1. *Understanding Throwing Mechanics*
    a. *Matthew Somma, PT, DPT, CSCS*
2. *Facts*
    a. *Angular velocity is over 7000 degrees per second, the fastest recorded human movement*
    b. *Anterior forces on the shoulder equal 1 time the athletes body weight at maximum external rotation*
    c. *Distraction forces are greater than 1.5 times there body weight during follow through*
3. *History*
    a. *Generally asymptomatic with all other activities except for throwing*
    b. *Usually result of chronic repetitive throwing*
    c. *Reports difficulty getting loose*
    d. *Loss of command and/or velocity*
    e. *As symptoms progress, the athlete can localize where the pain is and where during the throwing motion where the pain occurs.*
4. *History*
    a. *Common Diagnosis*
    b. *Internal Impingement*
        i. Increased anterior laxity and potential posterior cuff/capsular tightness
        ii. Arm lag behind the scapula during throwing (excessive horizontal abduction)
        iii. Occurs at late cocking
    c. *Subacromial Impingment*
        i. Uncommon, likely an issue of excessive anterior tilting of the scapula
    d. *Bicipital Tendonitis*
        i. Usually due to excessive GH Joint instability
    e. *Posterior Cuff Tendonitis*
        i. Posterior Shoulder pain at ball release
    f. *SLAP Lesion Type II*
        i. Peel Back Mechanism – position of abduction and external rotation , torsional stress of the biceps on the superior labrum, occurs at maximal external rotation
5. *Total Motion Concept*
    a. *GIRD/Internal Impingement*
    b. *Normal Right Handed Pitcher*
    c. *Right Side*
        i. *ER @ 135 degrees*
        ii. *IR @ 52 degrees*
        iii. *Total @ 187 degrees*
    d. *Left Side*
        i. *ER @ 125 degrees*
        ii. *IR @ 60 degrees*
        iii. *Total @ 185 degrees*

    e. *Right Side*
        i. *ER @ 125 degrees*
        ii. *IR @ 48 degrees*
        iii. *Total @ 173 degrees*
    f. *Left Side*
        i. *ER @ 115 degrees*
        ii. *IR @ 66 degrees*
        iii. *Total @ 181 degrees*
6. *Abnormal Right Handed Pitcher*
7. *Changes Over Time*
8. *Examination (Lab Portion)*
    a. *Assessment of Posture*
        i. Cervical spine, thoracic spine, humeral head position, scapular position
    b. *Assessment of Total Motion Concept*
        i. Internal and External Rotation in the 90/90 position
    c. *Specific Special Test to Assess Labral Pathology*
        i. Dynamic Speed's test, Biceps Load Test, Pronator Load Test
    d. *Assessment of Scapulohumeral Rhythm*
        i. Flexion, Abduction, and "No Money"
    e. *Assessment of Strength*
        i. ER and IR in the 90/90 position, middle trapezius, rhomboids, lower trapezius, supraspinatus
    f. *Assessment of Thoracic Mobility*
9. *Mechanics Assessment*
    a. *Timing & Sequencing*
    b. *Timing and sequencing heavily contribute to mechanical efficiency of a pitcher.*
        i. Timing initiates the progression of movement and is dependent on athletes personal signature.
        ii. Sequencing (Critical Variables) is the natural progression of critical events that a pitcher must achieve to deliver a pitch. Sequence of events contributes heavily with mechanical efficiency.
    c. *4 Easy Things to Look At!*
        i. *Timing*
        ii. *Energy Angle*
        iii. *Opposite and Equal*
        iv. *Stabilize Glove*
    d. *Timing*
        i. *Optimal timing from first forward movement of the pitcher's stride leg to when the stride leg foot hits the ground*
        ii. *Optimal time is 0.95 to 1.05 seconds*
        iii. *To ball release 1.25 – 1.35 seconds*
        iv. *To follow through 1.93 – 2.03 seconds*
    e. *Timing*

        i. *If the pitcher is too slow to the plate, then this will often result in over-rotation of the trunk at maximum external rotation and at release point. Over-rotation will result in anterior shoulder stress because the pitcher will have to speed up his arm and result in excessive anterior translation*
    f. "Throwing across the body"
    g. Pitch also tends to be low and away to like sided hitter
    h. If a pitcher is too fast to the plate, he will under-rotate and there will be loss of efficiency or velocity
    i. Pitch will travel up an in to like sided hitter.
10. *Sequencing (Critical Variables)*
11. *Balance and Posture*
12. *Leg Lift and Body Thrust*
13. *Stride and Momentum*
14. *Opposite and Equal*
15. *Hip/Shoulder Separation*
16. *Stack and Track*
17. *Swivel and Stabilize*
18. *Angle of Wrist/Forearm*
19. *Release Point and Follow Through*
20. *Energy Angles*
    a. *Energy Angle*
    b. *Energy Angle*
    c. *Energy Angle*
21. *Greg Maddux*
22. *Opposite and Equal*
    a. *Opposite and Equal*
23. *Stabilize Glove and Head*
    a. *Pre-Correction*
    b. *Post-Correction*
24. *Stabilize Glove*
    a. *Pre Correction*
    b. *Post Correction*