

Types of Muscular Contractions

Muscle contractions are classified according to the tension developed and the movement that takes place in the muscle.

Isotonic contraction The muscle shortens or lengthens, as the load on the muscle remains same. Shortening of the muscle, the result of the sarcomere shortening is a **CONCENTRIC CONTRACTION**.

Lengthening of the sarcomere, while force is being produced within the sarcomere to control the stretch, is an **ECCENTRIC CONTRACTION**.

Isokinetic contraction An isokinetic contraction is an isotonic contraction when force is developed and the muscle shortening takes place at a constant rate. A machine sets the speed of motion through the full range of motion.

Isometric contraction The muscle develops tension due to the cross-bridges between actin and myosin, but the muscle does not change length. The sarcomeres are unable to slide, but continue to form cross-bridges and produce force.

Types of Skeletal Muscle Fiber Types

The force and endurance capability of skeletal muscles depends on the type of fiber within the muscle. There are several ways to classify muscle fibers but the most common is speed of contraction and the method used by the muscle to produce ATP.

Characteristics of Skeletal Muscle Fiber Types				
Type	Speed of Contraction	Endurance Capacity	Force of Contraction	ATP Production (Fuel source)
Fast Twitch (Fast Glycolytic). "white"	Fast- responds very quickly to nerve stimulus	Low endurance fatigues very quickly because stored fuel depletes quickly and the lactic acid level increases rapidly.	High - reaches high force production very quickly. A larger muscle cell that has greater capacity for 'hypertrophy'.	ATP/CP - readily available in the muscles. Good for events explosive in nature (e.g. sprints).
Intermediate (Fast-Oxidative-Glycolytic). "red-pink"	Moderate	Have moderate endurance capabilities and moderate stores of energy. Greater capillary density compared to fast twitch fibers.	Medium force of contraction. Contractile myofilaments (actin and myosin) are moderate in diameter.	Uses both aerobic and anaerobic methods of ATP production. Good for events that rely on a mix of power and endurance.
Slow Twitch (Slow Oxidative). "red"	Slow contraction rate	High endurance and resists fatigue due to large number of capillaries and continual supply of oxygen.	Low to moderate force production of contractile myofilaments (actin and myosin).	Aerobic production of ATP. Needs continual oxygen supply for low-moderate intensity as in continuous events.

Fiber Distribution

Although some skeletal muscles are predominantly one fiber type, most of the muscles in the skeletal system are a mixture of fiber types. Training in a specific manner can increase or decrease the response of the fiber, but will not cause one type to convert to another type - this has been determined by genetics. In subsequent chapters we will look in more depth at the manner in which each type of fiber responds to training and specific types of exercise.

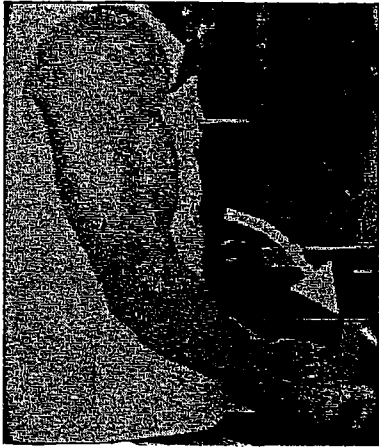
Types of Muscular Contractions



Concentric contraction: is shortening of the muscle as in a bicep curl.

Example:

During the **Up Phase** of a Bicep Curl **flexion** of the elbow joint occurs (because the joint angle is decreasing) and the biceps are performing a **concentric contraction**.



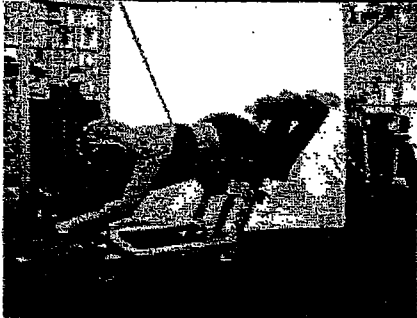
Eccentric contraction: lengthening of the muscle while tension developed attempts to shorten the muscle or resist lengthening as in the down phase of the bicep curl

Example:

During the **Down Phase** of a Bicep Curl **extension** of the elbow joint occurs (because the joint angle is increasing) and the biceps are performing an **eccentric contraction**.

Examples of Concentric and Eccentric Contractions and Joint Movements are:

Hamstrings Curls:



During the Up Phase of a Hamstring Curl **flexion** of the knee joint occurs and a **concentric contraction** of the hamstring muscle group.

During the Down Phase of a Hamstring Curl **extension** of the knee joint occurs and an **eccentric contraction** of the hamstring muscle group.

Knee Lifts:



During the Up Phase of a Knee Lift **flexion** of the hip joint occurs and a **concentric contraction** of the Hip Flexors (Specifically the Iliopsoas) muscle group.

During the Down Phase of a Knee Lift **extension** of the hip joint occurs and an **eccentric contraction** of the Hip Flexors (Specifically the Iliopsoas) muscle group.