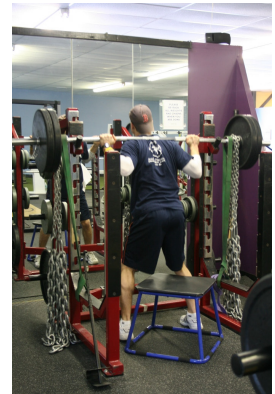


ACCOMMODATING RESISTANCE AND ACCENTUATION FOR INCREASED POWER

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ACCOMMODATE: [*uh-kom-uh-deyt*] to make suitable or consistent; **adapt:** to become adjusted or adapted.

In the world of strength and conditioning and performance enhancement, scientific research findings are vastly improving training methodologies program models, and equipment design. There are three major mechanisms for strength training involving dynamic voluntary muscle contraction against external resistance. Those being free weights, selectorized or plate loaded machines, and band (elastic tension) training. Each mechanism has its benefits and negative aspects. But, which is the best, if any, and why?



Weight Stack or Leverage Machines isolate/recruit prime movers while the athlete follows the restricted range of motion designed into the machine. Typically force is generated in only one plane of motion, with minimal recruitment in other planes. The body has no input on stabilizing the spine, pelvis, or knees during movement as the seated/prone position against a stable platform does this for you, thus “there is a decrease in neural activation of the stabilizer musculature. (1)” In other words, the body does not need to maximally recruit any stabilizer muscles of the working limb because no control of the weight is necessary in that the welded lever arm only has one set range of motion. Beside a “rehab patient instructed to isolate before they integrate (2)”, this mechanism of training does not yield a high transfer of training to on field activities. Isolation is the preferred training method for bodybuilding, not multi functional athletes. When does one typically see a football player sitting down performing any type of work? Perhaps sitting on the bench drinking a Gatorade between plays.

Free weights and weight resistance cable machines are a great mechanism for overloading the body as they provide resistance throughout an entire range of motion and require activation of the body’s stabilizer mechanisms to control movement. The speed of movement can vary from isometric to ballistic, while maximally recruiting large groups of muscle fibers. Free weights do have a shortcoming when it comes to performance enhancement for athletes. ‘One is limited in the amount of weight they can lift by the



weakest point of the range of movement (3).” After working through the “sticking point” (weakest point), as the joint angle nears end range of motion, the muscles have greater leverage to perform the movement. So the greatest overload on the muscle is decreased as one works toward the end range of motion, which just so happens to be where most sporting movements occur (i.e.: the vertical jump, sprinting, pitching, etc). Watch any athletic event and look for a true 90degree knee flexion as found in the parallel squat. For example the drive phase (foot in contact with ground) of sprinting typically occurs with knee flexion of about 135degrees or greater and the same can hold true (not always, though) for some of your best performers in the vertical jump test. Compare this to the aforementioned

parallel squat. An athlete may max out at 315 in the parallel squat, but may max out at 375 in the quarter squat. The limiting range of motion of the parallel squat is parallel (bottom position with joint angle of roughly 90 degrees), and for the quarter squat it may be 130 degrees. It is at these points that the muscle tension and overload are the greatest. But once the athlete has driven through the weakest point of motion, and accelerates up to approximately 180 degrees, the lift becomes progressively easier as the joint angle increases. With this in mind, the 315lbs may not be enough to overload the working muscles at the end range of motion, creating less transfer of training to on field results. Another issue lies in the fact that, when training for power, the athlete will accelerate with load great velocity. As the athlete nears the end range of motion, the muscle tension will be minimal in that momentum has taken over for the last 10-20 degrees of extension, creating a deactivation like symptom in the musculature, when the greatest muscle activation is necessary.

So why not perform quarter squat as they follow the specificity guidelines with regard to lower extremity joint angles? In essence this makes sense, in that the end ranges of motion are going to receive greater stimulation due to heavier loads, but the maximal muscle recruitment patterns are altered with squat depth. To run faster and jump higher, an athlete needs to be capable of generating great force from the powerful hip extensor mechanism. The major hip extensors are the gluteus maximus, adductor magnus, and hamstring musculature (biceps femoris, semimembranosus, semitendinosus). In 2002 Caterisano et al conducted a study on thigh muscle contribution during the partial, parallel, and full squat. “During the partial squat they found 69% recruitment from the quadriceps, 16.9% recruitment from the gluteus maximus, and 13.37% recruitment from the biceps femoris (Not sure why adductor magnus was not tested??). In contrast, the parallel squat had 56.64% recruitment from the quadriceps, 28% recruitment from the gluteus maximus, and 15.35% from the hamstrings (4).” The glute activation nearly doubled, when increasing the range of motion from quarter squat to parallel squat, while the hamstring recruitment stayed

the same. With this knowledge, an athlete lacking in posterior chain development, specifically hip extension power from the gluteus maximus, may want to perform squats to at least the parallel position, assuming no pre-existing injuries in the low back or knees.

Band resistance lies on the opposite end of the spectrum as free weight training. At the beginning range of motion, the band will have minimal if any resistance. As the athlete progresses through the range of motion, the resistance increases, with the greatest resistance being at the end range of motion, where most sporting movements occur. Taking into account joint angles and accommodation of these angles for transfer of training, this method of training makes sense. “The use of bands can also cause an overspeed eccentric effect, pulling the body down faster than gravity (5).” This increased eccentric acceleration raises the neuromuscular demand, therefore making the body stronger and more efficient at absorbing forces. The more force an object can absorb, the more power it can generate. The negative side to this method of training lies in the beginning range of motion, where maximal recruitment of specific muscles occurs. If an athlete performs the parallel squat with bands only, there would be no tension at the bottom range of motion, leading to minimal gluteus maximus recruitment. With weak or underdeveloped gluteus maximus, the athlete may once again lack hip extension power. So what is the best method? The answer lies between free weights and band training.

Accommodated resistance is used to “develop maximal tension throughout the complete range of motion rather than at a particular (e.g. weakest) point (6).” The use of free weights combined with bands (chains, weight releasers, or lightened method of accommodation) allows for increased resistance at the end range of motion, while accommodating for the joint angles throughout the entire range of motion. This method combines the positive aspects of both free weights and bands, while minimizing the negative effects. In the parallel squat example, the athlete will have adequate resistance from the load on the bar at the parallel position. This ensures maximal gluteus maximus activation during the squat. As the athlete accelerates the weight upward, the tension on the band will increase, thus providing more resistance at the]



end ranges of motion, where the sporting movements occur. As the athlete nears the top of the motion, the total tension (load) will be the greatest, providing adequate stimulus (tension) throughout the movement. Momentum will not be a factor at the end of the range of motion, therefore no potential muscular deactivation can occur at the top. In a study performed by the late Mel Siff, he set out to “compare the effectiveness of combined method (band and weights) and free weight training (7).” The results clearly show the benefits of accommodated resistance training.

1. **Greater mean and peak forces were generated throughout the movement**
2. **The descent was accelerated above the normal gravitational rate of 9.8m/s**
3. **The stronger eccentric loading and brief transition period provided neuromuscular stimulation similar to that found in Plyometric training**
4. **The force generated during the later stages increased, in strong contrast to that of normal squatting in which force production tends to decrease significantly.”**

Siff M. (2003), Supertraining Pg 412

The effectiveness of this method of training is clear, but one should maintain great restraint when training in this manner. The demand on the joints and neuromuscular system is very high, so proper technique, periodization, repetition counts, training experience, rest intervals, prehab and recovery methods must be implemented prior to beginning a program utilizing accommodated resistance.

Recommendations:

- a. **Programming:** Perform weight release (eccentric emphasis) for 1 week, followed by 3 weeks accommodated resistance (bands or chains). Follow with minimal of 3 weeks non-accommodated resistance training.
- b. **Reps:** 1-3 reps is preferred, with 1-2 for squats, and 2-3 for bench press. Reps should be at 1 second in total duration. For example, 2 reps of squats should be performed in 2 seconds.
- c. **Load on the Bar:** If goal is power, approximately 50-70%. If goal is strength 70-90%
- d. **Set Count:** In Russian Conjugated programming, one may see 10 sets of 2 repetitions in the squat on Dynamic Effort day. This should be at the elite/advanced level.
- e. **Rest Interval:** Approximately 60-90s.
- f. **Prehab/recovery:** SMFR with foam roller, reciprocal muscle stretching prior to sets, Static stretching after workout, and post workout contrast shower.

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