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GENERAL CONSIDERATIONS DESIGNING POWER TRAINING FOR SKATERS (1)

Designing (strength)training (ST) for the last 20 years our attention shifted from muscles and muscle targeted training methods towards thinking in terms of neural drive and inter- and intra muscular coordination. This has proven itself in many sports as far more efficient.

As far back as in the 1980s the Bulgarians and Soviets learned the international olympic lifting community that simply building more and more strength leads to a inefficient process. The gained strength serves the athlete less and less.... As an olympic lifter I learned that all training must focus on improvement of power. Power is also what makes you skate faster. In the case of the olympic lifter the aim is to speed up the bar as much as possible. His "projectile" on the other hand will also becomes heavier and heavier throughout the years..... different from the skater for whom the forces he will encounter during competition change when his speed increases. Lifting heavier weights in the gym year after year makes the gap between this type of training and competition bigger and bigger. The olympic lifter competes in a weight class (except super heavy) so any gain in bodyweight should be muscle mass of the highest possible efficiency. This is why you should never train to gain mass.... Except when you're bodybuilder or just want to be bigger and have no interest in performing in athletic competitions. Gaining extra mass is a natural effect and part of you adapting to the stress of your training. So mass comes naturally.

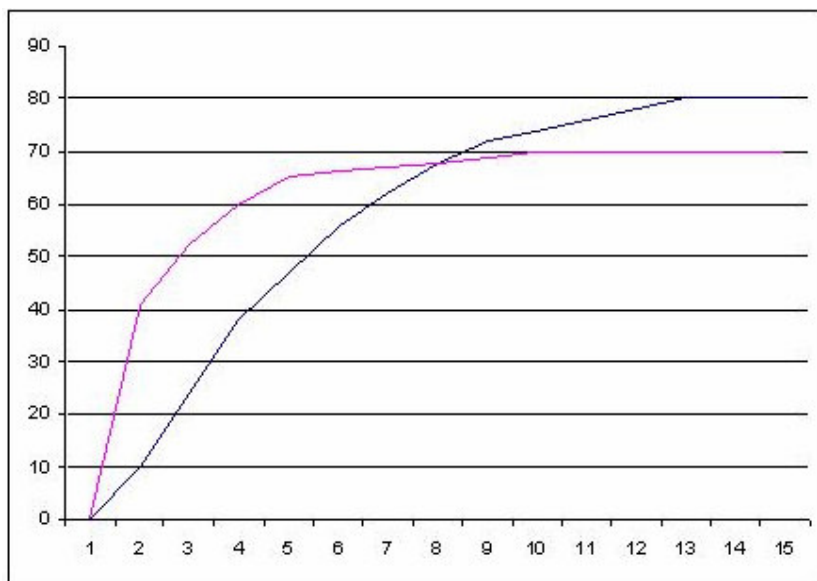


Figure 1

Take a look at figure 1. Think of a single push off, the numbers are exaggerated to serve as an example. Figure 1 shows us the rate of force development of the leg's push off of two skaters. Horizontal is time passing by in steps of 0.1 seconds. Along the vertical axis is the strength displayed during the push. Now suppose that a skater has no more than 0.5 seconds time to perform a forceful push. Half a second is close to real values. It is clear to see that within this time skater L (left curve) exerts a force of 65 kg and skater R (right curve) reaches 50 kg.

If we would allow these skaters eg. 2 seconds to perform their maximal leg / trunk extension than L would reach 70kg and R would reach 90kg. Two seconds is a contact time you won't easily see in sports (0.5 is already long compared to other sports actions) but you *will* get 2 seconds when performing squats. So R does a "better" squat but the quality of L makes him (physically) a better skater. Should L train to do a 80kg squat? Should R go on and make his squat a 100kg? Definitely not without concerning their development of power instead of just focusing on strength.

Free weight training

Free weights training is a must for any sportsman trying to improve overall performance. This type of loading will put a skater in a situation comparable to the 'field situation' in training and competition. The training offers: closed chain circumstances, improvement of proprioception (balance), pre-stretch, speed and power. In strength training using free weights it is easy to create an optimal relation between concentric, eccentric and static work (60-25-15%).

The optimal frequency of training is two times a week, possibly three for professional (world class) skaters. The number of exercises throughout the year should be as small as possible so full attention can be given to the chosen exercises. The two days immediately before important competitions are less suitable for any non ice training. When training and power / strength training are on the same day, the ST should be done first, preferably in the morning, several hours before the second training. The main exercises are: Squats, jumps, power cleans and pulls. These exercises demand certain technical skills of the skater, it takes about 8 training units to teach an average sportsman how to use free weights safe. It is worth it's while because these exercises force us to use speed. On his way to a complete training, the skater will start to work with pulls and squats preparing for the more technical exercises. Some smaller exercises target the trunk, eg. rotation and abdominal exercises

The main technical exercise for skaters is the power clean. It's very different from classical exercises like squats, eg. 90% in the power clean is incomparable to 90% in a classical strength exercise. The power clean, when properly learned, forces to very special adaptations and has a tremendous effect on horizontal speed. We discovered that the power clean also triggers special effects for skaters. I use different techniques in volleyball / basketball etc. compared to skating, or athletics, to get closer to the specifics of skating (sprint / all round /long distance). Training explosiveness will force specific neuromuscular adaptations. Maximum strength will improve over time, growth of muscle mass will be minimal, but performance under high speeds circumstances will increase significantly.

The other main core exercise is the squat in various forms. The leg press is no substitution for doing squats! I started using leg presses until 1999 or so. The position is closer to skating so you'd expect that it would be beneficial.... It became a redundant exercise.

Intensity and workload

The strength training only consists of a small number of exercises during the training season. The training methods to use are all designed to improve intra muscular coordination. The number of repetitions, using a barbell, should be small, 3 to 5 in technical / speed exercises and up to 10 for smaller, assistant, exercises. Rest breaks should be long enough so the next exercise can be done using proper technique and optimal speed. It's no use to train endurance with weights... the extra endurance is strongly linked to the circumstances under which you gained it... meaning using weights, not on ice!

Three factors play a mayor role when determining intensity and training load:

- 1) The periodisation of the main training. Meaning the cooperation with the head trainer, and being aware of the exact date and time of important competitions or trainings.
- 2) The initial and actual condition of the individual skater during the training season. Using relevant tests and keeping in contact with the head trainer will give an objective impression.

The total load in strength training will increase during the season because of learned skills, more speed and thus greater power display during training. Now and then more work can be done through an increase of series. Putting more weight on the bar should be a last resort to adjust the training regime. Using squats there are many possibilities to change the technique so lighter weight must be used. Thus the skater has to “train himself back” to the former level.

Testing

The most important about tests is how to interpret test results. When designing strength training programs for skaters, we used two tests.



Figure 2 Testing maximal static force preferably in the smaller “skate angle”

1) Determine maximum static force on bigger muscle groups. This method (done by Dr.J.A.Vos in the Netherlands since 1960) does provide us with a general impression of strength and condition. Advantages: it's safe, easy available (in the Netherlands there are about 20 sets), almost 100.000 values have been collected (Vos), and a left / right comparing of the legs. The maximal static leg / trunk extension strength of a skater is quickly determined. To test for maximal strength with weights is nearly impossible. I consider this dangerous with top athletes and a squat to 95° results in a very different value than a squat to 90° etc.

2) Maximal jump test. (Squat Jump =SJ) A single maximal jump without pre-stretch, flight time is registered using a contact mat. Advantages: dynamic. Small mobile test equipment (mat and laptop). We already started to test the SJ around 1985. The highest value ever recorded in the Netherlands by a woman was M.Timmer (0.61) a few months before her world title sprint.



Figure 3. Initial position on the contact mat for the Squat Jump.

Inter muscular and intra muscular coordination.

Apart from making more mass there is another, more important, way to gain strength and power: improving intra muscular coordination (=IC). Intra muscular coordination is the efficiency of the whole motor unit. The main aspects of IC are:

Recruitment

All muscles contain a mixture of fast-twitch (=FT) fibers and slow-twitch (=ST) fibers. According to the Henneman principle, the smaller cell body of the motor neuron, will be activated before bigger ones. This is true in the central nervous system (=CNS) but not always at the level of the actual muscle contraction. In fast explosive movements nearly all motor neurons will be activated but the axons of the bigger cells (coupled to fast twitch fibers) send their action potentials faster to the target muscle cells. Thus the reverse size principle describes the sequence of contracting muscle cells, meaning FT before ST. The ST fibers will easily be activated in any common (slow) action but activating large number of FT fibers in untrained persons is not possible. The pattern of recruitment determines what exact movement is made.

Discharge frequency

This is the frequency of action potentials send from the central nervous system to the muscles. The discharge frequency (=DF) will grow when the muscle needs to generate more power to move faster or move against greater resistance. In smaller muscles it's the DF that contributes the most to deliver more and more power because even with smaller resistances nearly all neurons are already activated. In bigger muscles like the biceps recruitment of more and more neurons is responsible for a growing power output up to an intensity of 80% of maximum intensity. Above 80% a growing DF delivers the extra power.

Synchronization

If many neurons discharge at the same moment, their cooperation will lead to a high power output. In untrained persons there is no efficiency in this cooperation of neuron discharges. Well trained athletes are capable of better synchronization of discharges.

Good strength training should enhance intra muscular coordination and the training methods must be those that in the first place target IC. Hypertrophy (growing of more muscle mass) will only take place as a consequence of adaptation to the training stimulus. This way extra mass will show a high efficiency in gained power output.

Next time: How to think about training in terms of neural programs.

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