

Core stability training in Taekwon-do

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Introduction:

The purpose of this essay is to discuss the importance of core stability in relation to developing power in Taekwon-do movements and injury prevention. I will also provide examples of exercises that can be performed to increase general core strength and stability - both at club and as part of fitness training with access to gym equipment.

Core muscles and main functions:

A simple way to think about the muscles of the core is by imagining a cube with a ceiling, floor, front, back and sides. The diaphragm forms the top of the cube ('ceiling') while the pelvic floor muscles form the bottom ('floor'). The abdominal wall muscles form the anterior (front) part of the cube. The erector spinae group and thoracolumbar fascia make up the posterior (back) of the cube. The sides of the cube are made of the lateral hip muscles and internal/external obliques (1).

Anterior (front) core muscles:

- Rectus abdominus
- Transversus abdominis
- Internal oblique
- External oblique

Posterior (back) core muscles:

- Erector spinae group
- Iliopsoas group
- Quadratus lumborum
- Multifidi
- Thoracolumbar fascia

Lateral (side) core muscles:

- Gluteus maximus
- Gluteus medius
- Gluteus minimus
- Transversus abdominis
- External oblique
- Internal oblique

All the borders of a cube overlap and are connected to one another. In the same way all the muscles of the core function as one unit to transfer forces and provide spinal stability. The muscles of the core are organised in layers. The superficial (top) layer functions to produce muscular power, the middle layer is involved in stabilisation and the deep (inner) layer functions in providing neural feedback.

Table 1: Muscles of the anterior core

| Muscle | Origin | Insertion | Action |
|-----------------------------|---|---|--|
| External oblique | Outer surface ribs 5 - 12 | Anterior iliac crest, rectus sheath, fibres angle towards midline | Unilateral – lateral trunk flexion to same side, rotation to opposite side Bilateral – compression of abdomen |
| Internal oblique | Lateral inguinal ligament, iliac crest, thoracolumbar fascia | Costal cartilage ribs 9 – 12, rectus sheath to linea alba | Unilateral – lateral trunk flexion to same side, rotation to same side Bilateral – compression of abdomen |
| Transversus abdominis (TVA) | Lateral inguinal ligament, iliac crest, thoracolumbar fascia, costal cartilage of ribs 7 - 12 | Rectus sheath to linea alba | Unilateral - trunk flexion to same side as contraction, rotation to opposite side Bilateral - compression of abdomen, assists trunk flexion |
| Rectus abdominis | Crest of pubis, pubic symphysis | Costal cartilage of ribs 5 – 7, xiphoid process of sternum | Flexes trunk, compresses abdomen |

N.B- TVP – transverse process (bony projection on side of vertebrae)

The muscles of the anterior core also act on the hip and pelvis.

Table 2: Muscles of the posterior core

| Muscle | Origin | Insertion | Action |
|-------------------|---|---|---|
| Lumbar multifidus | L1 – 5 superior aspect of articular processes | Spinous process of vertebrae 2 – 4 levels above | Unilateral – rotation to opposite side, side bending to same side Bilateral – extension of trunk |

| | | | |
|--|---|--------------------------------|---|
| Iliocostalis lumborum (part of Erector Spinae group) | Sacral crest and medial iliac crest | Angle ribs 7 - 12 | Unilateral – trunk lateral flexion to same side Bilateral – trunk extension |
| Longissimus thoracis (part of Erector Spinae group) | T11 – L5 spinous processes, sacral crest, medial iliac crest | T1 – 12 TVPs | Unilateral – trunk lateral flexion to same side Bilateral – trunk extension |
| Quadratus Lumborum (QL) | Posterior iliac crest | Rib 12, L1 – 4 TVPs | Lateral trunk flexion to same side |
| Iliopsoas group Psoas Major and Iliacus involved in trunk flexion | Lateral surface of T12 -L4 vertebrae, intervertebral discs, iliac fossa | Lesser trochanter of the femur | Hip flexion, internal rotation of the hip, tilts pelvis anteriorly, trunk flexion |

The thoracolumbar fascia consists of three layers (anterior, posterior and middle) that function to maintain stability in the spine and trunk and prevent unwanted motion during movement. The anterior and middle portions are connected to the quadratus lumborum, iliopsoas and multifidus. The posterior layer covers the back with a tense tissue and is pulled laterally by the abdominal muscles to create stability by removing the slack and tensing the fascia (1).

The thoracolumbar fascia plays an important role in transferring forces between the upper and lower extremities and vice versa and in stabilisation of the lumbar spine. Force transfer between the lower and upper extremities occurs via the posterior oblique sling which consists of the latissimus dorsi, thoracolumbar fascia, gluteus maximus and iliotibial tract. The gluteus maximus and latissimus dorsi conduct forces contralaterally (e.g. left latissimus dorsi to right gluteus maximus) as the fibres of the thoracolumbar fascia cross the midline between the 4th lumbar and 2nd sacral vertebrae. Contraction of these muscles helps stabilise the lumbar spine and sacroiliac joint (2).

The erector spinae group consists of the iliocostalis, longissimus and spinalis muscle groups.

Table 3: Gluteal muscle group (part of lateral core)

| Muscle | Origin | Insertion | Action |
|-----------------|---|--|--|
| Gluteus maximus | Iliac crest, posterior gluteal line and posterior surface of ilium, posterior lateral border of sacrum and coccyx | Gluteal tuberosity of femur and iliotibial tract | Hip abduction, lateral rotation and extension Extension of trunk from flexed position |
| Gluteus minimus | Outer surface of ilium between inferior and anterior gluteal lines | Greater trochanter of femur | Hip abduction and medial rotation |

| | | | |
|----------------|---|-----------------------------|-----------------------------------|
| | | | |
| Gluteus medius | Outer surface of ilium between posterior and anterior gluteal lines | Greater trochanter of femur | Hip abduction and medial rotation |

The gluteal group has been included in my definition of the core as it has an important role in dynamic stabilisation of the hip and trunk during motion. The Gluteus Maximus muscle is also involved in trunk extension from a flexed position (1).

Core Stability

Core stability can be defined as 'the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities' (3,4). There are two main functions of the core muscles. Firstly, to allow force to be transmitted from one limb to another by stabilising the spine and abdomen. The core muscles contract prior to limb movement (anticipatory postural adjustment) to allow the limbs to have a stable base for motion and muscle activity (3). The coupling of these functions together makes the core the centre of the kinetic chain. In other words, the core functions to transfer force between the upper and lower extremities during movement and plays an important role in posture.

For example, when performing a walking stance forearm low block (as in Chon-Ji tul, mvmt 1) the end point is the forearm delivering the block while the starting point is the use of knee spring in the lower extremity. Before the motion starts there is an anticipatory contraction of the transversus abdominus (1,2). When the lower limb contracts at the start of the sine wave, power is generated in the lower limbs. At the start of the step into walking stance the abdominal and back muscles contract to provide stability. As the forward step into the walking stance continues, forces are transferred from the lower limbs through the stabilised core to the upper extremity (forearm) where the block is performed.

In Taekwon-do we enhance the core's natural function of transferring force between the limbs by using hip twist to add power. General Choi stated in the theory of power that we should 'concentrate every muscle of the body, particularly the bigger muscles around the hip and abdomen (which theoretically are slower than the smaller muscles of other parts of the body) towards the appropriate tool to be used at the proper time. Also, to concentrate such mobilized muscles onto the opponent's vital spot. This is the reason why the hip and abdomen are jerked slightly before the hands and feet in any action' (5). This turning of the hip also allows mass to be increased by "increasing the body weight during execution of a blow" (5).

Ideally, there would be no points of breakdown in the kinetic chain where forces can be lost because of instability or weakness (1). If the core is weak or unstable, transmission of forces from the lower to upper extremity will not be as effective and the power of the attack or defence will be decreased. Also, in order to create the same amount of power (with a weak or unstable core) compensation will be attempted by other muscle groups which increases injury risk (1). Generally, this compensation occurs through the muscles of the posterior oblique sling e.g. with left lower back pain the mobility, stability and strength of the left hip and right shoulder would be affected.

Core stability training:

Effective core stability training has been described as any exercise that involves 'integrated activation of multiple segments, provides force generation and produces interactive movement characterised by proximal stability and distal mobility' (6). In other words, any exercise that activates a large number of core muscles which are held in a rigid position with movement of the limbs.

In Taekwon-do we have a lot of movements that are done explosively. We need to isolate the core with targeted exercises in order to improve strength and stability and reduce injury risk due to overuse or compensation from stronger muscle groups. I acknowledge that Taekwon-do movements themselves can help with core strength and stability and that injuries can be reduced somewhat due to the 'self-limiting' nature of training (e.g. a child with a certain amount of power and skill would not necessarily hurt themselves performing an unstable block or kick, it just would not be delivered as effectively). I would also like to emphasise the direct training of the posterior core and lateral core muscles. These are important to kicking ability, muscular balance and injury prevention and are sometimes neglected in the club environment. It is possible to be a good kicker through flexibility, specific wall drills and practice. Similarly, you may be able to hold a four-minute front plank but struggle with side planks and gluteus medius strength and activation. I am in no way against using specific kicking drills for kicking, just suggesting that we include more balance between anterior and lateral core exercises in clubs (less sit ups, front planks and leg lifts, more side planks and partner back extensions).

Key points (importance of core muscles in relation to developing power in Taekwon-do):

- **In transferring force between the legs to the arm (blocking or attacking tool)**
- **Maintenance of posture in movements**
- **Kicking ability, posture, and endurance**
- **Co-ordination of the whole body to stop movements**

Core training exercises:

Exercises or progressions that could be used at clubs are highlighted in bold. In the movement/muscle section a lot of the exercises use all the anterior core muscles and are anti-extension (avoiding hyperextending the back). The form tips are for the main exercise shown in the photo and includes a 'how to' element if I thought some bits were not obvious from the photo. The progressions are listed from easiest to hardest. Any interesting side notes for progressions for further clarification are included below the table.

Thanks to Leaton Performance and Rehabilitation and Gillies Ave Weightlifting for letting me take and use photos.

Hanging leg Raise:



Russian Twist:



Hollow hold/Rock/V-up:



Hanging Leg Raise:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Hip flexion, anterior core, iliopsoas group |
| Form tips | Keeps legs straight, don't swing |
| Progression | Double leg lift (on ground) , hanging knee raise, hanging leg raise, knee to elbows, toes to bar |
| Programming | 3-4 sets, 12-15 reps |

NB: Hip flexors can take over. Reduce this by putting feet in frog position (heels together) before lifting legs.

Russian Twist:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Rotation, anterior core |
| Form tips | Feet up, lean back about 30-45 °, rotate from side to side slowly, arms stay fixed, keep legs steady when up |
| Progression | Unweighted feet on ground, unweighted feet up , weighted feet on ground, weighted feet up |
| Programming | 3-4 sets of 12-15 reps per side |

Hollow hold/V- up:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Hollow hold/rock: isometric hold V-up: hip flexion Anterior core (both) |
| Form tips | Hollow hold (bottom left pg 8): keep lower back on ground, squeeze glutes and core, lift shoulders and feet off ground, hold or rock back and forward V-up: from hollow hold position bring feet and hands together. Legs straight, move explosively |
| Progression | sit up with soles of feet together, bent knee v-up, v-up, jumping v-up for hollow hold bend knees or practice deadbug to make easier |
| Programming | 3-4 sets of 12-15 reps |

Forearm Plank:



Weighted Plank:



Swiss Ball plank:



Feet on ball plank:



Forearm side plank:



Side plank with leg lift:



Weighted side plank:



Front Plank:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Anti-extension, anterior core |
| Form tips | Keep body straight, slight posterior pelvic tilt |
| Progression | Forearm plank, plank up downs , swiss ball plank, feet on ball plank, weighted planks (I prefer the hanging with the weight belt version). High plank (hands on ground) and swiss ball high plank (hands on ball) also works shoulder stability |
| Programming | 3-4 sets 30-60 sec holds |

Side Plank:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Isometric hold, internal & external obliques, shoulders, gluteus medius |
| Form tips | Keep body straight, proud chest |
| Progression | Forearm side plank, forearm side plank with rotation, high side plank, forearm/high side plank with leg lift , weighted side plank, Copenhagen plank |
| Programming | 3-4 sets 30-60 sec holds (or work up to 80% of max front plank hold per side) |

N.B.- side planks are not as often trained at club but useful for kicking strength development (outside of specific kicking drills like side kick pulses, circles etc)

Copenhagen Plank (short and long lever):



Ab Rollout:



Stir the Pot:



Swiss Ball Pike:



Copenhagen Plank:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Internal & external obliques, gluteal group, adductor group |
| Form tips | Keep body straight, proud chest, squeeze bottom leg into bottom of bench |
| Progression | Forearm short lever (knees bent at 90 °on bench), forearm long lever (feet straight) |
| Programming | Work up to 45 sec hold per side before progressing |

N.B.- Useful for strength and injury prevention of the adductor muscles and tendons.

Ab Rollout:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Anti-extension, anterior core, latissimus dorsi |
| Form tips | Don't hyperextend lower back |
| Progression | Ab rollout from knees, swiss ball rollout, ab rollout from knees with weight on back, ab rollout from feet |
| Programming | 3-4 sets for 12-15 reps |

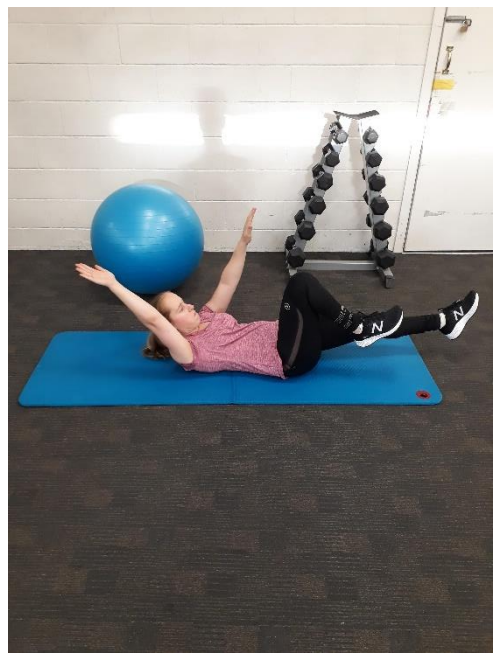
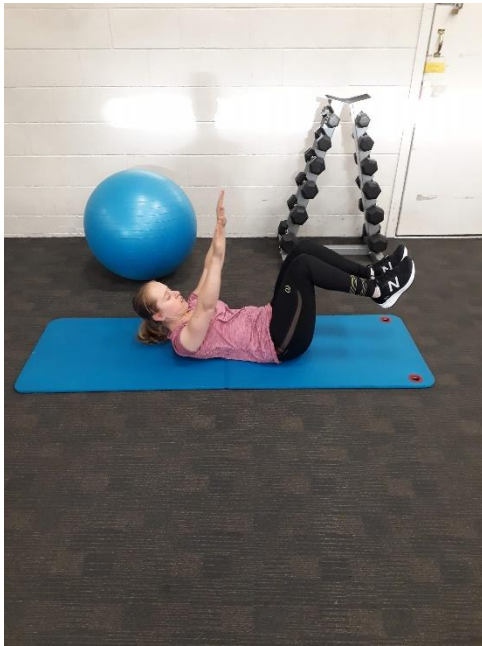
Stir the pot:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Anti-extension, anterior core, reactive core and shoulder stability |
| Form tips | Hold swiss ball plank position and make small circles with the arms. Change direction halfway through timer. Keep body straight, avoid hyperextension of the back, feet width (further apart is easier) |
| Progression | Forearm or high plank position, increase circle size is harder, bring feet closer |
| Programming | 3-4 sets for 30-60 secs |

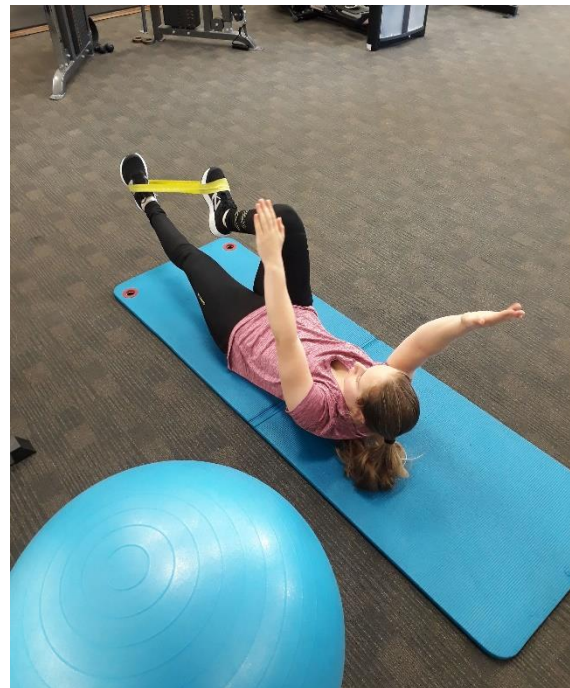
Swiss Ball Pike:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Hip flexion, iliopsoas, anterior core |
| Form tips | Start in swiss ball high plank (hands on ground), lift hips up in a straight line to roll ball forward. Keep legs straight. |
| Progression | Use socks or sliders and move between high plank and downward facing dog position keeping legs straight , modified swiss ball pike by bending knees, place forearms on bench feet on ball and bend knees (less shoulder stability needed), full swiss ball pike |
| Programming | 3-4 sets 12-15 reps |

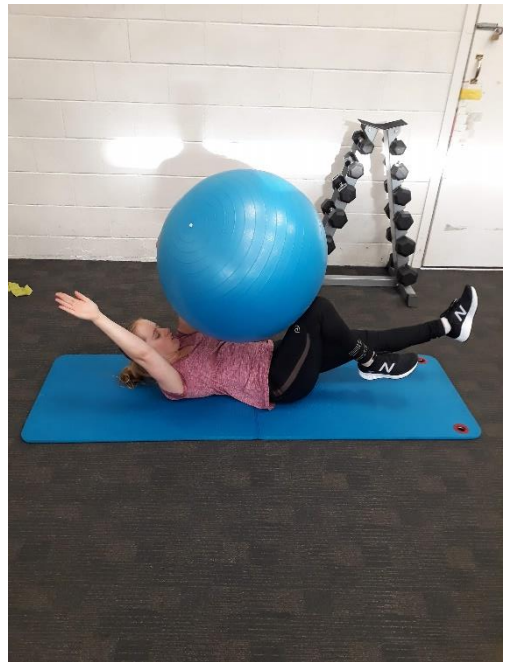
Deadbug:



Banded Deadbug:



Swiss Ball Deadbug:



Bird Dog:



Deadbug:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Anti-extension, core stability, anterior core |
| Form tips | Bodyweight and banded deadbug: lower back in contact with ground and shoulders raised slightly at all times, extend opposite arm and leg Swiss Ball deadbug: push non-extended arm and leg towards each other to stabilise ball |
| Progression | Bodyweight , banded, swiss ball |
| Programming | 3-4 sets 10-15 per side |

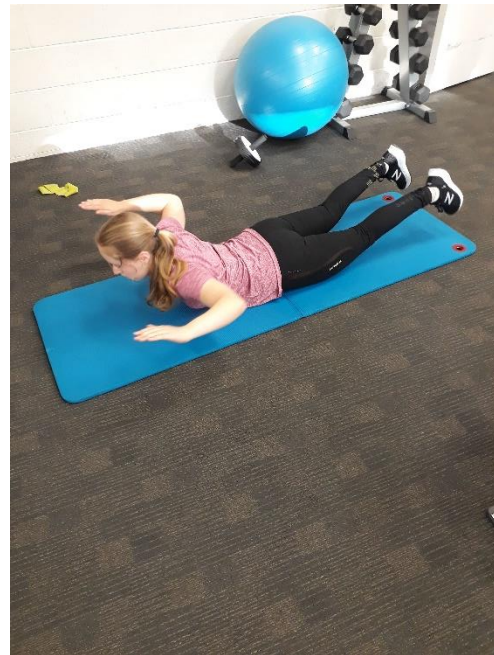
Bird Dog:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Anti- extension, anterior core, core stability, gluteus maximus, gluteus medius |
| Form tips | Keep back and hips straight, pause 1 sec at full extension |
| Progression | Bird dog, holds at full extension, lift back foot off ground at start (only knees and hand on ground) , add band or light weight in hand (2-3 kg) |
| Programming | 3-4 sets 10-15 per side |

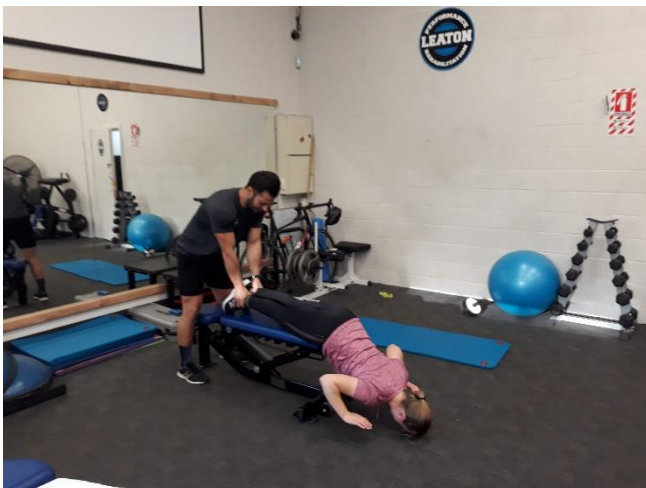
Back Extension:



Unweighted alone:



Unweighted with partner:



Unweighted on machine:



Weighted on machine:

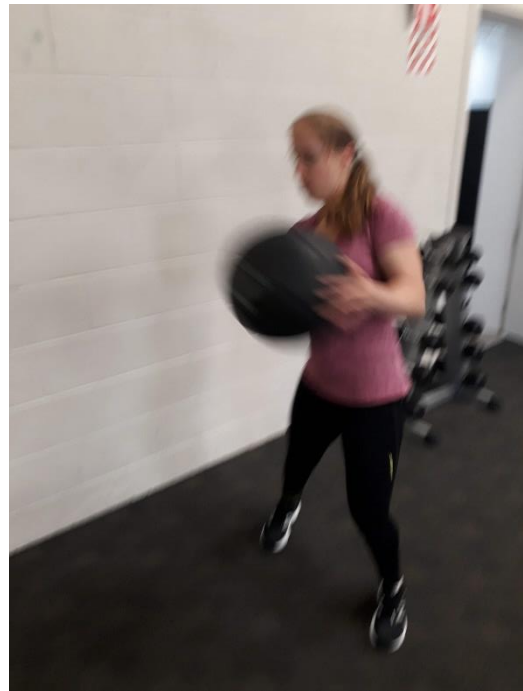


Back Extension:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | hip flexion/extension Erector spinae, quadratus lumborum, gluteal group, hamstring group, anterior core (on way down) |
| Form tips | Unweighted alone- don't do if have lower back pain (6000N force going through facet joint (4)) On machine: Don't extend past neutral (180 °) Toes point straight down Body in straight line at top Look forwards |
| Progressions | Unweighted alone (top pg 19) or with partner (bottom pg.19), off back extension machine unweighted or weighted (pg 20), full reps or hold top position. |
| Programming | 3-4 sets 10-20 reps or 3-4 sets 1 min for holds |

N.B. – Holds at top position on machine are good for developing endurance and improving posture.

Med ball throw:



Catch position:



Waiters Carry start position:



Bottoms up overhead kettlebell carry:



Kettlebell farmers carry:



Kettlebell Suitcase carry:



Bird Dog Row:



More challenging functional movements:

Sideways med ball throw:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Rotation, power movement |
| Form tips | Keep ball close to body at belly button level, slight knee bend, rotate and throw as fast and hard as possible, engage core |
| Progression | add weight |
| Programming | 3-4 sets 6-8 reps |

Bottoms up overhead Kettlebell carry:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Loaded carry, shoulder and core stability |
| Form tips | Keep wrist straight, try not to lean when walking, walk slowly |
| Progression | Double kettlebell overhead carry, Single and double kettlebell waiters carry (bottoms up but with elbow makes a 90° angle with the shoulder) – pg.23 , same weight per side one overhead and one at side carry, offset overhead carry (same as previous but heavier weight on KB at side), bottoms up overhead KB carry, offset bottoms up overhead KB carry |
| Programming | Walk for distance (30m) or time 3-4 sets of 30 - 60 secs |

N.B.- Can also add lunges instead of walking to any of the above position. I like the waiters carry as a fun alternative to push ups on knuckles, wrist rollers or just hitting things for learning to keep the wrist straight while punching because of the immediate feedback of the kettlebell dropping on the wrist if it's not straight.

Kettlebell Farmers Carry:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Loaded carry, anterior core, grip, bracing |
| Form tips | stay upright, keep shoulder blades down |
| Progression | Add weight or time, walk uphill or up stairs |
| Programming | Walk for distance or time 3-4 sets of 30-60 secs |

Kettlebell Suitcase Carry:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Loaded carry, anti-lateral flexion, anterior core |
| Form tips | Keep KB slightly away from leg, stay upright |
| Progression | Add weight or time |
| Programming | Walk for distance or time 3-4 sets of 30-60 secs |

Bird Dog Row:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Anti-rotation, core and shoulder stability, latissimus dorsi, gluteal group |
| Form tips | Pull scapulae back and down before initiating row, keep body straight |
| Progression | Lift foot up (only knee on bench), add weight |
| Programming | 3-4 sets 12-15 reps per side |

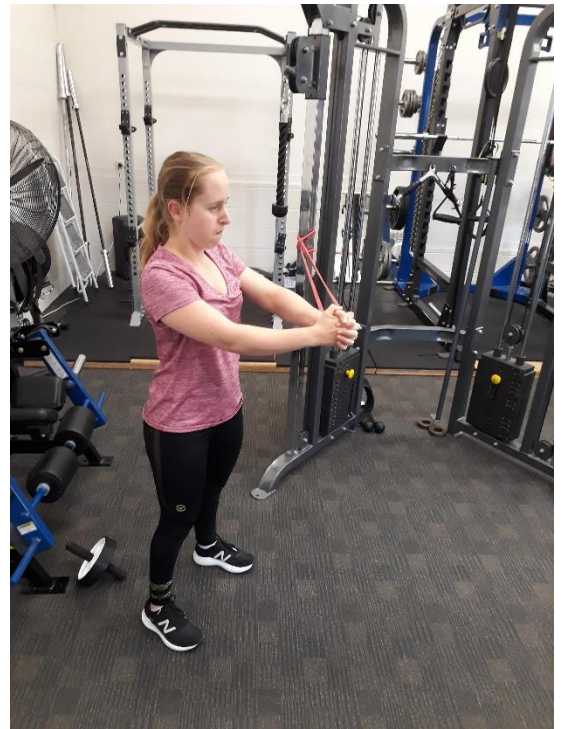
Pallof Press:

| | |
|----------------------------------|--|
| Muscles/movement pattern trained | Anti-rotation, anterior core |
| Form tips | Start: Stand straight (knees unlocked) elbows tucked with tension on band (laterally). Finish: extend arms away from body without shifting hips and return to start. Exaggerate core engagement Prevent wrist extension |
| Progression | Kneeling, standing, increase band resistance |
| Programming | 3-4 sets 12-15 reps per side |

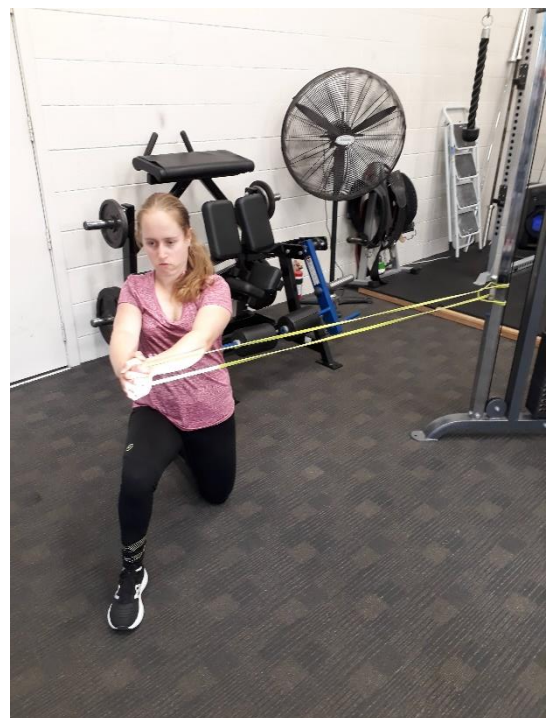
Banded Rotation:

| | |
|----------------------------------|---|
| Muscles/movement pattern trained | Rotation, external & internal obliques, transversus abdominus |
| Form tips | Start: straight arms in 'finish' position of Pallof press at 45 ° to straight in front Finish: rotate 90 ° (to 45 ° in other direction) without moving arms or shifting hips. Move slowly with control Exaggerate core engagement Elbows bent is easier |
| Progression | Kneeling (bent elbows), kneeling (straight elbows), standing (bent elbows), standing (straight elbows) |
| Programming | 3-4 sets 12-15 reps per side |

Pallof Press (Standing and Kneeling):



Banded rotation:



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