Strength and Conditioning for Fencing

Modern fencing competition is held in three different weapons, the foil, the epee, and the sabre, each weapon contested with different rules for combat, each demanding slightly different stances and grips. The competition is organized into preliminary bouts, each fencer facing the other members of a pool of 5 or more fencers for bouts of 5 touches, each touch lasting from a few seconds to as much as a minute, with a few seconds rest between each touch. If the fencer is successful in advancing out of the pool bouts, the next phase of competition is the direct elimination bouts. They consist of 15 touches, the same few seconds rest between touches, until the fencer is defeated. The customary "en guard" position varies with the weapon, but is generally a partial squat position with the forward foot perpendicular to the back foot. The most common attacks are ballistic movements initiated from the "en guard" position, with the weapon arm in extension for a thrust or a cut, depending on the weapon. Advances and retreats are performed while maintaining the partial squat of the guard position. Defense is accomplished by evasion, retreat, and parrying the opponents weapon with contact and pressure from the defender's blade.

Fencing is a sport of skill, speed, and power. Skill is improved by long years of practice and experience under the guidance of expert coaching. Traditionally, fencers have relied on this same practice for the development of speed and power. However, the days are gone when elite competitors in any strenuous sport can rely on the practice of sport skills as their sole source of conditioning. Resistance training, or more specifically a correctly designed weight training program, is the choice of athletes all over the world, regardless of sport, for the development of the strength necessary to compete at the elite level. The lower levels of all sports are composed of recreational competitors, athletes with less than elite potential in terms of talent, and those who are unwilling or unable to devote sufficient time and energy to training. As the athlete rises through the competitive ranks, the first and easiest improvements occur as the athlete achieves the success facilitated by natural talent for the sport and the conditioning provided by the practice of sport skills. Eventually even the most talented people reach the point where progress comes only through increasingly intense training, eventually approaching the limit of potential. The percentage of potential achieved and the rapidity of its achievement are functions of training efficiency.

Reasons to Include a Resistance Training Program

Weight training is the conditioning modality of choice for athletes the world over for many good reasons. In addition to the fact that weight training programs can be designed to meet the specific conditioning needs of each individual sport, the nature of the training is such that it allows quantifiable control over progress in the conditioning program through precise manipulation of volume, intensity, frequency, and duration. The results are predictable and controllable on a weekly, monthly, and annual basis, allowing the trainee to tailor conditioning to fit competitive schedules. Incremental progress built in to the schedule is a necessary part of a well-designed resistance training program, and is the reason sport conditioning specialists now prefer weight training to insure conditioning progress for their athletes.

Competitive fencers can obviously benefit from an increase in strength. Stronger muscles can be faster muscles (2,3,8). Studies have shown increases in contraction speed when weight training was used in conjunction with sport skill practice(5). Improved sprint performance subsequent to weight training demonstrates the application of strength to speed production(4).

Power is the application of force with respect to the time of application. In a practical sense, power is the ability to apply maximum force in a mimimum amount of time, the ability to recruit the maximum number of motor units in a muscular contraction, or the ability to "explode". This concept is tremendously important to all combative sports where contact with an opponent, even indirectly through a fencing weapon, is involved. Attacks and parries are effective only if they transmit sufficient force through or to the opponent's weapon. The muscles involved with the extension, the grip, the parries, as well as all ground-reaction activity, e.g. lunge, ballestrae, advance and retreat, etc., benefit from an increased ability to generate power. Power production can be enhanced by both increasing absolute strength and through the use of explosive exercises that specifically develop power(9,10,11,17), and will be addressed in the recommended program.

Muscular endurance is also greatly enhanced through resistance training. As absolute strength increases, the percentage of that absolute strength required to perform non-maximal tasks decreases, thus reducing the relative demands on muscular endurance. For example, if a fencer doubles her leg strength, the relative amount of leg strength required to maintain her in "en guard" position is reduced, and she is able to maintain the position longer before fatigue becomes a limiting factor. This phenomenon is observed in endurance sports when weight training is introduced into the conditioning program, and is a widely recognized effect of resistance training(1,7,8,13).

Flexibility is of great concern to fencers, as the sport requires that the athlete be capable of movement through a wide range of motion. It is of extreme importance that fencers be aware of the fact that a properly designed weight training program does not adversely affect flexibility. In fact, many classic studies have demonstrated that joint range of motion(ROM) may actually be increased through the use of the classic barbell exercises performed through the full ROM(14). It is incumbent on the athlete and the strength coach to insure the correct performance of the proper exercises in order that this effect be realized, and the amount of time the athlete would normally spend in a stretching routine specific to fencing should be maintained. Full ROM performance of the exercises is also important in that improvements in strength have been shown to be specific to the ROM sujected to training(8). To be strong at full extension in the lunge, those muscles in that ROM must be strong in the weight room.

Prevention of injuries is facilitated by a properly designed resistance training program, due to both the increased flexibility provided by the program, and the nature of the adaptive response inherent to resistance training. Injuries caused by positioning accidents, e.g. hyperflexions or overextensions, can obviously be avoided or lessened through the aforementioned flexibility improvements provided by a properly designed and coached weight training program. In addition, incorrect positioning in fencing practice due to inflexibility increases the potential for injury inherent in incorrect execution of sport skills. Again, increased flexibility is ablative for these problems(16). A stronger musculature can also prevent injuries in combative sports by allowing for the

absorption of contact force inflicted both intentionally and accidentally by the opponent. For example, neck injuries, resulting from contact between the mask and weapon, are common. A stronger neck musculature can absorb the tremendous rotational or whiplash-type forces that are sometimes experienced in fencing.

Not as obvious is the fact that resistance training toughens and strengthens all the tissues affected by the exercise, not just the muscles. Human movement is produced by the contraction of muscles acting through tendons upon the bony skeleton, which is held together by ligaments. These three components, muscle, connective tissue, and bone, are functionally inseparable and are stressed as a system, not as individual components. Adaptation to stress occurs in all tissues in the system(6,19). The controlled, progressive stress provided by a properly designed resistance training program produces a beneficial physiological adaptation in the tissues most likely to suffer injury(12), thus reducing the rate and severity of injuries suffered during fencing practice and competition.

Balance and coordination are usually thought of as elements of talent, the innate ability to perform high-level skills with ease. Elite athletes competing in sports requiring high levels of agility and quickness are the embodiment of talent, and not all athletes are capable of developing this level of skill. However, at least one recent study has show that coordination can be improved by the use of resistance training(15). It is recognized by sport conditioning professionals that a correctly designed resistance training program can have a positive influence on balance and coordination, most especially in untrained individuals. The reasons for this might be the acquisition of strength in those muscles responsible for stabilizing the body in gross motor movements. For example, lateral stability in a forward movement such as the lunge is provided by the muscles on the lateral and medial sides of the legs, with the finely coordinated efforts of the external and internal rotators of the femur, the peroneus longus and other muscles of the lower leg that control pronation and supination of the foot, and the lateral trunk muscles that control the position of the spine and pelvis during the movement. Although hip and knee extension provides the gross movement, balance is facilitated by these other muscles. The coordinated use of these stabilizing muscles may be a function of talent, but resistance training can radically improve the efficiency of their function.

Body composition refers to the relative amounts of fat and lean tissue in the body, usually expressed as bodyfat percentage(17). Excessive levels of bodyfat are usually thought of as being reflected in a higher than desirable bodyweight, although this is not necessarily the case. Fencers, participating in a sport without weight classes, might not be overly concerned with body composition, although human vanity influences us all. Vanity notwithstanding, bodyfat may hinder performance through increased "inertia", excess mass that does not itself contribute to acceleration, and decreased range of motion around adipose-impacted joints. Under the anaerobic circumstances of a fencing bout, bodyfat is metabolically inactive, and contributes nothing to performance. Excessive levels of bodyfat can indicate an inadequate amount of time spent in general physical preparation, or a lack of dietary discipline.

A substantial body of data demonstrates the positive relationship between weight training and improved body composition(1,8,17,24). The addition of metabolically active lean body mass increases the basal metabolic rate(BMR) so that more calories are burned all the time, not just during exercise. This training-dependent increase in energy requirement causes the body to burn more fat, as a high percentage of this increased

BMR is supplied by fat stores. Thus, resistance training carries with it an improvement in body composition as a side effect.

Circumstances may exist that would prevent the inclusion of weight training in the conditioning program. The presence of an acute injury that prevents fencing would probably preclude participation, although many weight training modalities are useful for the rehabilitation of such injuries in the post-acute phase. Athletes should be evaluated on an individual basis to determine the possibility of their exclusion from the weight room. However, any athlete that is healthy enough to fence is also probably healthy enough to participate in a well designed weight training program.

Program Considerations

When considering the type of exercise to use in designing a resistance training program for fencing, the coach will be faced with the decision to use either free weights or exercise machines, or to include both in the program. All too often, the decision is not so much one of preference but of availability. If no free weights are available, machines are the default modality. The converse seldom occurs, as free weights are often perceived by the fitness industry as dangerous and not conducive to rapid turnover of traffic on the exercise floor, and are thus often not an option for a coach looking for an off-campus facility. In academic situations the choices are sometimes better, depending on the size of the school.

Much has been written about the relative benefits of the use of free weights, or barbells, and exercise machines(21,22,23). Briefly, free weights are considered by most exercise professionals to be superior to machine training due to the fact that sport specific conditioning can be accomplished so much more effectively. Human movement in sport, and in all other situations for that matter, is composed of many joints flexing and extending in a balanced, coordinated, complex, well-controlled manner. The principle of specificity of conditioning demands that for exercise to be effective in producing usable adaptations for the sport being trained, it must work the body in such a way as to be applicable to the sport in terms of biomechanics and bioenergetics. If a sport calls for the coordinated, concurrent use of all the leg, hip, and trunk musculature, as all sports do, then a simple knee extension exercise does little to specifically condition for the sport. If our aim in the weight room is to produce athletes in better condition to play sports, efficiency in conversion of conditioning to sport performance must be our prime consideration. For this reason, this program will be composed primarily of free-weight exercises.

Training frequency and intensity will depend on the calendar. Most sports have a competitive season, usually determined by the relationship of the sport to the school year, the weather for outdoor sports, or the availability of facilities to serve as venues. The conditioning program must be tailored to meet the demands of the competive schedule, and designed to have the athletes in peak shape for important competitions. In general, resistance training volume should be lower during the competitive season, with the intention of maintaining strength and condition without interfering with fencing practice, and higher during the off season, to take advantage of the athletes time away from intense fencing practice. Resistance training intensity will be higher during the off season, so that strength gains can be made without compromising fencing training, and lower during

season, in an attempt to maintain the strength gains produced during the off season. The programming of training cycles with respect to the calendar is known as periodization, and much attention over many years has been focused on the optimal way to design programs to ensure continued progress throughout the training year. These considerations are less important to novice athletes with no conditioning base, or even to advanced athletes just beginning a resistance training program. For help in designing periodized programs for well-trained athletes, a strength professional should be consulted.

A major problem facing coaches is the availability of facilities. The ideal situation for the fencing coach would be the presence of a well-equipped weight room on the training premises. This may not, to say the least, be a viable option. However, one of the advantages of the use of free weights is their relatively low cost. While it may take many tens of thousands of dollars to equip a facility with weight training machines, a perfectly adequate free weight room for an average size fencing club can be assembled for no more than two or three thousand dollars, and need not take up more than a few hundred square feet. For a small club, a spare room and a thousand dollars can be turned into a perfectly serviceable weight training facility. If the addition of facilities is not feasible, some arrangement with an existing facility will need to be made.

Programs

As already discussed, the suggested program will be based on free weight exercises. No attempt will be made here to assign a workout, as it is essential that a qualified professional be consulted regarding the application of these recommendations to the individual athlete. Just as it is impossible to learn to fence in the absence of qualified instruction, so it is with free weight exercise.

Each workout should be a full-body workout. No attempt should be made to divide it into bodyparts to be performed on different days, as is popular among bodybuilders. Once again, the workout should be specific to the sport, and fencing, as with all other sports, is performed with the entire body. This principle is reflected both in the choice of exercises and in their application during a full-body training session(21). If a split routine is necessary due to time considerations, the emphasis should still be placed on exercises that work as many muscle groups as possible at one time, generally dividing them between upper body and lower body movements.

The training session should begin with a general warmup using some type of mild repetitive exercise that would be aerobic if done for an extended period. Jogging in place, or the use of a treadmill or stationary bike are examples. No more than 5 minutes is necessary, as the purpose is not aerobic training, but the mild elevation of body temperature as preparation for subsequent exercise(20).All other pre-preparation activity should follow this initial warmup. Situps or other abdominal exercise should be performed next, as it is the opinion of the author that these movements tend to be forgotten if placed at the end of the workout, and in a conditioned athlete abdominal exercise contributes to total warmup without excessively fatiguing the trunk musculature.

Stretching prior to resistance training would seem a foregone conclusion to competitive fencers, whose sport depends on flexibility. In weight training, however, there is disagreement among sport conditioning professionals as to the benefits of stretching before a workout for strength athletes. This is a minor consideration for

untrained or inexperienced athletes just beginning a strength program. If the athlete desires a pre-workout stretch, time should be alloted for it in the program.

Of much benefit is a dynamic warmup using the movement about to be trained with very light or no weight. This specifically prepares the muscles for the movement to be performed. In addition, a multijoint exercise incorporated into the workout prepares the body for subsequent exercises that may use the same muscle groups(18). Generally, the more complicated the exercise, ie. the greater the number of joints and muscle groups involved in the movement, the more extensive the warmup needs to be, and the greater the likelihood that the athlete will be warm for any subsequent exercises. Warmup for and performance of the power clean, for example, serves as warmup for the squat.

Exercises should be performed in order from fast to slow, multijoint to single-joint, complex to simple(18). This rule insures the most efficient performance of those exercises most crucial to rapid development of strength and power. The athlete is freshest for the explosive, high-skill movements, eg. cleans and power snatches, that translate into athletic improvement. Slower multijoint movements such as squats and presses follow the fast movements, as slight fatigue tends not to interfere with their correct execution. Assistance movements are done last, as they have the least effect on overall improvement, and if time runs out for the workout the loss is minimal.

The following exercises are suggested for inclusion in a program:

Explosive Multijoint Exercises

Power Clean
Power Snatch
Push Jerk

The inclusion of these movements is contingent on the availability of qualified coaching assistance, as these movements cannot be taught by inexperienced coaches. Therefore, despite their high degree of usefulness in the conditioning program, they must be considered optional.

Core Strength Exercises

Squat
Military press
Bench Press
Deadlift
Lat pulldowns or Chins
High repetition vertical jump

These exercises should be considered essential, and every effort must be made to include them in the program.

Assistance exercises

Lunge
Hammer curls
Wrist roller
Various grip exercises

These exercises have been chosen for their specific application to fencing.

In obtaining help with the implementation of the program, it is advised that a credentialed professional be sought. The National Strength and Conditioning Association certifies degreed strength professionals and maintains a directory of these individuals. USA Weightlifting also has a coaching certification program, and can be contacted for help in locating qualified coaches.

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