hang durations short, always leaving a buffer before muscular failure. Pauses must allow full recovery (▶ **Table 1**).

Intermittent dead-hangs method (IntHangs) and Submaximal dead-hangs method (SubHangs)

Apart from enhancing muscular endurance, they presumably aid with strength gains through hypertrophy due to two concurrent factors: mechanical tension and metabolic stress [12]. Intensities are around 70–80 % and margin to failure or buffer for each set is negligible. Rest time between repetitions and sets is incomplete, but enough to maintain the desired level of intensity (▶ **Table 1**).

How to determine optimal loading

Load management or autoregulation is the most important aspect of training. Loading needs to be estimated not just for a training session as a whole but also for each set and repetition. Achieving the desired effect and avoiding injuries depends on this.

For instance, during 2-3 warming up sets, someone realized they should use 10 kg as the initial added weight for a prescribed session of four 10-second sets (leaving a 2-second margin). The first two sets are performed without incident but the 3 rd one ends almost with failure. The load for the last set must be thus reduced. By the contrary, if the margin starts to feel longer than initially planned it is a hint to add some extra weight. The strategy for the MED variant is analogue, tweaking the edge depth as necessary.

FINGER TRAINING PLANNING

How to integrate hangboarding into the general training plan?

In complex sessions involving disparate qualities, deadhangs are the first exercise after warming up. MaxHangs will preferentially coincide with other strength contents like bouldering or general conditioning, while IntHangs and SubHangs will be on endurance days along with on-the-wall workouts like intervals, laps or continuous climbing.

Except for athletes with an already exceptional level of finger strength, the order of the methods in a macrocycle starts with MaxHangs for strength development. SubHangs and IntHangs would come after, to gain endurance and promote hypertrophy-induced strength gains. For example: 8 weeks of MaxHangs, 2 weeks without fingerboard training and then 8 weeks with SubHangs or IntHangs. The rationale for this sequencing is that improving strength first allows using higher absolute intensities with the subsequent methods (smaller holds or heavier weights), which is related to better climbing performance.

Mixing several methods in the same week might be an interesting strategy for experienced and elite athletes.

Basic guidelines for Hangboarding training

It is generally advisable to follow the Minimum Effective Dose rule [1]. It means picking the easiest method and lightest load that still has a positive effect. Eventually, experience and level grow through the use and sequencing of the different methods and intensities, to the point where the progression curve starts to flatten and a different approach is needed, including the higher volumes and intensities shown in ▶ **Table 1**.

For example, a starter in hangboarding will see benefits with the MaxHangs method using just 2 sets of 12 seconds with a margin of 3 or 5 to failure for the MED variant. By contrast, an elite climber will likely opt for the MAW MaxHangs method, needing to perform up to 8 sets, hanging just 3 to 5 seconds on an edge between 6–10 mm instead the 18– 20 suggested to beginners in this method.

A volume and intensity weekly periodization, based on research [12][13] is suggested in ▶ **Table 2** and ▶ **Table 3**.

Example of hangboarding training plans for climbers with lower through high-level in finger strength.

▶ **Table 2** Sample Planning for *lower level of finger strength and beginners with dead-hangs.

week	Day 1	Day 2 (48–72 h after Day 1)
1	2 Sets × MaxHangs MED × 12 s (5): 3 min	2 Sets × MaxHangs MED × 12 s (5): 3 min
2	3 Sets × MaxHangs MED × 12 s (5): 3 min	3 Sets × MaxHangs MED × 12 s (5): 3 min
3	4 sets × MaxHangs MED × 12 s (5): 3 min	4 Sets × MaxHangs MED × 12 s (5): 3 min
4	4 Sets × MaxHangs MED × 12 s (5): 3 min	4 Sets × MaxHangs MED × 12 s (5): 3 min
5–6	Rest from dead-hangs	
7	3 Sets × MaxHangs MED × 12 s (3): 3 min	3 Sets × MaxHangs MED × 12 s (3): 3 min
8	4 Sets × MaxHangs MED × 12 s (3): 3 min	4 Sets × MaxHangs MED × 12 s (3): 3 min
9	4 Sets × MaxHangs MED × 12 s (3): 3 min	4 Sets × MaxHangs MED × 12 s (3): 3 min
10	5 Sets × MaxHangs MED × 12 s (3): 3 min	5 Sets × MaxHangs MED × 12 s (3): 3 min

* being able to hang for less than 10 seconds off a 10 mm edge
MaxHangs = Maximal hangs; MED = minimal edge load adjusting variant; (5) = leaving 5 seconds in reserve to failure, which means the climber should choose an edge depth that would allow them to hang for 17 seconds to failure, and actually hang for just 12 seconds.

▶ **Table 3** Sample Planning for *medium to high level of finger strength and adequate experience with dead-hangs.

week	Day 1	Day 2 (48–72 h after Day 1)
1	3 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min	3 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min
2	4 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min	4 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min
3	5 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min	5 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min
4	5 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min	5 Sets × MaxHangs MAW × 18 mm × 10 s (3): 3 min
5	Rest from dead-hangs	
6	3 Sets × MaxHangs MED × 10 s (3): 3 min	3 Sets × MaxHangs MED × 10 s (3): 3 min
7	4 Sets × MaxHangs MED × 10 s (3): 3 min	4 Sets × MaxHangs MED × 10 s (3): 3 min
8	5 Sets × MaxHangs MED × 10 s (3): 3 min	5 Sets × MaxHangs MED × 10 s (3): 3 min
9	5 Sets × MaxHangs MED × 10 s (3): 3 min	5 Sets × MaxHangs MED × 10 s (3): 3 min

* Able to hang for more than 40 seconds off an 18-mm edge
MaxHangs = Maximal hangs; MAW = maximum added weight load adjusting variant; MED = minimal edge load adjusting variant; (3) = 3 seconds margin before failure, which means the climber should choose an edge depth that would allow them to hang for 13 seconds to failure, and actually hang for just 10 seconds.

Conflict of interest

The author was involved in the development of the climbing boards mentioned in the article.

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