PDHPE

Analysis of a Sport: Tennis

The sport of tennis has many different movements which are used when participating in this physical activity. The main movements are the five main shots which are serve, backhand, forehand, volley and smash. When performing these key movements in the sport, there are many contributions being made by the body. These contributions are made more often than not by the muscular and skeletal body systems.

The Oxford PDHPE textbook states that “muscles convert chemical energy into mechanical energy to create force, and this allows us to move.” The function of the muscles is to produce movement, provide stabilisation and generate heat. The skeletal system consists of bone tissue, bone marrow, cartilage and the periosteum. The function of the skeleton is for support, protection, movement, mineral storage, blood cell production and storage of energy. These two systems form the musculoskeletal system and work together to perform the primary movements of tennis.

The serve starts with the ball toss which begins with the radius and ulna in a supinated position when the arm is flexed upward with the biceps acting as an agonist and the triceps as an antagonist. When the ball is tossed the dominant side of the person begins the swinging action of the serve with the abduction of the arm by the latissmus dorsi, pectorals and deltoids working together and getting the arm superior of the body in a hyperflexed position. The arm then is bent and flexes at the elbow’s hinge joint with the bicep acting as the agonist and the tricep as the antagonist then when the ball is hit the tricep then becomes the agonist and the bicep becomes the antagonist and then the follow through of the serve occurs with the latissmus dorsi and pectorals adducting the arm while the deltoid contracts help keeping the serve controlled. Whilst all this takes place the leg muscles are working to do the “jump” phase of the serve. The downward bending at the synovial joint of the femur and tibia occurs with the hamstrings contracting and the tibials anterior acting as a stabiliser. The upward motion and jump takes place when the quadriceps act as agonists contract simultaneously with the gastrocnemius and soleolus to make the “jump” of the serve to occur.

The next shot the backhand iniates with the arm in a hyperadducted position across the body with the forearm extended. While the forearm is extended in this position the tricep acts as the agonist and the bicep as the antagonist whilst the deltoids are contracting to act as a stabiliser. The arm is then flexed at the elbow’s hinge joint with the bicep becoming the agonist and the tricep becoming the antagonist. To then hit the ball the forearm is extended whilst the trunk is rotating to provide weight and power transfer. As the shot is being made the dominant foot is placed forward whilst the quadriceps are contracting and the synovial joint in the knee is slightly bent for weight transfer. For the follow through the arm that is extended is adducted with the pectorals as the agonist and the latissmus dorsi as the antagonist.

The forehand starts with a hyperextension of the arm back by using the latissmus dorsi and the pectorals. The forearm then flexes at the hinge joint of the elbow and the bicep contracts as the agonist and the tricep as the atagonist. As the arm moves forward to hit the ball the forearm extends and the tricep becomes the agonist and bicep the antagonist as well as the trunk rotating for a power transfer. Also like the backhand as the shot is being made the dominant foot is placed forward whilst the quadriceps are contracting and the synovial joint in the knee is slightly bent for weight transfer. For the follow through the arm that is extended is adducted with the pectorals as the agonist and the latissmus dorsi as the antagonist.

In a volley shot the arm is extended out in front of the body and forearm is slightly flexed with the bicep as the agonist and the tricep as the antagonist. When the shot is played the arm is protracted slightly and the trunk rotates towards the ball whilst they also step toward the ball as the quadriceps are contracting and the synovial joint in the knee is slightly bent for weight transfer. For the follow through the arm is adducted and then is retracted.

The smash starts with an upwards abduction of the arm by the use of the latissmus dorsi and the pectorals. The forearm is then flexed and the bicep contracts as the agonist whilst the tricep does as the antagonist. The at same time the arm extends and the tricep becomes the agonist and the bicep becomes the antagonist whilst a jump motion for the smash occurs by the quadriceps acting as agonists contracting simultaneously with the gastrocnemius and soleolus muscles.

For participation in the sport of tennis as well as all other sports you need fitness to perform effectively. The Oxford PDHPE textbook sees fitness “as the ability to carry out everyday tasks without undue fatigue and to cope with unforseen situations and having enough energy to enjoy leisure pursuits, including sport at any level.” To have good fitness you need to have well developed health related and skill related components of fitness. So tennis, like all sports it crucial you have a both types of fitness components.

The Oxford PDHPE textbook describes health realted components of physical fitness as “all those aspects of fitness that enables us to maintain our health, perform daily tasks and jobs, perform well in sporting activities and help protect us from sickness. The health related components of fitness are cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition.

Cardiorespiratory endurance or sometimes known as stamina is the ability of the body to continuously enough energy to sustain exercise by the circulatory and respiratory systems working together to provide working muscles with oxygen. This is important in tennis because muscles used in tennis require oxygen to move constantly. To improve this health related component the tennis player could include activities such as running and swimming for sustained time periods.

Muscular strength is the abilty to exert force to overcome a resistance. Muscular strength is important in tennis because having muscular strength can reduce risk of injury as well as helping with power in shots. A training option for a tennis player to improve this health component could be doing a regular weight circuit program.

Muscular endurance is the abilty of muscles to make repeated contractions over a period of time. This is particularly important in tennis because of the repetiveness of the swinging arm motion to hit the ball. To improve this health component training could consist of using a rowing machine for 10-15 minutes at a fast rate.

Flexibility is the movement that our length of our muscles allows us to have at our joints. Flexibility is very important in tennis because it is important to have a good range of motion for movement around the tennis courts as well as the shot itself.

Body composition is the make up of the body and its shape. It includes the amount of fat, muscle, bone, cartilage that make up the body. Body compostion can be important in tennis because it reduces strain on joints, muscles and bones therefore reducing risk of injury. This health component can be trained by doing excercises such as sit ups, push ups to improve core strength and the body's composition.

The Oxford PDHPE textbook defines skill related components to be "related to the performance aspect of an activity. The skill related components of physical fitness are power, speed, agility, coordination, balance and reaction time.

Power is the amount of force a muscle can exert which is a very important skill in tennis because the muscle can exert a strong force that can to hit the ball harder. You can train this skill by doing small repetitions of heavy weights which over a period of time will increase power.

Speed is the amount of time it takes for the body to complete many different tasks. This can be important in tennis because the more speed you have the quicker you can get around the court. This skill can be trained by doing sprint training ranging from distances of 30 – 100 m.

Agility is the ability to change direction of the whole body rapidly . This skill is very valuable in tennis because you benefit from being very quick and agile when you get around the court. An effective training exercise to improve agility is to sprint and do courses that use agility poles to go around as quick as possible.

Coordination is the ability to uses senses and body parts to perform motor skills very accurately. This is very important in tennis for shot timing and smooth hitting of the ball. You could improve this skill by catching tennis balls coming at you and work your way up difficulties.

Balance is the ability to maintain an equilibrium when either stationary or moving. It is very important in tennis to have good balance when playing shots so they are smooth and efficeint. An example of an exercise to improve balance is an one legged squat which helps to learn how to be balanced and stable.

Reaction time is the time it takes when exposed to sensory stimulus for them to react. This like all the other skills is very important because how quick yo react to shot can determine losing and winning a point, This skill may be trained by hitting ball back from a machine and slowy increasing the speed for increased difficulty.

Another major area of study that can be applied to tennis is biomechanics. The Oxford PDHPE textbook states that "biomechanics is the area of study in which the knowledge and methods of mechanics are applied to the biological actions and structures of the body". There are four main types of biomechanics that influence movement. They are fluid mechanics, balance and stability, force and motion.

The Oxford PDHPE textbook refers to fluid mechanics as "forces that operate in water and air environments. A fluid mechanic that is evident in tennis is fluid resistance. A type of fluid resistance called drag or sometimes referred to as resistance applies in tennis when swinging a racquet because friction occurs when one body (racquet) moves over surface of another (air). Drag also occurs when the ball is travelling in the air. The ball in tennis also sometimes spins in shots like 'top-spin'. It creates a whirlpool of air rotating around it which causes velocity to increase on one side of the ball and the other to decrease causing the ball to spin which is called the Magnus effect.

The Oxford PDHPE textbook sees "the concepts of stability and balance being closely related to the equilibrium." At one point where a whole force is concentrated is called the centre of gravity and it plays a major role with foot work and gaining good balance to play shots. Base of support is the area bounded by the body parts with a surface providing a reactive force. Base of support is also crucial when keeping balance playing tennis.

The Oxford PDHPE textbook states that “force causes or has potential to cause, divert or slow the movement of an object upon which it acts”. Force includes Newton’s three laws of motion.

Newton’s First Law of Motion states that: “Everybody continues in its state of rest or motion in a straight line unless compelled to change that state by external forces exerted upon it.”

Newton’s Second Law of Motion states that: “The rate of change in motion of a body is proportional to the force causing it, and the change takes place in the direction in which the force acts.”

Newton’s Third Law of Motion states that: “For every force that is exerted by one on another, there is an equal and opposite force exerted by the second body on the first.”

When forces often are described whether they involve contact between bodies they are called contact forces. Contact forces that take place in tennis are ground reaction force, friction, joint reaction force, fluid resistance, inertial force and elastic force.

The Oxford PDHPE textbook describes motion as “movement of a human body, a human limb or objects propelled by a human body.” In tennis the shots played are mainly curvilinear. Velocity measures displacement of the body divided by the time to get to point A from B. It can be applied to tennis by measuring the velocity of racket head or the velocity of the player running or even the velocity of the serve. When athletes increase velocity rapidly it is called acceleration and this can also measure many different things in tennis.

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