

8.0 INJURY PREVENTION TECHNIQUES

8.1 General Principles of Conditioning

It is a well known fact that athletes are less likely to be injured when they are physically fit. In addition, well conditioned athletes can perform at a higher level of intensity for longer periods of time without becoming fatigued. This resistance to fatigue allows fit athletes to be both physically and mentally in control of themselves from the drop of the puck until the final buzzer.

The basic components of fitness are:

- Aerobic and Anaerobic Conditioning
- Muscular Endurance, Strength and Power
- Motor Coordination and Skill
- Joint Flexibility
- Speed, Agility and Quickness Characteristics

This section will briefly describe these components of fitness. To learn more about the systems specific to your team, please consult a professional in this field.

Aerobic Conditioning

This is the training of the athlete to utilize oxygen as an energy source at different workloads. The athlete is generally training for a longer period of time at an intensity of anywhere from 50-85% of maximum exertion. The proper work to rest ratio involves exercising for longer than 120 seconds then resting for an equal amount of time. The development of this energy system is critical in the game of hockey. A large degree of Aerobic Conditioning allows the player to recover better enabling them to perform for an entire game at maximum intensity. The development of Aerobic Conditioning is essential in the development of Anaerobic Conditioning for hockey.

Anaerobic Conditioning

This is the training of the athlete to work at a high intensity (greater than 85% of maximum exertion) for a short period of time. Generally, an athlete will work from 0 to 120 seconds with 5 to 6 times as much rest allowed between work intervals. During this type of activity the muscles do not require oxygen to work, however, lactic acid is produced as a by-product that accumulates in the muscle. The key to its success is following the proper work to rest ratios when training. It is through this type of conditioning that players will develop improved speed.

Muscular Endurance/Strength/Power

Muscular endurance is the ability of a muscle or group of muscles to work for an extended period of time.

Muscular strength is the ability of a muscle or group of muscles to produce a large amount of force a few times.

Muscular power is the ability of a muscle or group of muscles to produce force in a short period of time.

The training of these fitness components is complex and dependent on the athletes' age and experience.

- For 9 to 12 year olds emphasis should be on motor coordination and skill development.
- For 13 to 16 year olds emphasis should be on development of aerobic conditioning and muscular endurance.
- For 17 to 20 year olds emphasis should be on development of aerobic conditioning, anaerobic conditioning and muscular strength and power.

Note: It is important to consult a professional when introducing muscular endurance/strength/power training.

Motor Co-ordination and Skill

This is the training of the athlete to perform new skills, agility and quickness. It is important that the development of new skills follow an acceptable sequence, allowing the athlete enough time to practice these skills in a controlled situation prior to executing them in a game situation. When teaching new skills, it is important to first teach these skills when the athlete is well rested and not fatigued. As the new skill is mastered, it is important to allow the athlete to practice the skill under different levels of fatigue and stress.

During the growing years, motor co-ordination is influenced by periods of rapid growth causing the athlete to lose certain aspects of his/her motor co-ordination and skill. During these periods, it is important that time is allowed for the athletes' motor co-ordination and skill to catch up with their growth.

Joint Flexibility

Flexibility is defined as the range of motion (ROM) available at a joint or series of joints.

The development of joint flexibility allows the body to move more freely with less energy costs; indicating that the joint has better movement efficiency. Another way to look at this movement efficiency is in terms of movement stiffness. The goal of flexibility training is to increase the range of motion and decrease the movement stiffness or resistance to movement. A joint's range of motion is improved through stretching while the movement stiffness is improved through warm-up activities.

Stretching improves a player's flexibility. Therefore, stretching is a fundamental component of any risk management and safety program. An appropriate stretching program can provide the following benefits:

- Increased Range of Motion
- Increased Strength
- Increased Movement Efficiency
- Increased Muscular Relaxation
- Improved Posture and Symmetry
- Improved Body Awareness
- Decreased Muscle Soreness

Stretching ultimately allows a player to increase their level of performance and decrease their risk of injury.

There are generally two types of stretches or flexibility:

- 1) **Dynamic:** Dynamic stretching consists of controlled movement that takes you gently to the limits of your range of motion. It involves the ability to use your own muscular strength to move under control through the entire range of motion of a joint. As hockey requires dynamic movements, it is necessary to conduct dynamic stretching exercises. Start off with the movement at half speed for a couple of repetitions and then gradually work up to full speed movement under control through-out the entire range of motion of the joint.

Examples of Dynamic stretching are found in the Dynamic Warm-up section of this module.

- 2) **Static/Active:** Static/Active stretching involves gradually assuming a position and then holding it there on your own with no assistance other than using the strength of your own muscles.

The position should be held statically and you can often move further into the stretch position as the stretch sensation subsides.

Static/Passive: Static/Passive involves gradually moving into the stretch position and holding that position within the joint's range of motion using your own body weight, the support of another limb or the support of an external object. Often in static stretching you are advised to move further into the stretch position as the stretch sensation subsides.

It is generally accepted that to improve static flexibility an athlete must stretch regularly holding each stretch for 15-30 seconds and repeating 2-4 times for each side. It has also been shown that the total time spent stretching is important in the amount of range of motion gained.

Examples of Static active/Passive stretching are found in the Cool-down section of this module.

Speed, Agility and Quickness Characteristics

The secondary fitness characteristics of Speed, Agility and Quickness are cornerstones in hockey. Today's hockey player must work to develop top speed, defining agility and lightning quickness to adapt to the multi-directional demands of hockey. These fitness parameters are developed through-out the athlete's career.

The foundation of all of these skills is first the ability of the athlete to stop under control with balance on a single foot regardless of the direction of movement. So it is important to teach the athlete to stop first and move second!

All of these skills are generally anaerobic in nature and must follow the training guidelines as outlined in anaerobic conditioning. As there is also a high skill and motor control component to these skills, the coach must first teach the skills of these drills prior to the training of speed, agility and quickness

The development of these basic components of fitness is the goal of every coach. Their development should be aimed not only at improving the athletes' performance, but also for injury prevention. Through proper conditioning a player will be able to better handle the stresses of the game, putting them at a lower risk for injury.

8.2 Off-ice Conditioning: Considerations And Guidelines

- The development of an appropriate off-ice training program should incorporate all the major components of fitness. It is necessary to consult with an appropriate fitness professional when starting an off-ice training program.
- All activities must be appropriate for the age and ability of the player:
 - For 9 to 12 year olds emphasis should be on motor coordination and skill development.
 - For 13 to 16 year olds emphasis should be on development of aerobic conditioning and muscular endurance.
 - For 17 to 20 year olds emphasis should be on development of aerobic conditioning, anaerobic conditioning and muscular strength and power.
- All players must warm-up before and cool-down after all training sessions, and players must drink sufficient amounts of cold water before, during and after sessions.
- It is important that all players are properly supervised during off-ice conditioning and players should never participate in any form of conditioning that aggravates an injury.
- Training and exercise must not be used as a form of punishment.
- The player should be able to stop participating in any exercise if he/she chooses to do so.
- The exercises should be discussed with the player so he/she understands both the purpose of the exercise and the expected stress and fatigue of the exercise.

8.3 Warm-up Considerations And Guidelines

While the player may be in top form in terms of their physical conditioning, participation in vigorous sports like hockey requires a proper warm-up to help prepare the body for the increased demands and to help prevent injuries.

A proper warm-up provides a number of benefits to the body:

- Increased general body and tissue temperature.
- Increased blood flow throughout the cardio-respiratory system and ultimately to the working muscles.
- Increase in the body's metabolic processes.
- Decreased resistance of connective tissue thus allowing for greater movement in muscle and associated joint structures.
- Enhanced psychological preparedness of the athlete.
- Reduced risk of muscle/tendon pulls.

While the above is not an exhaustive list, the benefits are readily seen. To be effective, a good warm-up should focus on the following:

1. To raise body temperature resulting in an increase in respiratory and heart rate.
2. It should affect as many of the large muscle groups as possible to effectively make tissues less stiff and flexible.
3. It should be made up of general body activities and some sport-related ones.
4. To reduce muscle stiffness, as muscle injury is thought to be related to muscle stiffness.

Off-Ice Warm-up

Ideally players should arrive at the arena at least 30 minutes before a game or practice to prepare both mentally and physically. Players should warm-up for approximately 10-15 minutes.

The warm-up can be divided into 3 phases:

- 1) General Total Body Warm-up
- 2) Dynamic Warm-up
- 3) Speed, Agility and Quickness Warm-up

1) General Total Body Warm-up

The General Total Body Warm-up is simply a general aerobic activity such as jogging, biking or skipping at a low intensity. The goal is simply to get the heart and lungs working at a higher rate, and to get the body warmed up to a light sweat.

2) Dynamic Warm-up

The Dynamic Warm-up is a series of callisthenic type movements and exercises aimed at moving the body in a controlled manner through a variety of movement patterns. Exercises such as jumping jacks, lunge walking, high knee marching, bum kick walking, straight leg marching, push-ups, carioca, trunk rotations, burpees and arm circles are simple examples of the type of exercises completed during the dynamic warm-up. The goal is to ensure that the athlete moves under control through the entire range of motion available at the joint and to gradually increase the intensity of the movements during the dynamic warm-up.

3) Speed, Agility and Quickness Warm-up

The Speed, Agility and Quickness Warm-up should consist of a series of drills to prepare the athlete to play hockey. The exercises could be things like hopping, skipping, pattern drills like hop scotch and ladder drills, jumping or reaction drills. These warm-up exercises should be done at a high intensity for a short duration with lots of recovery time between exercises. These exercises should not fatigue the athlete prior to the game!

On-Ice Warm-up

Once players are on the ice, the warm-up should follow the same 3 basic phases:

- 1) General Total Body Warm-up
- 2) Dynamic Warm-up
- 3) Speed, Agility and Quickness Warm-up

1) General Total Body Warm-up will consist of basic skating drills aimed at gradually increasing the athlete's heart rate and respiratory rate. The player should get a feel for the ice by doing some basic skating skills:

- Forward/backward skating in a straight line as well as turning corners to the right and left.
- Skating in circles to the right and left.
- Cross-overs to the right and left.
- Slow stops and starts to the right and left.

2) Dynamic on-ice Warm-up will consist of some basic movement exercises such as:

Shoulder Flexion

- Holding the stick with both hands in front of their body, the player lifts their arms over their head as far as possible without arching their back.

Shoulder Extension

- Holding the stick with both hands behind their back, the player lifts their arms behind their back as high as possible without arching their back.

Trunk Rotation

- Holding the stick at shoulder height with both hands, the player rotates their trunk to one side, returns to the middle and stops, and then rotates to the opposite side. **DO NOT** rotate from side to side without stopping in the middle.

Note: During these exercises the athlete should control the swing. There should be little momentum and no bounce.

Groin/Thigh

- While gliding, as in illustration, the left leg is forward with knee bent over the skate.
- Keep back straight with hips and shoulders square.
- Keep the right leg straight with inside of skate gliding on the ice.
- Press forward and down, bending the left knee, stretching the right groin and thigh.
- Slowly move in and out of stretch.
- Repeat stretch for opposite leg.



3) Speed, Agility and Quickness Warm-ups are done doing technical skills specific to hockey. The players should ensure that they are moving at top speed prior to the opening face-off.

8.4 Cool-down

The cool-down is the opposite of the warm-up. If the warm-up prepares the body for exercise, then the cool-down recovers the body following exercise. The cool-down is one of the most important features of the recovery process following exercise.

An appropriate cool-down will:

- Aid in the dissipation of waste products
- Reduce the potential for muscle soreness following exercise
- Reduce the chances of dizziness or fainting caused by the pooling of venous blood in the extremities
- Reduce the level of adrenaline in the blood

The cool-down should consist of a period of 5 – 10 minutes of light aerobic activity to keep the muscles working to aid in the dissipation of waste product and keep the blood from pooling in the extremities. It is generally agreed that static stretching during the cool-down is beneficial.

STRETCHING

Stretching should be completed after every game, practice and off-ice training activity.

General Static Stretching Instructions:

- 1) Players should be warm prior to stretching.
- 2) Players should maintain the proper body position and alignment during each stretch.
- 3) Players should be alert to the feel of the stretch: the feeling should be one of gentle stretch not pain.
DO NOT OVER STRETCH.
- 4) The stretch should be static and not bouncy.
- 5) Stretches should be held for 15-30 seconds and repeated 2-4 times each.

Things to Remember

- These stretches should be considered the minimum requirements.
- For more stretches, consult an appropriate professional in your community.
- If a player complains of pain during any of the dynamic or static stretching exercises, the player should stop the exercises and seek medical advice.
- A player's flexibility will decrease during their growth spurt. This occurs at approximately age 12 for girls and age 14 for boys. More frequent stretching may decrease these effects.

Players should perform the following seven (7) stretches to complete the cool-down.

Cool-down Stretches

1. Trunk/Shoulder

- Stand with feet shoulder width apart -bring left arm overhead reaching hand down spine
- Hold the left elbow behind the head with the right hand
- Bend the trunk straight sideways to the right
- Do not rotate the trunk



2. Thigh/Quadriceps

- Stand on your left foot holding wall with left hand for support
- Reach behind with the right hand holding the right foot
- Keep back straight and hips and shoulders square
- Lift the right foot and ankle towards the right buttocks
- Keep the right leg in good alignment: the right shoulder, hip, knee and ankle should be aligned



3. Thigh/Hip Flexor

- Kneel on the right knee
- The left leg is forward with the knee bent
- Place hands on the floor at each side of the left foot
- Keep your back straight and hips and shoulders square
- Stretch forward feeling the stretch in the right thigh and hip flexor



4. Groin

- Sit on the floor with your feet together as in the picture
- Keep your back straight
- Pull your feet in towards your groin until you cannot keep your back straight or keep your feet together
- Put your elbows on your knees and your hands on your ankles
- Press your knees towards the floor; to increase the stretch rotate forward at the hips while keeping your back straight



5. Hamstring/Lower Back

- Sit on the floor with the left leg extended and the right leg bent inward as in the picture
- Keep the back straight and hips and shoulders square
- Keep the left leg in neutral rotation and aligned with the left shoulder. Reach forward with your hands keeping the back straight (Think of bringing your chest towards the thigh, not the head to the knee)



6. Low Back/Hip Extensor

- Lie on your back with the right knee bent up towards the chest as in the picture
- Hold the right knee with both hands (If a player complains of pain holding the knee as illustrated; instruct them to hold the leg/thigh under the knee)
- Keep the right knee in alignment with the right shoulder
- Pull the right knee towards the chest



7. Gluteal/Hip/Low Back

- Lie on your back with the right hip and knee bent and the foot over the left leg as in the picture
- Place the right hand flat on the floor with the shoulder at 90 degrees as in the picture
- Turn the head to the left
- Hold onto the right knee with the left hand and pull the knee towards the floor
- Allow the body to rotate until the shoulder is about to lift off the ground
- Keep the shoulders and right hand in contact with the ground



REMEMBER

Players should be dressed in comfortable track/athletic clothing when performing stretching routines. (These stretches may also be done in equipment)

Hold each stretch 15-30 seconds and repeat 2 – 4 times for each side.