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Sports Skills and Strength Training, Part II

by Thomas Kurz

In Part II you will learn more about sport-specificity of strength training. Part I "Sports Skills and Strength Training" appeared in Spring of 1998.

In 1968, Soviet scientist U. I. Ivanov published the results of an experiment showing that different kinds of strength exercises develop distinctly different kinds of strength. He had three similar groups do strength training twice a week for three months. The first group did typical (concentric) dynamic weight exercises, the second group did static strength exercises (isometric) with maximal tensions, and the third did yielding (eccentric) exercises with weights exceeding by 10-40% what they could lift in a normal (concentric) way.

After three months, compared to their own previous performance, the first group on the average could lift 8.5 kg more in a squat, 5.5 kg more in a clean to chest, jump 3.7 cm higher, and pull with 14.6 kg more force in a back strength test. The second group on the average could lift 9.2 kg more in a squat, 12.7 kg more in a clean to chest, jump 5.4 cm lower than before training, and pull with 30.0 kg more force in a back strength test. The third group on the average could lift 15.0 kg more in a squat, 9.7 kg more in a clean to chest, jump 1.6 cm lower than before training, and pull with 19.1 kg more force in a back strength test.

As you can see, athletes tested strongest in the tasks that were most similar to the exercises they did. Those that performed dynamic exercises (group one) were best at jumping. Those that did static exercises (group two) were best at the static pull in back strength test and the clean to chest—a rather slow lift—and worst at jumping. Finally, those who did eccentric exercises (group three) improved best in the squat, done as a slow movement in this test.

There are more kinds of strength than just the two most basic kinds—dynamic and static—a division based on the relationship between the muscle's length and tension during efforts.

Static or isometric strength is used when the tension of a muscle increases while its length remains constant. Example: holding a weight. Strength is gained in the muscle within 40° (plus or minus 20°)

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Highlights

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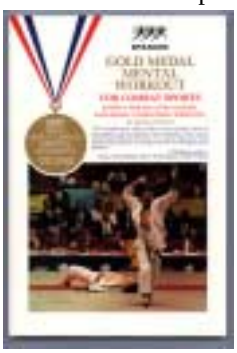
Our Author Nominated to Technical Committee of WTF

Dariusz Nowicki, one of the top European sports psychologists and author of *Gold Medal Mental Workout*, has been nominated to be a member of the Technical Committee of the World Taekwondo Federation (WTF). The WTF is the organization of the Olympic sport taekwondo.

The Technical Committee of the WTF deals with the development of taekwondo as a sport, tendencies emerging in the process of its techniques, equipment both for protection and for judging, and competition rules and regulations. The committee consists of fifteen members and a chairperson.

Nowicki's amazing success as the winning factor in Olympic-level martial arts coaching helped to earn him this honor, but he has paid his dues in other ways as well. He has pioneered the dissemination of eastern European training methods to western hemisphere nations. He is also a successful taekwondo coach and an international referee for taekwondo. His mental toughness program—*Gold Medal Mental Workout*—was proved effective at the Olympics and at world championships.



Sports Skills and Strength Training, Part II

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of the angle held during isometric exercise. At 90°, for example, there'll be a gain within 70° to 110° (Baechle 1994). Increasing static strength does not always cause an increase of dynamic strength (Wazny 1992).

Dynamic strength is used when the length of a muscle changes while the muscle tenses. Dynamic strength is divided into slow strength, speed strength, amortizing strength, reactive strength, explosive strength, and starting strength.

Amortizing or *yielding strength* is used in fast eccentric actions such as landings.

Reactive strength is used for fast switching from eccentric to concentric action such as landing and immediately jumping up. It is used in track and field jumps and in all jumps other than those done from standing still. In martial arts, it is used when launching a flying kick.

Slow strength is used when near maximal mass is given minimal acceleration. For example, when a heavy barbell is lifted slowly.

Speed strength denotes the result of dividing one's maximal strength value in a given movement by the time it takes to reach that value (Tidow 1990), or in simplified terms, the ability to exert maximal force during high-speed movement (Baechle 1994).

Explosive strength is the ability to rapidly increase force (Tidow 1990). The steeper the increase of strength in time the greater the explosive strength (see Fig. 1). It can be also defined as the ability to apply as much force as possible in the shortest time and is useful in all situations where a considerable mass has to be moved quickly, for example, in sprinting starts and in grappling throws. To a large extent it determines athletes' results in all speed-strength sports such as judo, wrestling, karate, track-and-field jumps and throws, and weightlifting.

Starting strength is the maximal amount of force one can develop at the beginning of movement (in the first 30 milliseconds after beginning the contraction).

Graph curves showing the strength increase for different amounts of resistance are identical for a given athlete (Tidow 1990). No matter how great or small is the resistance (how heavy or light is the weight), the initial part of the curves representing the gradient of strength related to time is the same. What differs depending on the amount of resistance is the time it takes the athlete to generate enough strength to overcome the resistance and move (for example, move the weight). In other words, that difference relates to the time it takes to make a transition from isometric muscle action to concentric muscle action, as you see on the Fig. 1. Athletes with high starting strength can move a light object sooner than those with lower starting strength. Boxing punches, fencing touches, or badminton strokes are actions in which high starting strength is an advantage (Platonov 1997).

A long time ago a study was done comparing the strength of judoka and of taxi drivers. Both groups had similar maximal static strength but the judoka had much greater explosive strength. In a practical sense, this means that judoka can pull or push and throw their opponent long before people with less explosive strength could generate enough force to move their challenger.

All these kinds of strength are not closely correlated. People of similar maximal static strength can have very different speed strength, explosive strength, and reactive strength. Starting strength and explosive strength are not closely correlated either, but both can be increased independently with specific strength exercises.

A good example of the need to match your strength exercises to the task is training for increasing your jumping ability.

The height of your jump depends on the vertical velocity of your center of gravity at takeoff. The greater the force and the longer the time that force acts on your body the greater that velocity and the higher the jump. The only way to extend the time the force has for acting is to increase the distance the center of gravity travels, so there is more time for acceleration. Unfortunately, the human anatomy limits the effectiveness of this method, because lowering the center of gravity requires bending the knees, and bending them below 140 degrees reduces the efficiency of leg muscles. This leaves you with only one option—to increase your force by making your muscles stronger. But how? When the duration of takeoff is 120 milliseconds (long jump) or 240 milliseconds (high jump straddle style), then that is all the time you have for using your force. Your strength training for jumping ability has to enable you to generate as much force as possible in that short time. Slow squats with huge weights will increase your maximal strength but they will not develop explosive strength. And what good is great maximal strength if you can't use it within the split second you have for the takeoff?

So you see that increasing maximal strength alone is not a guaranteed way to achieve a better jumping ability. You need to keep your takeoff short. This is where plyometrics can fit into your strength training regimen. In the next issue you will learn when and how to use plyometric exercises.

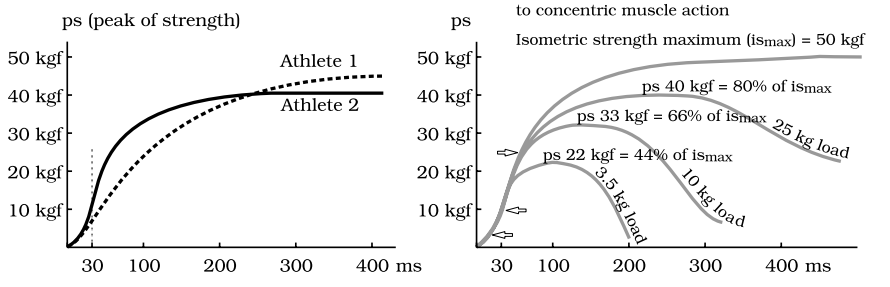

Fig. 1: Strength curves for different athletes and for various weights (Tidow 1990)

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Soft Drinks

On the left a bone that was kept in a bottle of Coca-Cola® for two weeks and on the right a bone that was kept in the same size bottle of water for the same time

See the rubbery bone? It was submerged in a bottle of Coca-Cola for two weeks. The soft drink has leached minerals out of this bone, and that is why it is so soft.

Soft drinks can behave in a similar way in your body if you don't know any better and drink them. The acids they contain tie up ions of calcium in your muscle cells, nerve cells, and in the blood. In order to restore a normal balance of these ions, the calcium from your bones is released, thus weakening your bones. To make matters worse, apart from leaching calcium out of the body, a high phosphorus content in soft drinks interferes with absorbing new calcium and rebuilding the bones (Maffetone 1997).

What else can soft drinks do to your body? If they contain sugar, they can make your blood sugar level unsteady (see "Children and Sweets" in *Stadion News*, Fall 1997). By raising the acidity of your saliva, soft drinks create conditions that promote tooth decay. If they are "diet" drinks and contain NutraSweet (aspartame) instead of sugar, then you are drinking some vile stuff. When drinks containing aspartame are stored at temperatures over 145°F (62°C) (Mullarkey 1992)—for example, in the sun—free methanol rapidly forms in them. Methanol is absorbed quickly in the stomach, more slowly in the small intestine, and then converted in the liver to formaldehyde. This in turn is then converted into formic acid both in the liver and in the blood. Methanol is a deadly poison used to make ethyl alcohol unfit for consumption. It blinds and even kills drunkards. Formaldehyde is a poisonous gas; its solution in water is known as formalin and is used to preserve corpses. This is the source of the strong odor found in anatomy labs. Formic acid is used in insecticides. Both formaldehyde and formic acid are known carcinogens.

Want to learn more? Further information on soft drinks is given by Cherly Wheeler, C.N., in her article, "Five Good Reasons to Lay Off the Soft Drinks," in *Black Belt* of July 1998 and on the web at http://www.holisticmed.com/aspartame/ and at http://www.copi.com/Articles/NutraSweet/Aspartame.html.

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Self-Defense Tip

There are two approaches to learning self-defense skills.

One approach starts with students practicing predetermined defenses, each against a known attack, for example, a left block against a right punch. With considerable practice, students eventually learn to anticipate the form of attack correctly and may respond instinctively with the most appropriate technique.

This first approach leads to spectacular results but requires many thousands of repetitions of defenses to learn it properly. Students who practice with partners who have considerable ring- or street-fighting experience will learn (consciously or subconsciously) the subtle moves that precede each type of attack. Eventually, thanks to picking up on those clues, the students may anticipate the attacks and instinctively defend with the appropriate move. The drawback of this approach is that it takes those thousands of repetitions to learn to respond to each different type of attack. It also requires that the training partner be intimately familiar with the technique of the attack—otherwise the student will learn wrong clues.

The other approach starts with students practicing one type of defense against a whole variety of similar attacks, for example, entry into a clinch against all fist strikes. In this "instant" approach the student is taught what attacks can be made at a given distance, what their common weak spots are, and how to neutralize a whole class of attacks with one and the same move. For example, at a distance greater than one length of your attacker's leg, you are not likely to be unexpectedly grabbed or hit with a fist, knee, elbow, or headbutt. To hurt you, the attacker must either reduce the distance or do a full extension kick which could reach you because of the rotation of the attacker's body. In such a kick, from this distance, the attacker has to aim for your midsection. (He or she would have to be closer to kick your knees or head.) Knowing this you do not have to anticipate where the kick is going and since all kicks at full extension can be defeated with the same move, you don't have to anticipate the type of kick either. In the case of hand strikes, this approach relies on jamming an attacker's arms, because at an arm's distance you can lay your hands on your attacker's hands and then either enter into a clinch or throw your own punch or kick. (This is a simplification. To see how these defenses work, see the Stadion video *Basic Instincts of Self-Defense.*)

In the second, instant approach, because it does not rely on correct anticipation of a specific form of attack, the partner's skill is not so critical. The number of repetitions needed to learn the universal defenses is much smaller—intelligent and fit people master them in a course of at most a few workouts. Those who keep practicing these techniques against skilled partners will develop the ability to anticipate correctly too, and eventually will be able to use specific defenses against various attacks.

To learn more about these universal techniques, order the video *Basic Instincts of Self-Defense* (see the order form on page four).

QandA on STRETCHING *(continued from previous issue)*

Study these typical questions on stretching and training carefully. You may find information that relates to questions of yours. Questions are in boldface.

■ ***I don't understand what the difference in the purpose of the strength training of athletes of different sports could possibly be. The purpose of strength training is to increase the muscles' ability to produce force regardless of the sport. Of course, if you are referring to Olympic lifting, then the skill of lifting that is being practiced independent from strength gains might be considered. Please elaborate further.***

This question is answered in "Sports Skills and Strength Training," Parts I and II (Part I in *Stadion News* Spring 1998 and Part II in this issue). The skill of olympic weightlifting is not practiced independently from strength training. Sport-specific strength training includes skill practice—sport-specific strength exercises are skill exercises.

As soon as Olympic weightlifters learn a form of movement such as snatch and clean and jerk with broomsticks and light barbells, they practice the technique with substantial weights because the precise coordination and timing of these lifts can't be learned with broomsticks and light barbells.

■ ***Active-isolated stretching has received a fair amount of press since the publication of* The Whartons' Stretch Book. *Does it represent any advancement in stretching science or is it simply a popularization of what has been known for a relatively long time?***

I have not read that book. Regarding representing any advancement: The proof of the pudding is in the eating. See his readers' results.

■ ***It is said that Charles Poliquin has developed a method of stretching that produces results much quicker and perhaps safer than PNF stretching. Though I have my doubts, I was wondering if you had heard anything concerning this subject.***

This gets the same answer as the previous question: "The proof of the pudding is in the eating." For me to pay attention to any expert's claims, I need to see results that are better than those achieved by people who use my book, *Stretching Scientifically,* or my video, *Secrets of Stretching.* To see what I mean, look at some of the people who have used my method and took the trouble of photographing themselves and mailing me their photos, which are on our web site at www.stadion.com/testimon.html.

■ ***Various strength coaches (Chek, Telle, Poliquin) have started advocating use of a Swiss ball for certain flexibility exercises, especially for the spine. Many, such as the members of the SuperSlow Guild, are violently against it. Any thoughts?***

From what I know about the Swiss ball, I do not see why it should be contraindicated for spine flexibility exercises. I do not use it because I do not need another gizmo, but I believe that nearly all props can be used beneficially by an intelligent person. All one needs to know are the properties of exercises—how exercises influence the body depending on when, how, and how much one does them.

■ ***I am stuck at my current flexibility range. I'm a bit sore after my isometric stretches, I don't have any sharp pains, my muscles just feel stiff. I feel this soreness in the area above my thighs [in front of my pelvis]; my inner thighs don't bother me. In adductor flyes I currently use a weight boot with about 12 lbs. on each foot. I use 27 lbs. for the adductor pull down load.***

Your problem may have to do with weakness of your psoas muscles. It may be caused by overworking them, by not having sufficiently strengthened them with leg raises before starting adductor exercises (see the video *Secrets of Stretching*), or by a wrong diet. This needs to be checked by very specific tests of Applied Kinesiology. See *Report 10* to confirm this and to find out how to deal with muscular problems.