

Supplementary file 1. Shoulder Control exercise programme

The effect of shoulder and knee exercise programmes on the risk of shoulder and knee injuries in adolescent elite handball players: a three-armed cluster randomised controlled trial.

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Supplementary file 1. Shoulder Control exercise programme

This programme is inspired by previous exercise resources for handball (Knä- och Axelkontroll – Prestera bättre SISU Idrottsböcker, Sweden 2007) and the aim of the programme is to increase strength, control and range of motion of the shoulder and upper body.

Choose one exercise from each category 1-5 at a difficulty level where you can perform the exercise with good technique but it is still challenging. During the off-season and pre-season (June to August) the programme is performed 3 times per week with 3 sets of each exercise, with a pace of 1-2 second from starting position to end position. During the off-season you also perform the throwing programme (exercise 6).

During the handball season (September to May) the programme is meant to be performed in conjunction with the normal handball warm-up. During the handball season the programme is performed in 2 sets of each exercise, with a pace of 1-2 second from starting position to end-position.

1. Shoulder strength/control – Part 1

Level A

Instructions:

Y-raises with an elastic band

Stand shoulder wide with an elastic band fixated in front on ground level. With slightly bent elbows, lift the arms so they shape a “Y” and go back to the starting position

2-3x30 seconds



Level B

Instructions:

Archer draws with an elastic band

Stand with an elastic band fixated in front of the body. Pull the band and rotate the upper body “draw the bow” and go back to the starting position

2-3x30 seconds



Level C

Instructions:

Resisted external rotation in 90-90 position

Stand shoulder wide with an elastic band fixated in front of the body. Put the arm in a “90-90 position” with the forearm pointing forward. Pull the band and rotate arm backward until the forearm pointing upward and go back

2-3x30 seconds



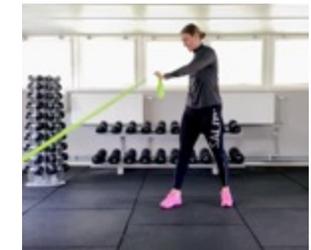
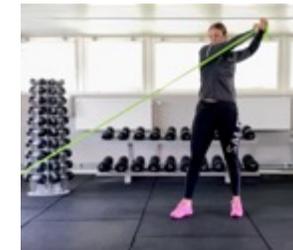
Level D

Instructions:

Eccentric diagonal patterns – “Lower the arm”

Stand with one foot in front of the other with an elastic band fixated in front on ground level. With help form the other arm, put the the arm in a throwing position. Slowly lower the arm

2-3x30 seconds



Partner exercise

Instructions:

Reversed arm wrestling – “Clock to clock”

Stand shoulder wide beside the partner. Put the arm in a throwing position and push the wrist against the partner’s wrist.

2-3x15 seconds



2. Shoulder strength/control - Part 2

Level A

Instructions:

Push plus on knees and forearms

Elbows are placed beneath the shoulder.

Push the upper body up, protract the shoulder and hold for a second and go back to the starting position

2-3x30 seconds



Level B

Instructions:

Overhead elastic band pull apart

Stand shoulder wide with the arms in an overhead position. Pull the band apart and hold for a second and then go back to the starting position

2-3x30 seconds



Level C

Instructions:

Bench to push up

Elbows are placed beneath the shoulder.

Push the upper body up, protract the shoulder and shift the position to a push up position and back to the starting position again.

2-3x30 seconds



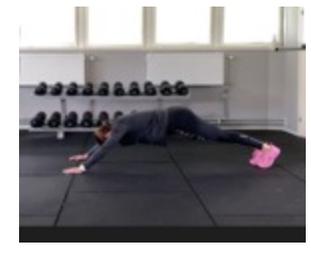
Level D

Instructions:

Superman walkouts

Stand in a push up position. Move the feet as far as possible while maintaining the body in a straight line

2-3x15-30 seconds



Partner exercise

Instructions:

Wheelbarrow with push plus/bench to push up

Same as level C but the partner support the ankles

2-3x15-30 seconds



3. Upper body mobility

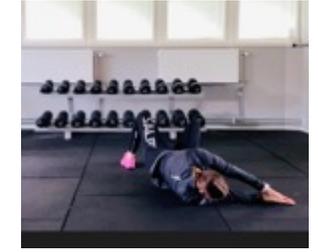
Level A

Instructions:

Supine rotations

Lay in a supine position with knees bent and feet on the ground. Put the hands together in front of the chest. Rotate the upper body as far as possible while maintaining the hands together.

2-3x30 seconds



Level B

Instructions:

Rotations in a bench position on knees

Elbows are placed beneath the shoulder and knees on the ground. Rotate the upper body by putting one arm under the body as far as possible and then rotate to the opposite direction.

2-3x30 seconds



Level C

Instructions:

Rotation in a bench position on toes

Same as Level B but support on toes instead of knees

2-3x15-30 seconds



Level D

Instructions:

Rotations in a push up position

Same as Level B but in a push up position instead

2-3x15-30 seconds



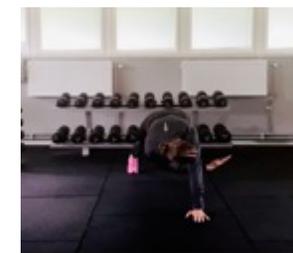
Partner exercise

Instructions:

Rotation in push up position with passes

Same as Level D but in the end position pass the ball to the partner

2-3x15-30 seconds



4. The Diver with one arm in overhead positions

Level A

Instructions:

One arm diver in overhead position

Stand on one foot with the arm in an overhead position. Bend forward while maintaining the body in a straight line, performing a "T" and then go back to the starting position.

2-3x30 seconds



Level B

Instructions:

One arm diver in overhead position with a ball

Same as level A but holding a ball

2-3x30 seconds



Level C

Instructions:

One arm diver in overhead position with an elastic band

Same as level A but holding an elastic band that is fixated in front of the body.

2-3x30 seconds



Level D

Instructions:

One arm diver in overhead position with a dumbbell

Same as level A but holding a dumbbell

2-3x30 seconds



Partner exercise

Instructions:

One arm in diver overhead position arm wrestling

Same as level A but the partner pushing the arm downward

2-3x15 seconds



5. Trunk rotational strength

Level A

Instructions:

Resisted trunk rotations with elastic band

Stand shoulder wide with an elastic band fixated the side of the body. Hold the arms straight in front of the chest. Rotated the upper body as far as possible while maintaining the body in a straight line.

2-3x30 seconds



Level B

Instructions:

Diagonal pattern in lunge position with elastic band

Stand in a lunge position with an elastic band fixated the behind the body. Hold the elastic band in an overhead position and rotate the upper body so the hands ends up at the front knee.

2-3x30 seconds



Level C

Instructions:

Trunk rotation in throwing position with elastic band

Stand shoulder wide with an elastic band fixated the behind the body. Hold the arm in an overhead position. Rotate the upper body while maintaining the body in a straight line and the arm in the overhead position.

2-3x30 seconds



Level D

Instructions:

Resisted throwing motion with elastic band

Stand with one foot in front of the other with an elastic band fixated the behind the body. Hold the arm in a throwing position and perform a throwing motion and go back to the starting position again.

2-3x30 seconds



Partner exercise

Instructions:

Isometric trunk rotation

Maintain the body and arms straight while the partner pushes the arms from side to side.

2-3x15 seconds



6. Handball throwing programme

The handball throwing programme is recommended to be performed every second day during the off-season (June-August). Start at level A and progress to the next level after one week until you reach level D.

Level A 2 sets of 15 throws at 50% of maximum velocity and 10 throws at 70 % of maximum velocity

Level B 2 sets of 15 throws at 50% of Maximum velocity, 10 throws at 70% of maximum velocity and 5 throws at 90% of maximum velocity

Level C 2 sets of 15 throws at 60% of maximum velocity, 10 throws at 80% of maximum velocity and 5 throws at 100% of maximum velocity

Level D 2 sets of 15 throws at 70% of maximum velocity , 10 throws at 90% of maximum velocity and 10 throws at 100% of maximum velocity