HEMOPHILIA, A HEREDITARY blood-clotting disorder, was once a condition that limited affected individuals from engaging in many physical activities. The limitations were primarily because of the possibility of severe complications from internal bleeding into joints, organs, and soft tissue (1). Current innovations in treatment, safety, and preventative care allow individuals with hemophilia to participate in many physical activities and sports that were previously contraindicated.

Despite the recognized benefits of strength training for muscular fitness and for preparation to engage in sport, many people with hemophilia do not engage in strength development activities. As the management of hemophilia continues to improve, more individuals with this disorder will participate in physical activities and sports; the need for strength and conditioning professionals to provide education, training, and services to these individuals is becoming increasingly important.

Although there is abundant literature about training athletes with special considerations (10), there has been little attention focused on physical training for individuals with hemophilia. Strength and conditioning professionals should be aware of the special considerations associated with developing and implementing physical training programs for individuals with hemophilia. The purpose of this article is to briefly discuss hemophilia, as well as resistance training for individuals with hemophilia, while focusing on the implications for strength and conditioning professionals.

What Is Hemophilia?

Hemophilia is a genetic disorder in which there is an abnormality, absence, or deficiency of a clotting protein present in the blood. This disorder, passed on through the mother’s X chromosome, almost exclusively affects males. The most common form of hemophilia, hemophilia A, is marked by an absence or deficiency of Factor VIII, one of the many proteins necessary for proper blood clotting. Other forms of hemophilia can occur from an absence or deficiency of other clotting factors.

The severity of hemophilia differs among individuals and falls into one of three categories: severe, moderate, and mild. The range of severity depends upon the amount of circulating clotting factor present in the blood. The severity of hemophilia remains constant throughout a person’s life and is usually similar among affected family members. Individuals with severe hemophilia have a factor activity level of less than 1%. These individuals are frequently prone to bleeding into joints, muscles, and organs. This may occur spontaneously or as a result of minor trauma. In moderate hemophilia (1–5% factor activity), bleeding into joints or muscles may occur following injuries or trauma; spontaneous bleeding is not usually a problem. Individuals with mild hemophilia (>6% factor activity) often do not experience complications unless they have surgery or trauma.
Treatment and Management of Hemophilia

Internal bleeding into joints, muscles, and soft tissue is the most common problem associated with hemophilia. Internal bleeding is often painful and may lead to severe arthritis and persistent inflammation of the joints and surrounding tissue. The joints most often affected are the knees, elbows, and ankles. Treatment of serious internal bleeding requires one or more intravenous infusions of factor concentrate to replace the missing clotting factor in the blood. Minor cuts and scrapes can generally be controlled with typical first-aid measures. More serious external bleeding would require the same medical attention and treatment as the general population with the exception being that these individuals also require factor replacement therapy.

Until the end of the 1960s, the prevention and treatment of bleeding episodes usually consisted of keeping the person with hemophilia as inactive as possible (1). Advances in the treatment of hemophilia, such as medically supervised home infusion therapy and preventative treatment (prophylaxis) have allowed individuals with hemophilia to live a more normal and active life (1). Prophylaxis involves the regularly scheduled infusion of clotting factor concentrate. Instead of waiting for a bleeding episode to occur, factor concentrate is administered 2 or 3 times per week to boost the level of circulating factor in the blood. Prophylaxis does not cure hemophilia but will increase the level of circulating factor to the mild or moderate category, allowing individuals to more readily avoid spontaneous bleeding, joint bleeding, and accompanying orthopedic problems. If started early, generally before the age of 2 years (before an established bleeding pattern is likely to occur), joint damage and other complications may be avoided (9).

Prophylaxis requires frequent intravenous infusions. Because frequent venous access can become problematic, the use of a venous access system such as a port may be prescribed. A port is a device placed under the skin of the chest that allows easy access to a vein. While the use of a port can present problems such as infection and clotting, proper infusing and sterilizing techniques can usually prevent these (9). Subcutaneous ports place virtually no restrictions on physical activities and have become a viable alternative to venous access, especially in younger populations.

Hemophilia and Sports Participation

People with hemophilia are now encouraged to engage in physical activity and sports such as baseball, basketball, soccer, and others that were previously contraindicated (1, 7). These sports carry inherent risks for all participants. While individuals with hemophilia may be at higher risk for injury than most others, often times, the physical, social, and psychological benefits associated with sport participation outweigh the increased risk. Participation in sport is important for the development of self-esteem and enhanced confidence for people with hemophilia, especially during adolescence (8). Adolescents have a strong desire for peer approval and to feel that they can be successful at some sport or game. Athletic activities encourage children with hemophilia to learn good judgment and become more independent. Studies suggest that when children with hemophilia become more assertive and independent, there is often a marked clinical improvement, with fewer spontaneous bleeding episodes (8).

Decisions regarding whether to participate in various sports should be made jointly by the athlete, the parents (when appropriate), and the athlete’s physician and hemophilia treatment center staff. Age, severity of hemophilia, maturity, medical history and treatment regimen, the level of competition, and the quality of instruction associated with the sport are some of the factors that should be considered (7). The National Hemophilia Foundation has divided sports and activities into three categories on the basis of risk. Category 1 includes sports in which most individuals with hemophilia can safely participate, like bicycling, golf, Frisbee, swimming, and walking. Category 2 includes sports such as baseball, basketball, mountain biking, rowing, and cross-country skiing. Category 3 includes activities in which the risks outweigh the benefits and are often dangerous for anyone, such as football, rugby, hockey, wrestling, and others (2, 8). Once the decision is made to participate in an organized sport, adequate preparation in the form of strength training and conditioning is vital (8). The strength and conditioning professional can play an integral role in preparing the athlete with hemophilia for sports participation.

Benefits of Resistance Training

The benefits of resistance-training programs for people in the general population have been well documented. A closely supervised, well-designed resistance training program can increase strength, can prevent atrophy of muscles,
and may contribute to motor development, skill mastery, feelings of competence and achievement, and athletic success. Additionally, resistance training may aid in reducing the risk of injury associated with participation in many sports (4). Research indicates that the increased strength, flexibility, and associated joint stability gained from strength training reduce the frequency of joint bleeding for people with hemophilia (5, 6) and that exercise, in general, causes a transient increase in clotting factor levels for persons with mild and moderate hemophilia (6). Resistance training can also aid in the improvement of self-esteem and provide a sense of accomplishment for individuals with hemophilia (1). Resistance training should be an essential part of the preseason training to prepare athletes with hemophilia for a sport season or for general improvements in muscular fitness.

**Implications/Considerations for the Strength and Conditioning Professional**

Individuals with hemophilia should be treated much like the general population and are likely to share the same benefits derived from participating in resistance training. However, as with any group with a chronic health condition, there are considerations that need to be addressed when developing and implementing strength and conditioning programs for these individuals.

Participation in strength training and conditioning activities is highly encouraged for individuals with hemophilia (8). It is always prudent, however, to discuss the benefits and risks of participation with the individual, parents, physicians, and hemophilia treatment center staff prior to starting any physical activity. Additionally, it is important to develop a plan for the treatment of a bleeding episode, should one occur. A written plan on how to handle such an event should be completed prior to participation in the strength and conditioning program.

The goals of the strength and conditioning program should be established up front. If the goal of the program is to prepare the individual for sports participation, then the program should be as sport specific as possible and focus on the strength, speed, and endurance requirements of the sport in question. Any individual weaknesses should be identified and corrected with specific exercises. Extra care should be taken to prevent overtraining, especially if there is a history of a "target joint" (chronic bleeding into a particular joint). Strict adherence to proper technique with an emphasis on gradual progression is essential to avoid muscle strain and joint injury. A proper warm-up and cool-down, which includes stretching, helps increase and maintain muscle extensibility and joint range of motion. Maintenance of adequate joint range of motion is especially important for individuals with hemophilia to prevent injury and to monitor progress following an injury.

Resistance or load assignment for individuals with hemophilia should start with low volume and low intensity and gradually progress to higher volume and moderate intensity. Proper form and technique should never be compromised by increases in load. While it may be appropriate to estimate a one-repetition maximum (1 RM) for an individual with hemophilia, this should be done with no fewer than 10 repetitions. Emphasis should be placed on a high number of repetitions with low weight. For example, loads should not exceed 83.50% of an estimated 1 RM (approximately 6 repetitions) and should start around 50–60% of an estimated 1 RM, providing that baseline strength has been established and that proper technique is used (11). Maximal efforts, such as a full 1 RM, are not recommended for individuals with hemophilia (8). Also, people with hemophilia in general should avoid conventional power lifting and Olympic-style competitive weightlifting because of the increased risk of injury associated with these activities (8).

Recovery is another essential part of the strength and conditioning program. Although many individuals participate in resistance training 5 days a week, it is recommended that individuals with hemophilia have at least 1 day of rest between exercise bouts (8). This is primarily to avoid injury or bleeding from overuse.

The selection of the appropriate methods and modes of training for individuals with hemophilia should be based on a needs analysis (12). Initially, manual resistance or free–body weight exercises may be most appropriate before progressing to resistance machines or free-weight exercises. There are benefits and limitations to all of these methods and modes (12). Final selection of training methods should be based on the individual’s needs, goals, current condition, and medical history. Age may also play an important factor in selection of training modes or methods. Typically, resistance machines are not designed to fit children and preadolescents; therefore, free–body weight and free-weight exercises are generally most appropriate (3) for such individuals. However, with older
beginners, resistance machines may be easier to learn on prior to progressing to free-weight activities.

**Conclusion**

With developments in home treatment, consisting of prophylactic infusion therapy and the use of venous access devices such as a port, it is much more likely that individuals with hemophilia will engage in physical activity, individual sports, and team sports. Therefore, it is important for strength and conditioning professionals to have a complete understanding of hemophilia, how it is managed, and how resistance training can be beneficial.

Proper preparation for physical activity will reduce the chance of injury. The conditioning program should progressively increase fitness without added health risk. Ingredients for a proper resistance-training program include close and continuous supervision, adequate warm-up and cool-down, adequate recovery time between sessions, and avoidance of maximal or near-maximal lifts. The emphasis should be on multiple sets of low-to moderate-resistance exercises for large muscle groups and on proper technique.

The benefits of a well-designed resistance-training program can have a significant impact not only on the physical fitness and athletic success of a person with hemophilia but also on the emotional and physical well-being of the individual. Proper resistance training may increase muscular strength and endurance, increase proprioception, and increase flexibility while reducing the risk of injury and bleeding that may result from participation in activities of daily living, sport, and physical activity.

**References**


Jeffrey D. Coelho, EdD, is an Assistant Professor in the Department of Physical Education at the United States Military Academy in West Point, New York.

Kenneth L. Cameron, MA, ATC, CSCS, is a Certified Athletic Trainer and Instructor in the Department of Physical Education at the United States Military Academy in West Point, New York.