BACK INJURY PREVENTION

The Four Rules of Safe Lifting:

1. Keep a neutral spine
2. Centre of gravity
3. Knee tracking over the second toe
4. Balance

Neutral Spine:

- Ability to maintain the spine in its natural curves.
- Contracting the supporting muscles to resist any force that tends to bend or twist the spine.
- Preserve alignment between the shoulders and hips.
Centre of Gravity:

- Maintain weight of the body and objects over the optimal point of control.
- Focus on the big muscle groups to initiate the movement.
- Contract the supporting muscles to provide support.

Knees Tracking over the Second Toe:

- Knees must keep track of the toes to create “pillars” during the movement.
- Hips must initiate the movement.
TOOL 13

Balance:

- Ensure the hips dominate the movement pattern.
- Execute the movement pattern under control.
- Keep the object being lifted close to the body.

Lunging:
Safe Lifting Corrections:
Incorrect lifting techniques to watch out for and correct:

1. Back-dominant lift
2. Break in the lumbar spine
3. Break in the thoracic spine
4. Poor knee alignment
5. Limited ankle mobility
6. Knee-dominant lift
7. Poor lateral balance

Following are examples of some common lifting errors, risks, and their subsequent corrections.

1. Back-Dominant Lift

**Error:**
Instead of having a neutral spine, the entire spine is rounded, from the cervical to the lumbar region. This can occur when the load is too close to the body (Fig. 1) or too far from the body. (Fig. 2)
Injury Risk:
Disk impingement resulting from spinal flexion and excessive load on the spine.

Correction:
Bend the knees and hips to load the hips (not the spine). Have the CAF personnel squat close to and facing a wall to help them understand how to position their back to safely lift the load. (Fig. 3)

Figure 3

2. Break in the Lumbar Spine (Excessive Lumbar Flexion)

Error:
The neutral spine in the lumbar region is compromised at the end of the lift. This error is caused by a narrow stance, going too low in the movement, or having trouble keeping the spine in a neutral position.

Figure 4
**Injury Risk:**
Disk impingement, resulting from spinal flexion and excessive load on the spine.

**Correction:**
Have the CAF personnel go into the table position (Fig. 5) and get them to arch their back to see where the break in the neutral lumbar spine occurs.

*Figure 5*

Once the break occurs, have them widen their stance to find the optimal degree (position) in which it is safe for them to squat and still maintain a neutral lumbar spine. (Fig. 6)

*Figure 6*
Encourage the CAF personnel to stop going too low and help them find the best degree at which they can maintain a neutral spine. (Figs. 7–8)

3. **Break in the Thoracic Spine (Excessive Thoracic Flexion)**

**Error:**
The neutral spine is compromised in the thoracic region. A lack of strength or control in the posterior chain muscles causes the spine to curve. (Fig. 9)

**Risk:**
Disk impingement resulting from spinal flexion and excessive load on the spine.

**Correction:**
Encourage the CAF personnel to use their latissimus dorsi muscles to stabilize the core when bending down to lift the load.
The wall exercise (Fig. 10) is one method to enforce a neutral spine. However, CAF personnel will need to lift loads from off the ground and consciously stabilize their back muscles to help maintain a neutral spine. (Fig. 11)

4. Poor Knee Alignment

**Error:**
The knee does not align (“track”) in the direction of the second toe. (Fig. 12) This error can be caused by:

- Poor mobility due to leg muscle imbalances.
- Not knowing how to control leg muscular contractions in order to maintain a straight movement during the flexion phase of the knees, hips, and ankles. (Figs. 12–14)
Risk:
Excessive pressure is exerted on the following joints: Knees, hips, and/or ankles.

Correction:
Depending on the type of error, have the CAF personnel use a resistance band to force the knees outwards or inwards. (Fig. 15)

Figure 15

5. Limited Ankle Mobility

Error:
The heels leave the ground during the lifting phase. (Figs. 16–17) This error occurs when the CAF personnel’s centre of gravity is misaligned, causing the load to be centered over the toes or the ball of the foot.

Figures 16–17
Risk:
Excessive pressure is exerted on the knee joints.

Correction:
Centre the load over the arch of the foot. (Fig. 18) Have the CAF personnel place their heels firmly on the ground. Encourage them to activate their glutes to ensure a strong stance. The wall exercise is useful as it forces the CAF personnel to keep their knees tracking their toes and the centre of gravity closer to the body. (Fig. 19) Placing an object such as a weight under their heels might improve their centre of gravity.

6. Knee-Dominant Lift

Error:
The majority of the weight is loaded on the knee joints. (Fig. 20) This error sometimes occurs when the knees are not aligned with the direction of the toes (“tracking”). (Fig. 21)
**Risk:**
Excessive pressure is exerted on the knee joints.

**NOTE:** There is a higher risk of injury to the knees versus the hip joints.

**Correction:**
Encourage the CAF personnel to correct their body position so that their knees track the toes and remain aligned with the toes. This will load the hip joint. The wall exercise is useful when trying to fix errors with knee-dominant lifts. The wall forces CAF personnel to push their hips out in order to properly execute the movement. (Fig. 22)
7. Poor Lateral Balance

**Error:**
Loss of balance due to poor mechanics or difficulty contracting muscles equally. (Figs. 23–24)

**Risk:**
Possible injuries to the following joints: Hips, knees, ankles, and back.

**Correction:**
To work both legs equally, encourage the CAF personnel to hold onto a chair while trying to maintain proper tracking with both knees. (Fig. 25) A resistance band can also be used to correct knee-tracking issues. (Fig. 26)