Healthy Thoracic Spine Function for Healthy Shoulders

Introduction

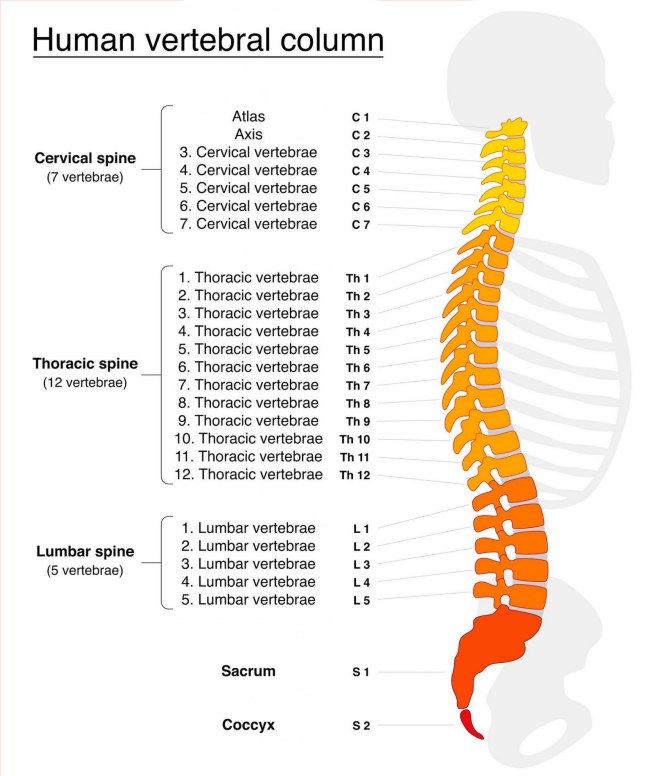
Firefighters are at a high risk of work-related injuries, due to the unpredictable, varied and physical nature (relatively high load carrying circa 25kgs) of firefighting duties. Injury rates can be three times that of those reported in the private sector. Addressing high-risk areas of physicality can help to maintain the physical integrity of a firefighter as well as having the benefit of reducing absenteeism costs.

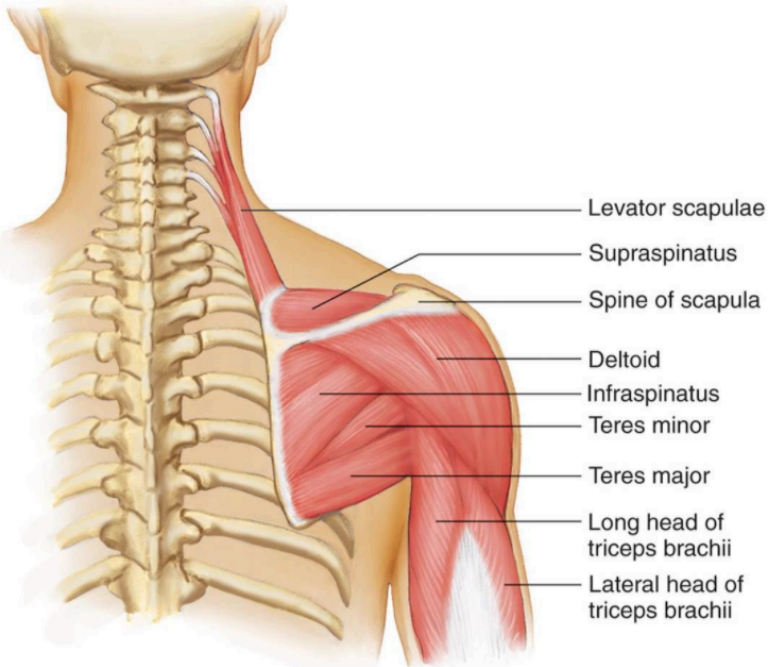
Bending, squatting and lifting are cited as being the most common cause of injury, with most injuries occurring in the firefighter's lower extremities (most commonly the knee) or back or shoulder. (Orr et al, 2019)

In this article we will specifically look at:

- How the thoracic spine's function will influence injury risk to the shoulder.
- What good thoracic spine function actually is.
- How to improve thoracic spine function.

Thoracic spine and the glenohumeral joint





Thoracic spine function is vital in preserving health to the glenohumeral joint, reducing the risk for shoulder joint injuries. This is largely due to its' relationship with the scapula.

The scapula is integral to the stability of the glenohumeral joint as it provides the insertion point for the rotator cuff muscles amongst others that stabilise the joint (see diagram). Many of the muscles that attach to the scapula originate on the ribs, therefore it is the orientation of the ribs that either promote or inhibit good scapula alignment. Optimal alignment of the thoracic spine (and thus scapula) will allow the key stabilising muscles of the shoulder to produce higher force, thus protecting the shoulder complex.

Mechanisms for injury

For good function, the shoulder complex should be capable of 180 degrees of shoulder flexion. The glenohumeral joint is responsible for around 120 degrees of this, with the remaining 60 degrees being supplied by the scapulothoracic joint (acromioclavicular and sternoclavicular joint movements combined).

The thoracic spine should also be capable of around 10-11 degrees of extension from 'neutral'. This extension should form part of any healthy, overhead lifting mechanics. The inability to achieve either full shoulder flexion or thoracic extension, will inevitably cause neighbouring joints and tissues to compensate in order to reach the desired final overhead lifting position.

Additionally, when extended, the thoracic spine is capable of more rotation than when flexed due to the tension created by the ligamentous structures. This is especially important when reaching overhead and behind.

Typical injuries

Impingement

Poor thoracic spine alignment will cause abnormal kinematics at the glenohumeral joint. When this is the case, repetitive motions and altered mechanics may result in pathophysiological changes within the rotator cuff tendons, labrum, subacromial bursa and long head of the biceps brachii. These changes can lead to impingement syndrome.

Abnormal scapular kinematics during shoulder elevation tasks have also been linked to glenohumeral joint pathologies related to impingement.

Rotator cuff tears

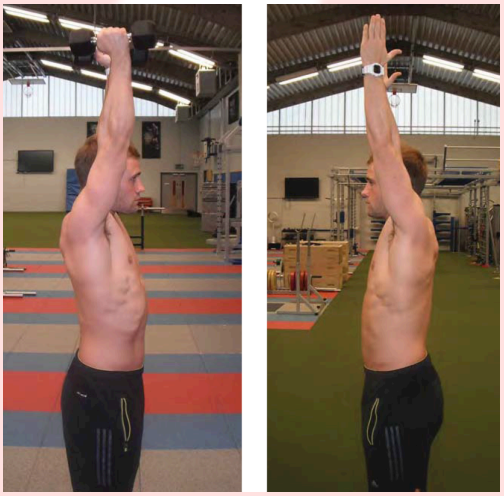
Over-reaching against a joints' given range of motion can lead to tears in the relatively weaker stabilising rotator cuff muscles.

Assessing thoracic motion

The following screening methods can be used to assess thoracic function. Screening should only take place with appropriate informed consent from the firefighter and after a PARQ has been completed that includes information about any spine or shoulder related conditions or injuries that the firefighter has. If a practitioner (the PTI) does not feel comfortable performing the screening, then the firefighter should be referred to another occupationally competent professional.

Thoracic extension – Bilateral shoulder flexion test protocol:

1. The firefighter should stand with their feet apart with the arms in the resting position by their side.
2. The firefighter raises both arms, keeping the elbows extended and the palms of the hands facing the midline.
3. Angle change measurements from T1/T2 to T12/L1 vertebra can be made via inclinometers (available as an app on smart phones). 11 degrees should be possible.



Thoracic extension – Occiput to wall test protocol:

This is a practical test that does not require specialised equipment.

1. The firefighter leans back against a wall, knees slightly flexed and feet one foot-length away from the wall.
2. With the sacrum and upperback in contact with the wall, the firefighter posteriorly tilts the pelvis flattening the lumbar spin.
3. From this position the firefighter attempts to make contact between the wall and their occiput, while maintaining a neutral head position. This aught to be possible with adequate thoracic extension.

Thoracic rotation – Standing rotational reach test protocol:

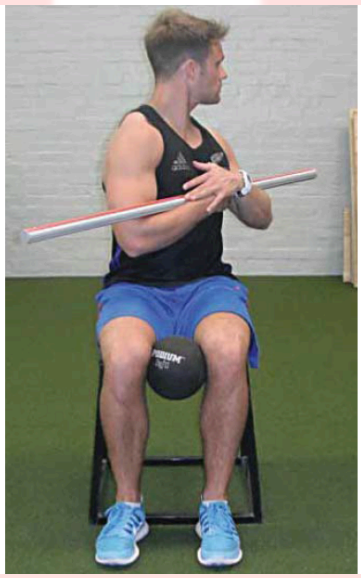
This test can show a firefighter's total body rotational capacity. Upper body as well as lower body rotational capacity can be assessed and compromise strategies noted

1. The firefighter should stand with feet hip width apart.
2. With one hand by the side and the other reaching across the body, the firefighter should rotate around as far as possible as if trying to look behind them
3. The firefighter should be able to rotate their pelvis 45 degrees from neutral in the transverse plane. The shoulders should show a further rotation of 45 degrees beyond the hips either ipsilateral or contralateral.


Thoracic rotation – Seated rotation test

The seated thoracic rotation test takes out contributions from the lower limbs.

1. Firefighter to sit on a chair with hips and knees flexed to 90 degrees.
2. A small ball can be placed between the knees to pevent any movement at the pelvis.
3. A bar is held in front of the body.
4. The firefighter should rotate to either side as far as possible.
5. A goniometer can be used to assess rotation. It should be placed at T1/T2 and oriented parallel to the floor. The moving arm should be aligned with the scapula. Again, 45 degrees is optimal rotation.


Results of screening tests

Careful analysis of the screening tests should be undertaken in order to ascertain the likelihood of the firefighter's risk for shoulder injury due to their thoracic spine function. Other factors such as; general fitness, overweight/obesity, previous injury should also be taken into account.

The firefighter should be given a detailed appraisal of the their thoracic spine function with recommendations made for improvement if required.

Examples of thoracic rotation mobilisations