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| PITCHING PHASES | CONCENTRIC CONTRACTIONS | ECCENTRIC CONTRACTIONS | ISOMETRIC CONTRACTIONS | MUSCLE FUNCTION | OTHER MUSCLE ACTIONS |
| WIND-UP | -Hip flexors (rectus femoris, iliopsoas, Sartorius, pectineus) |  |  | Lift lead leg | Shoulders partially flexed and abducted by ant/middle deltoids, supraspinatus, pectoralis major (clavicular head portion) |
|  | Quadriceps muscles |  | Slightly bend stance leg |
|  |  | Hip abductors of stance leg(gluteus medius, gluteus minimus, TFL) | Prevent downward tilting of opposite side pelvis |
|  | Hip extensors of stance leg | Hip extensors of stance leg | Stablilize hip flexion |
|  |  | Elbow flexors (biceps brachii, brachialis, brachioradialis) | Maintain elbow flexion |
| STRIDE |  | Hip flexors |  | Controls lowering of lead leg | Forward mvmt initiated by hip abd, followed by stance leg hip/knee extLead leg falls downward and fwd lead hip rotates externally Trunk tilts slightly sideways away from targetSupinator and biceps brachii supinate forearmRhomboids and middle trapezius retract scapula |
| Hip abductors of stance leg |  |  | Help lengthen stride |
| Hip extensors of stance leg (gluteus max, hamstrings) |  |  | Stance hip extends |
| Deltoid and suprapinatus |  |  | Abducting/ maintain humeral head in glenoid fossa |
| Shoulder  |  |  | Abduction, external rotation, horizontal abd |
|  | Elbow flexors of throwing arm | Elbow flexors of throwing arm | Control elbow flexion |
| Wrist and finger extensors (ext. carpi radialis, ext. carpi ulnaris, ext. digitorum) |  |  | Move from slight flexion to hyperextension |
| Arm positioned slightly behind trunk by hz abd |
| ARM COCKING |  | Quadriceps muscles of lead leg |  | Decelerate knee flexion | Shoulder girdle muscles (levator scapulae, serratus ant., trapezius, rhomboids, pec. Minor) work together to help stabilize scapula and position glenoid for humeral head actionRotator cuff muscles help keep humeral head properly centered within glenoid fossaForearm flexors and pronators help stabilize elbow |
|  |  | Quadriceps muscles of lead leg | Stabilize lead leg |
|  | Pectoralis major and anterior deltoid |  | Primary shoulder hz. abductors as trunk rotates to face target |
|  | Biceps brachii/subscapularis |  | Control shoulder ER |
| Supraspinatus/Deltoid |  |  | Shoulder abduction |
| Teres minor/Infraspinatus |  |  | Shoulder hz abduction and ER |
| Trapezius/ Serratus anterior |  |  | Scapula upward rotation |
|  | Lattisimus dorsi/Teres major |  | Control shoulder ER |
|  | Pectoralis major |  | Control shoulder hz abduction |
|  | Triceps brachii |  | Control elbow flexion |
| ARM ACCELERATION | Shoulder internal rotators |  |  | Help produce extremely high max IR velocity | At ball release, trunk flexes forward from hyperextension to neutralHigh activity from rotator cuff muscles, trapezius, serratus anterior, rhomboids, and levator scapula crucial during this phase (humeral head control and scapula stabilization) |
| Lattisimus dorsi, teres major, subscapularius |  |  | Shoulder Internal Rotation |
|  |  |  |  |
| Triceps |  |  | Elbow extension |
|  | Wrist flexors |  | Slow hyperextension at beginning of phase |
| Wrist flexors |  |  | Flexion as ball release is approached |
| ARM DECELERATION |  | Biceps brachii/supinator |  | Deload pronating forearm/control elbow ext. | Trunk and hip continue to flexLead knee and throwing elbow continue extensionLower trapezius, rhomboids, serratus anterior provide stability to scapula |
|  | Posterior deltoid/infraspinatus |  | Control of hz adduction |
|  | Supraspinatus/ Teres minor |  | Control of hz adduction and internal rotation |
| Wrist/finger flexors |  |  | Wrist flexion |
|  | Wrist/finger extensors |  | Decelerate wrist/finger flexion |
| FOLLOW-THROUGH |  | Posterior shoulder muscles |  | Continue to decelerate shoulder hz adduction | Serratus anterior most active contracting either concentrically or isometrically |
|  | Middle trapezius/ rhomboids |  | Decelerate scapular protraction |
|  | Wrist/finger extensors |  | Decelerate wrist flexion |