

Considerations for the Prevention and Return to Training after Pectoralis Major Muscle Tears

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Pectoralis major muscle tears are a rare injury that is appearing to become more common during the training of athletes. Recently pectoralis major muscle tears have been reported during the weight room training in a starting NFL football player as well as at a prominent Division I college football program resulting in the loss of these athletes for the upcoming football season. Over 50% of all pectoralis muscle injuries occur in athletes, classically in athlete's performing the bench press exercise.

Depending upon the location and severity of the pectoralis major injury surgical management may be required. Contingent upon each individual condition return to sport from surgical intervention is expected to be 9 months to 1 year post-surgery.

Mechanism of Injury

The mechanism of the pectoralis major muscle injury transpires during a strong eccentric maximum muscle contraction (i.e. the "plastic region" of the stress-strain curve of musculotendinous tissue) accompanied with shoulder hyperextension, external rotation, and abduction, a shoulder position assumed under load during the bench press exercise performance.

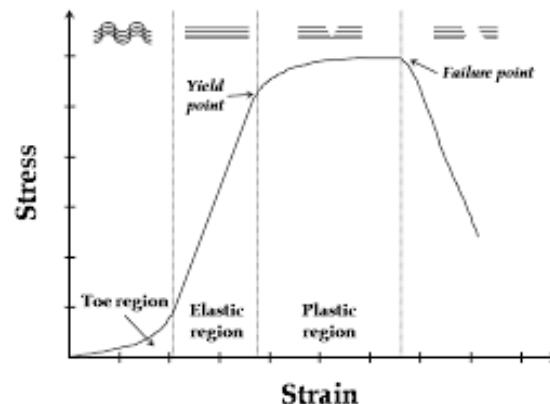


Figure 1. The stress-strain curve of musculotendinous tissue

An additional contributing factor to injury is the presence of associated excessive muscle fatigue. A real life example is an athlete that was rehabilitated post-operatively for a pectoralis tear. He was attempting to bench press 405 pounds for 4 sets of 5 repetitions and successfully completed his first 3 sets without any complaints. However, when performing his fourth and final set, at the time of the 3rd attempted repetition (the 18th total bench press repetition at 405 pounds) he ruptured his pectoralis

major muscle. This individual was certainly able to perform 17 bench press repetitions at 405 pounds, however he was unable to perform an 18th repetition thus was the problem a lack of strength or a lack of strength endurance (i.e. the onset of fatigue)?

Addressing Pectoralis Major Injury Prevention and Post-Injury Training

The following are considerations to avert possible injury and/or resume bench press training after pectoralis major injury/surgery:

- *Exercise volume* – as a guideline the daily workout bench press total exercise volume should not exceed a maximum of 35 work repetitions not including the warm-up set(s). The athlete should bench press no more than twice per week and one training session should be programed to be no greater than 80% of the “heavy day” session. Excessive muscle fatigue is to be avoided.
- *Incorporate standing overhead pressing exercises* – prescribing overhead exercises such as the military press, push press, jerks, etc. performed from a starting position of the plane of the scapula will assist in the enhancement of upper body strength and power while minimizing the risk of pectoralis major muscle injury. The authors are unaware of any scientific literature documenting a pectoralis muscle tear as a result of overhead pressing exercise performance.
- *Reduce the bench press exercise grip to 1.5 times the bi-acromial width* – a 1.5 times bi-acromial width will place less adverse stress (torque) upon the anatomical structures of the anterior shoulder, the pectoralis major and assist to decrease the incidence of other orthopedic weightlifting pathologies such as osteolysis of the distal clavicle when compared to wider grips. This narrower grip will not adversely affect the muscle recruitment pattern of the pectoralis major during the bench press exercise performance.
- *Limit shoulder abduction* – the shoulder should be limited to approximately 45 degrees of adduction during bench press exercise execution.
- *Assist the athlete with a “lift off”*- a “lift off” will ensure that the bench press exercise is initiated with the arms completely extended at 90 degrees of shoulder flexion and not with a weighted barbell racked in a position behind the athlete’s head.

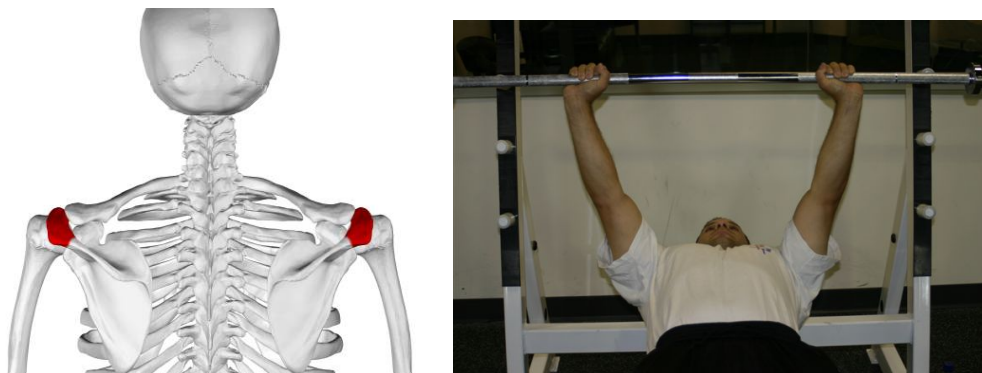


Figure 2a and 2b. The bi-acromial width and a 1.5 times the bi-acromial width grip

Modifications for resuming bench press exercise performance

- *Floor presses* – floor presses may be performed with either dumbbells, barbells, or both. Utilizing the floor during the bench press exercise will prevent the hyperextension of the shoulders during the exercise performance.
- *Board presses* – utilizing various size/width boards will allow for appropriately prescribed barbell descent distances along with prescribed weight intensity while controlling for shoulder hyperextension.
- *Rack starts* – rack starts like floor presses and board presses allow for controlled shoulder positioning thus avoiding a vulnerable shoulder position during bench press exercise performance. However, unlike other exercises if pain is felt at the initiation of the rack start (pushing against the barbell) the athlete may stop the exercise immediately prior to supporting the total weight to be lifted. With regard to floor presses and board presses once the athlete receives the barbell weight via a “lift off” they own it and if the onset pain does emerge the athlete may be exposed to re-injury as well as poor exercise execution.



Figure 3a, 3b, and 3c. Floor Presses, Board Presses, and Rack Starts

- *Accommodating resistance for enhanced power production* – the use of weighted chains as well as bands will assist to accommodate the load during the bench press exercise performance. These modalities will provide an “unloading” of stress at the more vulnerable exercise barbell “touch point” chest position. When utilizing chains it is important to incorporate “leader chains” for a more accurate calculation of exercise loads vs. the direct application of weighted chains to the barbell alone.



Figure 4a and 4b. Utilizing chains with “leader chains” for accommodating resistance

- *Bench press goals* – at the conclusion of the 6th post-operative month the athlete should be able to safely progress beyond their 50% pre-injury 1RM bench press performance.

The bench press exercise is commonly prescribed for upper body strength enhancement and development. This exercise is also fairly unique with regard to pectoralis major muscle injuries. With appropriate exercise program design and exercise performance modification these injuries may be avoided as well as provide a safe return to training after pectoralis major muscle injury and/or surgery.



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