

**Air Time!**  
**Strength training to displace the body!**

**This article and other articles in this series were submitted to t-mag.com in early 2001. Only Part 2 of the series was published – ‘White Man Can Jump’ (27 Apr 2001). The introductory or Pt 1 of this series titled ‘Air Time’ was not. Here it is below.**

King, I., 2001, Air Time – Strength training to displace the body, unpublished.

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Sport involves movement – moving an external object or yourself or both. Running, jumping and pushing can be considered the fundamentals of sports movements. No surprise therefore that track and field and weightlifting are two very influential sports on how we prepare for a wide range of sports. I want to focus on the movement of the body in this article series. Not the movement of part of the body eg. a limb – but the whole body.

To simplify the discussion of body displacement I use three dominant directions – vertical, horizontal and multi-directional. The big two are vertical and horizontal, with multi-directional being a combination of the two. The reason I give it a separate category is that it involves competitive and training activities that are not totally transferable from vertical and horizontal displacement activities. That means just because you can compete in the paint and sprint the lanes doesn't mean you can automatically match up in 'd' well!

Most sports or sporting actions are a combination of these three displacement directions, with one being dominant. Blocking in volleyball is a dominantly vertical displacement activity. But if there is one or more step ins, you add a horizontal component. Sprinting is a combination of vertical and horizontal displacement. Skating is predominantly horizontal displacement. But if there is the double axel required, you add a serious vertical component. Defending in basketball is a predominantly multi-directional displacement activity.

This first article is dedicated to information general to all displacement directions. The following 3 parts are dedicated to the specifics of each direction.

Part 2 : Vertical displacement

Part 3 : Horizontal displacement

Part 4 : Multi-directional displacement

There is an endless list of factors that contribute to displacement. For example, the text *Strength and Power in Sport* (ed. by P.V. Komi), in a chapter titled *Part 2 : Biological Basis for Strength and Power*, lists over ten. If you want you want to enhance your

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knowledge in this area, this is one of the texts you could turn to. What I am going to do is keep it really simple and talk about two things : skill and strength.

*Skill*: Strength training in itself will not be adequate to fully exploit your potential to displace the body. You are going to need to develop specific co-ordination, to develop the specifics of the skill. For example, skilful use of the arms and how much you bend the knees can significantly influence the outcome in a vertical jump.

A number of studies have reviewed the contribution of arm movement and the countermovement (the quick bend of the knees prior to jumping) to jumping performance. The contribution of arm movement to jumping performance has been reported as : resulting in a 5% greater jumping height (Payne, 1968); being 10% or more of the total performance (Luhtanen and Komi, 1978; Harman et al, 1990); 15% (Shetty and Etnyre, 1989) to as high as 40% (Ramey, 1973). The differences may be related to the sport background - athletes such as volleyball players and basketball players may have learned to use their arms more effectively than the non-trained individual to develop vertical displacement.

The contribution of the countermovement to jumping performance has been reported as resulting in a 12% jump height advantage. Harman et al. (1990) studied the various vertical jumps, with and without the involvement of the arms and the counter movement. They concluded that whilst both the arms and the countermovement had significant positive effect on peak post-takeoff total body centre of mass rise, the arm swing has a greater impact than the counter movement.

I have found that athletes involved in horizontal-dominant sports are ineffective in exploiting their potential in vertical displacement. They appear poorly co-ordinated, unable to harness all the potential power. Strength training will have minimal impact on this co-ordination. You will need to be rehearsing the specific displacement activity.

Now for some reality checks. How long will you need to rehearse the skill for and at what stage of your life?

There is a body of thought in literature in agreement that it takes ten years or 10,000 hours of practice to achieve elite level abilities. Not to suggest that you are pursuing this level, but this information gives you an idea of how much time or years you will need to dedicate to achieve relevant levels.

Now for the optimal stage in life to be exposed to developing the skills needed to displace the body. Leading international authority on multi-year periodisation, Istvan Balyi, presents a concept of four phases in the multi-year planning from childhood to champion. He, along with many other experts, stress the need to develop the fundamental motor skills before the age of 12-14 year.

*“...The mastery of fundamental skills, such as running, jumping, throwing, agility, balance and eye-hand co-ordination, ...are important because they form the base for all*

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*of the more complex, sport-specific skills to be attempted later. If these fundamental skills are not mastered early in an athlete's career, his or her ability to move to a higher level of sport achievement will be limited...*" (Balyi, I., 1998, Long-term planning of athlete development, Faster-Higher-Stronger, Issue One, p.8-11.)

The last two points have not been included to give you an excuse. Rather to help you maximize your potential, or understand why it may not be as high as you would like. In summary of this section, I have discussed skill first because in most sports it more important than strength.

*Strength* : Development of strength for displacing the body is a little more complex than simply getting bigger or stronger.

The strength of the eccentric contraction is one of the factors that are considered to maximise the plyometric effect (Sale, 1984). Podolsky et al. (1990) suggest that the height of the single and double axel in figure skating is significantly correlated with the muscle strength of the shoulder in abduction and adduction, the knee in extension, and the hip in extension and flexion. These measures were made of the concentric strength, including this contraction type along with the eccentric strength in a positive relationship with plyometric ability. Hakkinen (1989) also observed a positive correlation between maximal leg extension force and vertical jumping performance. Hakkinen and Komi (1983) reported a significant increase in vertical jumping ability in both the squat jump and the counter jump (9.7% and 7.0% respectively) from a sixteen (16) week strength training program.

It is also interesting to note the high levels of strength quoted for athletes in sports with high demands on the stretch-shortening cycle, and the relationship between their power as expressed in the vertical jump and their strength as expressed in the squat.

Schmidtbleicher (1991) differentiates between the influence of strength on power and the influence of strength on power in a stretch-shortening cycle. He suggests that maximal strength is the basic quality that influences power performance, the extent to which is dependant on the magnitude of the resistance and the (movement) coupling time involved. For power performance in a stretch-shortening cycle, suggests Schmidtbleicher, the correlation between maximal strength and power output are is fairly low. This assessment of the relationship between strength and power and strength and the stretch-shortening cycle is further supported by the work of Hakkinen and Komi (1983). Using leg extensor exercises with loads of 80-120% 1RM with a 3-4 sec eccentric contraction for a 16 wk period, these authors found that whilst both the squat jump and the counter jump improved significantly, the relationship or difference between the squat jump and the counter jump did not change. They claim therefore that whilst this type of training influenced maximal force and an improved jumping ability, no changes in the elastic properties of the muscle were observed.

The relationship between strength and the SSC ability will be influenced by the degree of external loading. It is suggested that the greater the external load in the movement which

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involves a stretch-shortening cycle, the greater the contribution (and therefore the importance) of strength. The lesser the external load in a movement which involves a stretch-shortening cycle, the lesser the contribution (and therefore the importance) of strength.

This relationship becomes extremely important in training philosophy for sport when one recognises the common requirement to displace one's own body - often with the use of one foot only. This creates a situation (without consideration of other influences eg. apparatus, opponents) where a one foot take off presents minimal loading equivalent to a two foot squat of twice bodyweight.

So strength is important, which raises the question which type of strength training should you do? Ultimately you need to be able to display the strength or force quickly. This is not to suggest that you should immediately and only do explosive or fast lifts. Not at all! But at some stage of the year or career you will benefit from being exposed to a range of strength training methods.

For the purposes of most sports strength needs, I like to develop strength in the following order:

- Stability/control
- General strength and hypertrophy
- Maximal strength
- Explosive power
- Speed strength

A simplistic approach to the long term development of the strength qualities would be to master one, then move on to the next, starting from top down. A more effective approach is to focus or prioritize one, and maintain or develop in a low key manner the other strength qualities.

Most importantly understand that you will need exposure to each of these training methods at some stage. Take speed strength for example. The development of the stretch-shortening cycle within certain speed strength training methods is something that will not occur in say maximal strength training methods – the pause time will be too long, too non-specific.

### **Conclusion**

The above discussion is aimed as a general overview of what I consider to be the two most important, trainable influences on how successfully you displace your body – skill and strength. In the following article series, I am going to provide you with practical guidelines on how to improve your vertical, horizontal and multi-directional displacement through the use of strength training. I am going to help you realize that with smart strength training, you can achieve some serious air time!