On Machine Training for Athletes

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Resistance training may be characterized as any form of training in which the muscles of the body are required to resist against an opposing force; via variations of overcoming, yielding, and sustaining muscular contraction regimes. This may be realized via a multitude of means:

- Bodyweight
- Elastic bands
- Barbells
- Weight discs
- Dumbbells
- Kettlebells
- Sand bags
- Weight vests
- Machines (plate loaded, selectorized, cable/pulley systems, hydraulic, pneumatic, and so on)

And etcetera…

In all cases in which a load is presented in excess of the weight of the limbs, or bodyweight, the effort may be characterized as overload training. Thus, exercising with machines is a resisted form of overload training.

All forms of training exist among a continuum; ranging from General to the Competition Exercise itself.

For this reason, it is nebulous to describe training means using words such as ‘better’ or ‘worse’ until a concrete task is specified as a training target. Even then, the most accurate way to describe training means is in terms of their transfer or correspondence to the competition exercise.

Machine based training has often been a subject of controversy amidst the sport training community. Exercising with machines is, in fact, a very useful form of training due to the small learning curve required to exact technical proficiency. The degree to which a machine, or any other form of exercise, approximates the neuromuscular and kinematic dynamics of the competition exercise determines its transfer. For this reason, specially constructed machines (whose origins date back a half a century in the former Soviet and Eastern bloc regimes) may possess high degrees of transfer towards the biodynamic structure of the competition exercise.

Alternatively, as a form of general exercise, in which machine based training is more prevalent, the contribution of their use in the training load is equally as warranted as it is for specific objectives.

The training load is constituted by psychological, technical-tactical, physical, and recovery/regeneration training. The technical-tactical component of the training load is characterized by the sports technical-biomotor training. In this way, the most specific aspects of preparation are addressed during sport/event practice itself followed by Specialized Developmental forms of training.

Only after the time: motion characteristics (biodynamic/bioenergetic structure) of the competition exercise have been identified may one intelligently program and organize the psychological, technical-tactical, physical, and recovery/regeneration training load.

Machine based training may effectively be integrated into technical-tactical, physical, and active recovery/regeneration training under the proviso that the machines used satisfy the requisite neuromuscular and kinematic aspects of each element of sports preparation.

The role of machines in the physical preparation training is what will be discussed here due to the fact that most machine manufacturers produce devices whose kinematic motion is most conducive towards general and specialized preparatory training relative to the biodynamic structure of the majority of sport disciplines.

In his text “Transfer of Training” Dr, Anatoly Bondarchuk provides descriptions of General, Specialized Preparatory, and Specialized Developmental Exercises. For the purposes here, it is important to know that General training does not involve any specific neuromuscular or kinematic similarities to the competition exercise; however, Specialized Preparatory exercises involve the same muscles and muscle contraction regimes. Thus, as a form of General and Specialized Preparatory exercise, machines may be used in a variety of sport training environments.

As a general form of training, machines prove themselves highly useful for developing both strength as well as muscular development. One particularly interesting option for machine resistance training is for the purpose of general organism strength assessment.

The honored late sprint coach Charlie Francis elaborated upon the concept of general organism strength in the paradigm of his training methodology. Important to recognize is that, by definition, general organism strength is developed via a myriad of means; the use of machines being only one. As a form of general organism strength assessment; however, machines become very interesting. In this way, the general strength of the proximal muscles may safely be measured; thereby vastly lowering the risk of strength assessment via exercises, such as barbell lifts, that demand greater coordination and pose much greater structural risk as loads near 1RM.

Important for physical preparation coaches to recognize is the fact that, unless they are training powerlifters, weightlifters, or strongmen, the majority of resistance exercises performed in the weight room are developing general and specialized preparatory qualities in their athletes. In the case of general strength, it truly does not matter how it’s developed because, by definition, it has no direct implication on the development of sport skill. The implications come in to play when one considers how it will be assessed. Measuring maximal strength with barbells comes at a high risk; particularly as athletes become stronger. The question the physical preparation coach must ask themselves then is “is it acceptable if one of my athletes sustains an injury in the general training?” If the answer is no then one option, for assessing strength via the same means that are used to develop it, is to revert to assessing strength with repetition maximums with sub-maximal loads. The farther the load distances itself from the 1RM, however, the more unreliable it becomes to calculate the maximum due to factors associated with muscle fiber type proportionality and motor unit rate coding and synchronization.

The assessment of maximal strength via 1RM on machines is a far safer option, in comparison to 1RM barbell lifts, and eliminates the guess work as to the accurate percentage of true maximal strength development that one must contend with when using sub-maximal repetition maximums. In fact, the use of machines, specially constructed dynamometers to be precise, is precisely how improvements in general strength were monitored in the former Soviet Union as is illustrated in much of the literature.

Unfortunately, machines are far more expensive in comparison to barbells and most of them require little in the form of sport skill operationally relevant inter-muscular coordination. It therefore stands to reason that, in most settings, the development of general and specialized preparatory strength is more effectively accomplished via the use of calisthenics/gymnastic variants, jumps, medicine ball exercises, and free weight options and the assessment of strength, particularly maximal strength, may be effectively monitored via the use of machines. In this way, a sports training weight facility might only require 2 or 3 machines: one for assessing arm extension in the scapular plane (chest press), another for the extension of the legs, hips/legs, or back/hip/legs (leg press, hack squat, or power squat respectively), and perhaps a third for the flexion of the arms in the scapular plane (arm pull/row). In this way, the maximal strength of the athletes may more safely be assessed via one repetition maximums and, thanks to general organism strength; the machines are not required for its development.

It requires no special knowledge to determine how machines may be used as a general form of exercise; hence their popularity in most commercial health clubs. As a form of Specialized Preparatory form of training, however, it is necessary that the machines used involve the same muscles as the competition exercise and that the method of execution involves the same muscle contraction regimes.

Consider the biodynamic structure of an offensive lineman in American football during a run block. The movement is initiated from the ground up and dynamically mobilized via the locomotive efforts of the legs; however, it is finalized by placing the hands, and helmet, on the opponent in an effort to displace him. The muscular tensions, specific to the upper body musculature, responsible for thrusting and securing the arms into the opponent, are explosive, maximal, and quasi-isometric. Consequently, a chest press machine executed with explosive, maximal,

and quasi-isometric tensions may effectively be integrated into the Specialized Preparatory training of offensive linemen. Alternatively, if an offensive linemen were to perform work on a chest press machine void of explosive, maximal, or quasi-isometric tensions than the exercise would be classified as General with respect to its correspondence to the neuromuscular structure of run blocking. In neither case is the exercise or its method of execution 'better' nor 'worse' than any other; it only varies in its correspondence to the competition exercise.

Utilize your knowledge of the biodynamic structure of the competition exercise in order to determine how machines may effectively be designed, used, and categorized, in the training of athletes.