

Ton Leenders was an International Olympic lifter (1980 - 1994) and is strength & conditioning trainer and advisor in nutritional topics since 1985 for Dutch and international top athletes and teams in more than 25 Olympic disciplines. He was responsible for power training and supplementation from May 1999 to October 2004 for the Dutch skate teams Sanex - TVM - SpaarSelect - VPZ - SBL. This year's Speed Skating World issues will bring more about power training and nutritional aspects for speed skating.

DESIGNING POWER TRAINING FOR SKATERS (2)

I started power training for the Dutch skaters (Sanex team) in 1999. I first had to learn about the training practice so far. The situation was that some individual skaters were doing good training but others did not know much about power training. For instance, skaters were doing a lot of fitness like training, using machines, circuit training in a battery of exercises, and again lots of machines to train endurance. There was a habit of tapering off training starting october or november so that at the end of the season some were off training for months! On the other hand, skaters and trainers were unfamiliar with the benefits of training and unfamiliar with training techniques so the situation could be improved. That made it possible to get quick results. Nowadays skaters have a lot of free weight training incorporated in their training. So, what are the big changes since '99? The old situation is easy to imagine. Visit a gym, preferably in the Netherlands because the situation is more extreme there than in other countries, and you will see all those machines that will let you 'train' a specific muscle(group). The focus is on muscles but it should be on function. What makes you a good skater? Your calf muscle? No, it's the fact that a lot of muscles work together in such a way that you get maximum power output. So skating is a function, and a very complex one. The better you fine tune this process the better your technique and performance. This process of reaching a higher level of efficiency is being managed by the central nervous system (CNS), your brain e.g. It is this CNS computer that runs the program telling all your muscles how and when to play their part. This neural program was not there always, you started to create it when you learned to skate as a child. The first time you fell was the first big hint (input into the CNS) warning you that your level of efficiency could be improved. The neural steering got a little better and waits for the next correction.

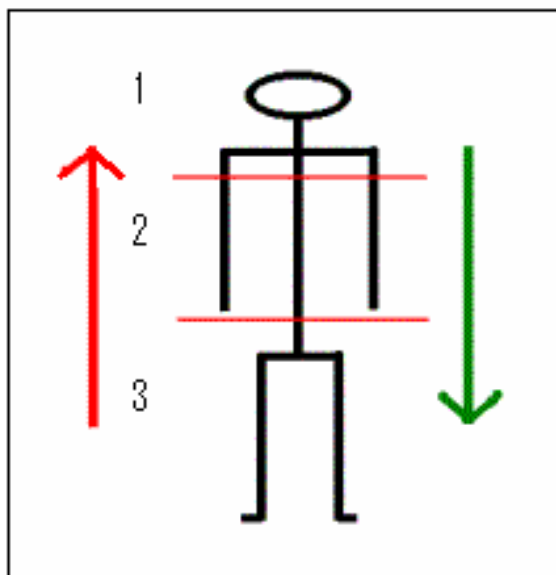


Figure 1. Bottom up? Top Down!

This process of improvement of the program after receiving input will take place on ever finer scale. Today your coach helps you to fine tune your neural program so as to skate a 500 meters a little faster. The gains are little but this makes a big difference since you already are competing for years and the differences on top level are small.

In figure 1 the arrow that points downwards is symbolic for the neural drive training. I call this approach top-down as opposed to bottom-up where you target your muscles and, in my opinion, get a less efficient result “on ice”. When looking top-bottom at your training then it has to comply with what we see during skating. Figure 2 shows a graph of the force exerted by a skate on the ice. This particular graph is more realistic when in a curve than skating straight but the principle is the same. The skater builds pressure... there is a static phase.... and a release. The time of displaying power is about 0.5 seconds. The power comes from the so called power zone, which are the muscles that extend the knee, the muscles that extend the hip and the muscles in the lower back.

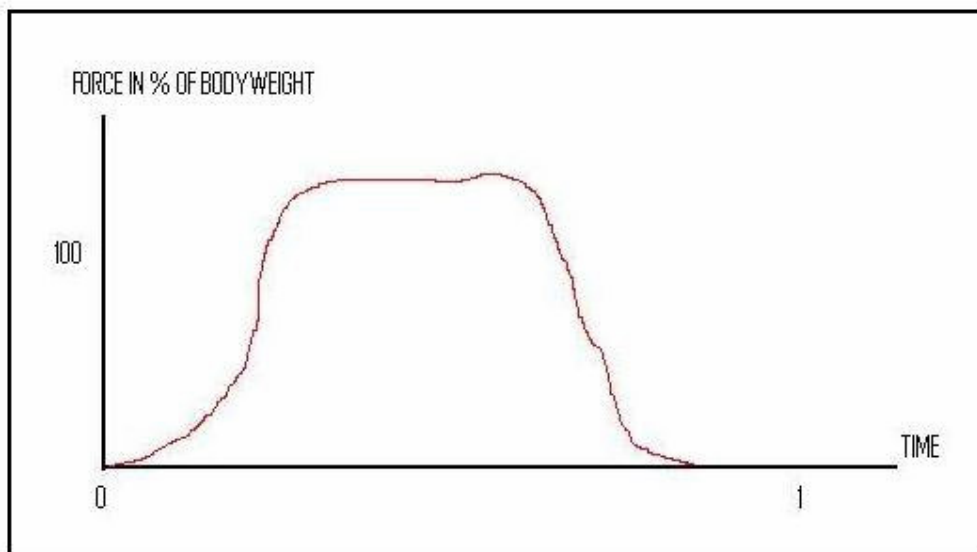


Figure 2.

Considering the knee it is easy to why we say that the skate action is a closed chain action. The knee is closed up between ice and the power zone / bodyweight. An example of open chain action is e.g. in swimming. In figure 3 you can see that when you are doing squats it fits into the top-down approach of training. Squatting is closed chain and you can build up a certain pressure and even mimic a release when doing jump squats. Furthermore it is possible to build in a static phase. You would expect the leg press to be of great value because it is done in a skate like position.... But it has some disadvantages.

- Skaters are strong athletes and they are simply strong enough to run into injuries in the leg press.
- It's difficult, although possible, to mimic the release.
- It is often considered a safe exercise for the lower back, but it's not. The lower back is in a arch like position. The SI joint and several discs are in the “tension area”.

The lying version of the leg press where the load is on the shoulders is no alternative because it is a poor version of the squat and it is mostly not possible to get in a good back position. In my experience it is the squat, in 90% of the skaters, that triggers the best training adaptations. Squatting means a 50/50 eccentric / concentric work. If you want to shift this balance to either one then the second important exercise in power training will help you out. This is the power clean. The latter can't be learned from any book or article. Find yourself a good power trainer. There are several ways to do squats. The basic back squat is pictured in figure 3. Compare this with the leg extension exercise that is done when you're sitting and

straighten the leg starting from about a 90° knee angle . It is an extreme example of a bottom up approach to training. The load is against the shin which makes it an open chain exercise. It is also an exercise that isolates the quadriceps muscle group. The hamstrings are not involved in this type of “functioning”.... Accelerating the movement can only be done from a knee angle of 80° to 180°, when the leg reaches his “lock”. Of course there is no release of pressure or load at the end of the movement.

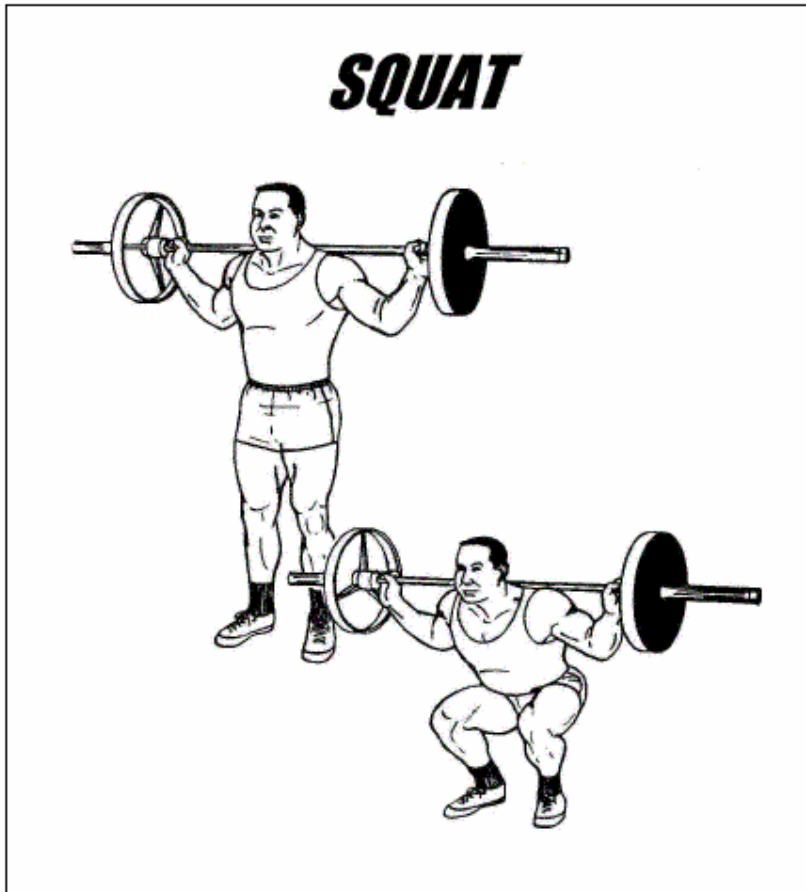


Figure 3.

Take a look at figure 4. The upper line shows the international notation. In 1989 the Bulgarians, at an international Weightlifting Symposium in Hungary, proposed an alternative to writing training plans. They showed that an athlete (top = 200kg) exercising with 90% (180) and another athlete (top = 100) using 90kg do not quite the same training.... So a plan that says minus 10kg means, for the stronger athlete in this example 190kg... compared to 90kg for the lighter athlete. In this case their efforts are more comparable.

EXERCISE	75	80	3	WEIGHT	SETS
	10	8		REPETITIONS	
BULGARIAN	-25	-20	-10	3	
	10	5	2		

Figure 4.

I don't use the 1RM (the single repetition maximum) and it's percentages, e.g. the 10RM. This 10RM is usually around 75% of the 1RM. This depends strongly on the individual and the training and sport he or she is engaged in. Furthermore there is a problem of determining the real 1RM. Top skaters are simply too strong to test for their max. And trying to do this with an exercise like the squat, you'll find a big difference between squats to a 85° or a 80° knee angle. The alternative is testing for the maximum static (single) leg press. You can see a picture of this test in the february 2005 (nr. 4/5) issue of Speedskating World. Of course we tested in a smaller "skate" angle. Testing like this is done in the Netherlands by Dr. J.A.Vos since 1960.

This testing of maximum strength in a 90° angle in combination with the vertical jump gives me a good impression of a skater's current condition.

Here is a quick impression of values of the maximum static leg strength in Newton. In brackets is the values in relation to body weight.

Women world class sprinters

Knee angle:	170°	170°	90°	90°
	Left	Right	Left	Right
	2400 (3.8)	2620 (4.2)	1220 (1.9)	1140 (1.8)
	2400 (3.8)	2000 (3.1)	1280 (2.0)	1420 (2.2)

Men world class allrounders

	3160 (3.6)	3240 (3.7)	2220 (2.5)	1900 (2.2)
	3180 (4.4)	3400 (4.7)	1040 (1.4)	1120 (1.5)

Leenders_T@hotmail.com