STRENGTH, POWER AND SPEED IN SHOT PUT TRAINING

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Dr. Poprawski, Director of the Sport High Performance Institute in Toronto, Canada, presents his views on strength and power development for the shot put, created, tested and modeled in the laboratories of the Pozan Sport Institute in Poland and practically applied in coaching at the Canadian High Performance Centre for Track and Field. Re-printed with permission from Modern Athlete and Coach.

Much like the man who walks to work each day by the same route, yet is so intent on making his destination on time that he is unaware of the great works of art he passes during the course of his route, coaches are often guilty of the same myopic vision and ignore what is right before their eyes. In our effort to help our athletes achieve greater and greater results we sometimes ignore the commonsense approaches to training, which with hindsight seem embarrassingly obvious.

Take the use of weight training in the development of shot putters. Everyone involved in the sport would agree that weight training is necessary and you would find almost universal acceptance that the main exercises used by shot putter are: bench press — snatch — power clean — squat.

It is equally true that the same coaches and athletes would agree that the most successful shot putter is the person who can extend the putting motion to the maximum length and, more importantly, perform this motion as fast as possible, without altering or shortening the motion.

Where we have missed the boat, so to speak, is in our failure to combine these two theories so that we are making the maximum use of our training sessions. Just like our poor fellow on his way to work, we have missed what was right before our eyes.

The mass of a shot is constant, so instead of striving for heavier and heavier lifts in the weight room, why don't we "play" with using a constant weight and concentrate on increasing our speed during the exercises.

When our athletes lift we use their results as a practical way of monitoring changes in basic strength and so we do periodic testing of performance in the four main areas of lifting. However, many coaches have learned that improvement in the amount of weight lifted by an athlete does not always mean there has been a corresponding increase in the strength of the athletes. The

increase could be the result of improved lifting technique. This is the trouble with using standard measurements such as amount of weight on the bar. We do not know the intensity with which the exercise was performed. Simply speaking, we do not know the power created by the athlete when they perform these exercises.

Biomechanics tells us that power is:

$$\frac{\text{work}}{\text{time}} \quad \text{or,} \quad \frac{\text{weight of the bar x distance}}{\text{time required to perform the task}}$$

this gives us a measure in Watts.

The real question in this instance is whether or not we need to know the power generated during training sessions in order to improve the distance an athlete achieves in competition? The answer would appear to be yes, since a shot putter must develop power during the throw

$$\frac{\text{16lb x distance of putting motion}}{\text{time required to perform the task}}$$

We theorized that the same should be true in our training sessions in order to achieve maximum distance during competition. In our testing program we did careful testing and monitoring of the strength training process with the intent of measuring speed and power (see research material).

For our experiments we chose a group of 10 well-trained shot putters, selected on the theory that, as top level throwers, any increase in performance would be more likely related to their training programs rather than any major improvement in their throwing technique.

Among the athletes:

- Edward Sarul, later a world champion
- Helmut Krueger, later 21 m +
- Janusz Gassowski, later 21m+

All tests were conducted in a drug free environment. During the course of the experiment we isolated the test results of the best thrower (Sarul, 19.80m) and compared his results with the average of the remaining athletes in the test group.

We did not do direct testing of the traditional strength exercises i.e. bench press, snatch, clean and squat. This was because of limited time and it was felt that the actual testing would fatigue the athletes and could affect the end results of the study. Instead we conduct interviews with both the athletes and their coaches

and established personal best figures for the various lifts.

We did, however, test the following under laboratory conditions:

1. Maximum strength in isometric conditions
2. Speed of the bar during snatch exercise (S = 1.35m).
3. Power of legs, Kaleman test using PSM-2 device.
4. Velocity of bar in squat (S = 0.5m)
5. Power of legs in three consecutive squats using PSM-1 device.

Table 1. Overall data

Test	E. Sarul	Throwers Group	Difference %
1. Results (m)	19.80	17.36	14.6
2. Age (years)	21	21.5	
3. Weight (kg)	112.7	108.1	
4. Bench press (kg)	145	143	1.4
5. Snatch (kg)	110	102	7.87
6. Power clean (kg)	140	133	5.26
7. Squat (kg)	200	185.5	7.82
8. Maximum strength — isometric (kg)	257	243	2.88
9. Power of legs — Kalamen test (Watts)	2239	2060	8.69

As you can see from the data, Sarul had a minimal edge in his bench press and maximum strength results. Yet, he registered a 14.6% difference in his personal best throw. Since his results in the standard exercises were very similar to his peers and their technical abilities were also similar, the difference in their results must have some from some other source.

Table 2. Velocity of the bar in snatch exercise (m/s).

	20 kg	40 kg	60 kg	80 kg
E. Sarul	5.04	4.10	3.48	2.62
Shot Putters	4.84	3.74	2.97	2.14
Difference %	4.13	8.78	17.17	22.43

Where we can see a major difference is in the results of the tests which were oriented towards speed and power, rather than sheer brute strength. Here we see that Sarul registered far superior results. In each test he was far ahead of his peers. In the snatch his velocity ranged from 4.13% faster than the average to a 22.43% difference as the weight on the bar increased. In the squat his velocity ranged from 8.48% better to 25.71%, while in the leg power tests he was 12.28% to 27.3% better than his peers.

Table 3. Velocity of the bar in squat exercise (upwards motion only) (m/s).

	20 kg	40 kg	60 kg	80 kg	100 kg	120 kg	140 kg
E. Sarul	3.07	2.25	1.82	1.56	1.46	1.17	0.88
Shot Putters	2.83	2.19	1.80	1.44	1.24	1.00	0.70
Difference %	8.48	2.74	1.11	8.33	17.74	17.00	25.71

The results of this experiment obviously contradicted the school of thought that more weight is automatically better. Rather, what we recommend to the coaches and athletes is that instead of striving for increased weights during their training they should be spending time extending the distance of the bar (translocation of bar) in lifting. In this case we suggested they use weights that are smaller than their usual maximum and sub-maximum and concentrate on speed. The athletes still used the same exercises coaches recommend for the shot i.e. pulls, pull-jerks and squats, except now they changed the focus of these exercises. One athlete who, we heard later, used this advice was Sarul and his coach A. Daszkiewicz, as they made great use of speed-power work.

Table 4. Power of legs in 3 consecutive squats (Watts)

	20 kg	40 kg	60 kg	80 kg	100 kg	120 kg	140 kg
E. Sarul	3396	3370	3083	2949	2830	2670	2481
Shot Putters	3559	3175	2976	2656	2436	2245	1950
Difference %	12.28	6.14	3.60	11.03	15.76	18.93	27.23

I should point out that our research was supplemented by biomechanical and physiological testing, as well as analysis of multi-year training programs.

So, where does that leave the coach who is interested in improving the performance of his athletes? Our first recommendation would be to ignore the traditional theory that more weight is automatically better. The bench press, while still an important exercise, does not seem to be a major indicator of throwing potential. The most important lifts then are the snatches, cleans, continuous clean and jerk and squats.This is a point of view also advocated by Mac Wilkins, Al Feuerbach and W. Komar (2,4).

The weight on the bar when you are striving for maximum power should reach 50-75% of maximum strength (personal best) of each athlete. The emphasis in these exercises should be on translocation of a bar and speed. There are many variations of these premises depending on the athlete. For example, my coaching experience has taught me that stronger and slower athletes should use weights in the upper end of the scale mentioned above in order to achieve the same power as their “weaker” or faster peers.

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