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Aspects of strength, power and speed in shot put training

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"This paper was gleaned from a survey of long-term theoretical research and practical observations in the throws area. The research was conducted between 1976-80 at The Sport Institute in Poznan, Poland by myself, Prof. E. Wachowski, W. Osinski, Phd, R. Strzelczyk, Phd, A. Winkler, M.A. and G. Jarecki, M.A.
The theoretical observations were accented by my years of coaching, both in Poland and at The Canadian High Performance Centre for Track and Field at The University of Toronto. During this period of practical application I have discovered that the theories of training that were created, tested and modelled in the laboratory are still valid and are being emphasized in modern-day shot put training."

Much like the man who walks to work each day by the same route, yet is so intent on making his destination on time 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 common-sensical approaches to training, which with hindsight seem embarrassingly obvious.

A case in point is the use of weight training in the development of shot putters. Everyone involved in the sport would agree 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 these 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 quickly as possible without altering or shortening the motion.

These two theories are givens in the shot world, but 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.

Before I go on, why don't we stay in the weight room for a moment and look at the four stand lifting exercises we mentioned earlier?

When our athletes lift we use their results as a practical way of monitoring changes in basic strength 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:

$$\frac{\text{labour}}{\text{time}} \quad \text{or,}$$

$$\frac{\text{weight of the bar x distance (translocation of the bar)}}{\text{time required to perform task}}$$

this gives us a measure in Watts.

The real questions 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 throws during competition? The answer would appear to be yes.

Since a shot putter must develop power during the throw:

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

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

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

Among the athletes in these sessions were:

— Edward Sarul, later a world champion;
— Helmut Krueger, later a 21m+ thrower;
— Janusz Gassowski, later a 21m+ thrower.

The findings of this paper are based on two days of testing done in 1980. All results were conducted in a drug-free environment. During the course of the experiment we isolated the test results of the best thrower (Sarul, 19.8m) 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 to do actual testing would fatigue the athletes and could affect the end results of the study. Instead we conducted 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:

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 – Kaleman test /Watts/	2239	2060	8.69

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

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

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	3996	3370	3083	2949	2820	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

1. Maximum strength in isometric conditions
2. Speed of the bar during snatch exercise (S = 1.35m)
3. Power of legs using 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.

(Further information on the methodology is available from the author).

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 come from some other source.

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Where we can see a major differences 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 to 25.71% better while in the leg power tests he was 12.28 to 27.23% better than his peers.

The results of this experiment seemingly lay in the face of the school of thought that more weight is automatically better. Rather, what we recommended to the coaches and athletes was, instead of striving for increased weights during their training they should be spending time extending the distances of the bar (translocation of bar) in lifting. In this case we suggested they use weights that are smaller than their usual maximum and submaximum and concentrate on speed. The athletes still used the same exercises coaches recommend for 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. The details of his programme were presented to a group of coaches at the I.A.A.F. Shot/Discus Conference in London, England in 1983 (1).

I should point out that our research was supplemented by biochemical, physiological testing plus analysis of multi-year training programmes. We also owe a great debt to the coaches and athletes for their sharing of practical expertise.

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 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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