Strength and Conditioning: the Hockey Player
Background Information

- Strength and Conditioning Coach: Catalyst Health, Universal Hockey, Florida Panthers
- Chiropractor
- Active Release Technique Provider
- Rehabilitation Specialist
Overview

0 Importance of **strength and conditioning** for the hockey player
  - the ability to compete
  - Strengthen appropriate muscle and joints for increased performance
  - Stabilize the body for injury prevention
  - Sport specificity for all aspects of the game

0 3 **Key Steps** in the planning, implementing and executing of an effective strength and conditioning program
  - Assessment
  - Training
  - Mobility, Recovery, Injury prevention
Strength and Conditioning (Off Ice)

**Importance** of off ice strength and conditioning for hockey players:

- Improved skating technique
- Improved speed and power
- Stronger, more accurate shooting
- Better puck possession ability
- More explosiveness (checking, skating, shooting)
- Increased endurance for situational play (over time, long/double shifts, penalty kill)
- More allusiveness and agility
Planning, Implementing and Execution of an effective Strength and Conditioning Program

0 Assessment:
  - Fitness
  - Biomechanical
  - Developmental

0 Training:
  - Tailored: aspects of program depend on assessment
  - Comprehensive: general principles of strength and conditioning

0 Mobility, Recovery and Injury Prevention:
  - what’s the point in the above if not able to utilize on the ice?
Assessment: Fitness

Fitness testing for hockey: **Differs from other sports**

- Most important part is appropriate for hockey and level of development and level
  - Speed
  - Strength (upper and lower body)
  - Muscular endurance
  - Agility/Quickness / Hand Eye Coordination
  - Explosiveness (power)
  - Cardiovascular energy systems
    - Aerobic
    - Anaerobic
    - Heart rate control

**Old thinking** (NHL combine, Heavy weights/Olympic lifting) vs. **New school** (on ice, sport specific, technologically advanced)

- Not correlated to performance always (NHL combine study)

- Best for documenting the **effectiveness of a player’s strength and conditioning program**
Fitness Testing

Diagonal Power Testing

Force Plate Testing
Peyer et al. (2011) measured the **Michigan State University Men's Hockey Team's (NCAA D1):**

- **Body Analysis:** Age, Height, Body Mass, Body Fat %
- **Cardio Testing:** VO2 Max, Maximal Lactate Level, Max Heart Rate, Repeat Sprint Test Ability
- **Strength and Endurance:** Max Push-Ups, Max Chin-Ups, Max Leg Press Reps with 182kg, Max Bench Press Reps with 70kg
- **Speed:** On-Ice Dot-to-Dot Sprint Time (Offensive face-off dot to far same side, but opposing end face-off dot), On-Ice 1-Lap Sprint Time, On-Ice Lightening Drill Time (Start at blueline->redline->back to blueline->far blue line->back to redline-> finish at far blue line)

**Plus/Minus** was used as the primary indicator of hockey performance because of it’s ability to effectively incorporate both offensive and defensive efforts.
Fitness Testing: Study

The Results: Notable findings included

0 There were no significant differences in any of the measures between forwards and defensemen except for VO2Max (cardio level) with the forwards having higher values.

0 Plus/Minus was ONLY significantly correlated with four of the tests: Repeat Sprint Ability (12 x 110-m sprint every 45 s, off-ice), Chin-Ups, Leg Press, and Bench Press.
Fitness Testing: Study

Interpreting the Findings

1) it was interesting to see that strength (lower body and upper body) and repeat-sprint ability were the two qualities most predictive of plus-minus. This should come as no surprise to most of you, but it certainly has some important implications.

2) Aerobic fitness and body composition do not appear to be significant predictors of player performance as measured by the +/- system or coach evaluation. To maximize the efficiency of preseason testing, coaches may rely on strength (chin-ups, leg press, and bench press) and repeat sprint tests while decreasing the number of aerobic capacity and body composition analyses to minimize player burden…"

3) The big take home from this is that a hockey player’s training program CANNOT neglect strength work, and that interval-based work is more appropriate for conditioning purposes.
Assessment: Biomechanical

Assessing Movements

Quality of Essential Basic Athletic Movements

1) Squat: weakness in glutes = predisposed to knee injury
tightness in hip flexors = predisposed to low back injury

2) Lunge: balance, stability, weakness in lower body

3) Push Up + Row: Scapular/Shoulder Movements

4) Cross-Crawl: Spinal + Core stability
Assessment: Biomechanical

1) Squat
2) Lunge
Assessment: Biomechanical

3) Push Up + Row

4) Cross-Crawl
Assessment: Biomechanical

Optimal Skating Biomechanics: Study (Journal of S + C: 2012)

Game-performance skating is characterized by: 17 positions analyzed
- two-foot gliding: squatting
- struggling for puck or position.

Fastest/Most efficient skaters have:
- **wide strides**: strong glutes
- deep knee flexion: **muscular endurance and leg strength**
- significant forward lean: **core** strength

**Training program** should emulate, as much as possible, the game-performance skating characteristics that have been found in the research literature.
Assessment: Development

1) Chronological age: number of years and days elapsed since birth

2) Developmental age: refers to the degree of physical: height, weight, growth hormones; mental / cognitive and emotional maturity.

Critical periods of development: is a point in the development of a specific behaviour when experience or training has an optimal effect on development.

The same experience, introduced at an earlier or later time, has no effect on or retards later skill acquisition.
**Development: Terminology**

http://canadiansportforlife.ca

1. **Peak height velocity (PHV):** on average girls = 12, boys = 14
   - maximum rate of growth in stature during growth spurt.
   - The age of maximum growth is called the age at PHV.

2. **Peak strength velocity (PSV):** 2 years post PHV (why there is a lag in strength gains)
   - maximum rate of increase in strength during growth spurt.

3. **Peak weight velocity (PWV) is the**
   - maximum rate of increase in weight during growth spurt.
   - The age of maximum increase in weight is called the age at PWV.
Development: Optimal Windows

**Endurance (conditioning):** The optimal window of trainability occurs at the **onset of PHV**. Aerobic capacity training is recommended before athletes reach PHV. Aerobic power should be introduced progressively after growth rate decelerates.

**Strength:** The optimal window of trainability for *girls* is immediately after PHV or at the onset of the menarche, while for *boys* it is **12 to 18 months after PHV**.

**Speed:**
- For *boys*, the first speed training window occurs between the **ages of 7 and 9 years** and the second window occurs between the **ages of 13 and 16**.
- For *girls*, the first speed training window occurs between the **ages of 6 and 8 years** and the second window occurs between the **ages of 11 and 13 years**.

**Skill:** The window for optimal skill training
- For *boys* takes place between the **ages of 9 and 12**
- For *girls* and between the **ages of 8 and 11**

**Flexibility/Mobility:** The optimal window of trainability for suppleness for both genders occurs between the **ages of 6 and 10**.
Development: Terminology

Ancillary Capacities: Maximize Potential

- refer to the knowledge and experience base of an athlete
- warm-up and cool-down procedures
- stretching
- Nutrition / hydration
- Recovery / mental preparation
- When athletes reach their *genetic potential* and physiologically cannot improve anymore, performance can be improved by using the *ancillary capacities* to full advantage
Development

0 Specializing before the age of 10 in sports contributes to:

- one-sided, sport-specific preparation.
- lack of basic movement and sports skills.
- overuse injuries
- early burnout
- early retirement from training and competition
General Guidelines to Youth Training

0 Active Start Stage: chronological 0 – 6 years of age

- FUN and part of daily life
- Fitness and movement skills development
- Focus on learning proper movement skills such as running, jumping, wheeling, twisting, kicking, throwing, and catching
- Not sedentary for more than 120 minutes except when sleeping
General Guidelines to Youth Training

0 Fundamentals Stage: chronological 6-9 years of age

- Overall movement skills
- Integrated mental, cognitive, and emotional development
- Athleticism: agility, balance, coordination, and speed
- Medicine ball, Swiss ball, body weight strength exercises
- Introduce simple rules of ethics of sport
- Start to screen for talent
- No periodization, but well-structured programs
- Daily physical activity
General Guidelines to Youth Training

Learning to Train Stage: chronological and developmental 9 to 12 years of age

- Overall sport skills development
- Introduction to mental preparation
- Medicine ball, Swiss ball, body weight strength exercise
- Introduce ancillary capacities
- Talent Identification
- Single or double periodization programs (phases of training)
- Sport specific training 3 times week; participation in other sports 3 times a week
General Guidelines to Youth Training

**0 Training to Train Stage**: chronological and developmental 12 to 16 years of age

- Sport specific skill development *(same for all positions)*
- Major fitness development stage: *aerobic and strength.*
- The onset of **Peak Height Velocity (PHV)** are the reference points
- Develop mental preparation
- Introduce **free weights**
- Develop **ancillary capacities**
- Frequent musculoskeletal evaluations during PHV
- Single or double **periodization**
- Sport specific training **6-9 times per week** including **complementary sports**
General Guidelines for Youth Training

0 Training to Compete Stage: 16 to 23 years of age

- Sport and position-specific physical conditioning
- Integrated mental, cognitive, and emotional development
- Advanced mental preparation
- Optimize ancillary capacities
- Single, double, or triple periodization
- Sport specific technical, tactical and fitness training 9-12 times per week
Implementing Off Ice Assessment into Strength and Conditioning Programs for Hockey Players

0 **Deficiencies** (focus on them in development, need baseline level of all physical components)

0 **Strengths** (focus on strengths at high levels, excel at something)
Training: Capacity

0 The higher a player’s overall capacity the better he/she will perform on the ice.

0 The ability to institute and perform a COMPREHENSIVE training program increases the capacity of an athlete.

0 The Goal of a Training Program: create maximum capacity by improving ALL physical aspects that will enhance a hockey player’s performance.

0 Focusing or isolating one particular physical attribute will allow for improved performance in one area but the capacity for the athlete to improve will be limited or capped.
Strength + Conditioning

**In-Season: is about maintaining capacity**

- maintain physical components

- **speed and conditioning work done on the ice/ in game** (too much wear and tear), practices and games should be sufficient (unless a player that does not get a lot of ice time then supplementary low impact conditioning is important);

- **avoid rotation training** (done enough during games and practice but maintain optimal rotational movement patterns)

- strength and power are key (not done in game or practice) work should be **low volume, high intensity/quality reps**

- Time for hard training sessions (**team building or mental toughness building**)
Strength and Conditioning

**Off-season:** is about developing capacity

- Initially important for recovery and rehabilitation of injuries
- In latter part: increasing all aspects of hockey specific physical qualities

**Pre-Season:** is about maximizing capacity:

- Introduction of on-ice and conditioning
Training: Hockey Specific

0 Lower body Strength and Endurance protocol

0 Upper body Strength and Endurance protocol

0 Core protocol

0 Speed and Agility protocol

0 Conditioning protocol
Lower Body Protocol

0 Posterior chain focus: Strength Training

0 Explosive/Plyometric exercises: Power

0 Leg muscular endurance: Conditioning

0 Single leg exercises for pelvic stability: Balance/Stability

0 Eccentric adductor/groin movements: Injury Prevention
Split Squat
One Legged Deadlift
Eccentric Lateral Lunge
Single Leg Exercises with Stability

One Legged Squat

Single Arm Split Squat
Plyometrics

Split Squat Jump

Box Jump
Upper Body Protocol

0 Pushing exercises for game situation: **Strength**

0 Explosiveness / Plyometric Training with Medicine balls: **Power**

0 Pulling exercises: scapular stability for shoulder **Injury prevention**
Upper Body: Pushing
Upper Body: Pulling

Horizontal Pull Up

Plank Row
Core Protocol

0 Core stability: **Strength and Endurance**

0 Rotational power: **Power** for shooting

0 Anti-rotation for lateral core strength: **Puck possession**

0 Postural correction: **Injury Prevention**
Core Strength

- Side Plank
- Paloff Press
Russian Twist

Side Medicine Ball Throw
Speed + Agility Protocol

0 Alactic/Aerobic

0 Change of direction: forwards, backwards, diagonally, laterally

0 Reaction Speed Drills

0 Acceleration drills (first stride): minimal 15% bodyweight added

0 Hill Sprint training: more stress on leg muscle (intervals)
Conditioning Protocol

- **Goal:** Delay or avoid fatigue

- **Adequate aerobic capacity** / VO2 max

- **Anaerobic capacity (sports specific):** anaerobic to increase VO2 max more effectively
Training: Hockey Specific

- Program must be **COMPREHENSIVE**

- Every aspect of a program **COMPLIMENTS** or is related to another aspect of a program: as one area improves as does another area

- **Examples:**

  1) Strength = Speed (must improve strength to improve speed, ultimately speed is a **transfer of force into the ice**; this force is increased with increase strength)

  2) Strength/Muscular Endurance = Conditioning (improved **ability to maintain ideal hip and knee bend for optimal skating position** equates to less energy being utilized and is more easily sustainable aka can perform **for longer** aka conditioned)

  3) Speed = Conditioning = if the player is faster (increased speed) then they will be **using less energy when competing for loose pucks** etc and this will allow for more sustainability (aka to perform for longer)
Body Types

Ectomorph  Mesomorph  Endomorph
Body Type

0 Endomorph: have a larger bone structure with higher amounts of total body mass and fat mass.
- They tend to be insulin dominant: lower carbohydrate tolerance / slow metabolism
- higher fat and protein intake with carbohydrate intake being controlled and properly timed (e.g., after exercise).
- Their ideal intake might look like 25% carbohydrates, 35% protein, and 40% fat.

0 Mesomorph: medium sized bone structure and athletic body, and if they’re active, they usually have a considerable amount of lean mass.
- Tend to be testosterone and growth hormone dominant. This profile leads to a predisposition for muscle gain and the maintenance of a lower body fat.
- Their ideal intake might look like 40% carbohydrate, 30% protein, and 30% fat

0 Ectomorph: thin individuals characterized by smaller bone structures and thinner limbs. Think of a typical endurance athlete.
- Tend to be thyroid hormone dominant / fast metabolism
- This group generally does best with more carbohydrates in the diet, along with a moderate protein and lower fat intake. A nutrient distribution for this body type would ideally be around 55% carbs, 30% protein, and 15% fat
Body Type

0 **Endomorph:**
  0 Increased conditioning

0 **Mesomorph:**
  0 Mix of Strength and Conditioning
  0 With age must increase anaerobic conditioning for body fat percentage maintenance

0 **Ectomorph:**
  0 Increased Strength and Volume Training
Postural Patterns in Hockey Players

Lower Cross Syndrome: Vladimir Janda
Postural Patterns in Hockey Players

**Anterior Pelvic Tilt**
Upper Cross Syndrome: Vladimir Janda
Injury Prevention

Rehabilitation of Common Hockey Injuries:

0 **Hip flexor/groin strains / Hockey hernia’s**

0 **Shoulder:** separation and dislocations can be related to scapular stability.
   - These injuries occur from direct contact of the shoulder with another player, the boards, or the ice

0 **Lower Back:** due to the flexed (forward) posture of skating

0 **Knee Injuries:** The medial collateral ligament is most susceptible to a sprain
   - Pushing off the inside edge of the skate blade—and contact to the outside of the knee.
Mobility

0 **Warm up protocol: Dynamic**
  - heart rate + blood/oxygen to muscles
  - activate dormant muscles
  - Sport specific muscle tension (hip flexors, hamstrings, adductors)
  - **Static**: detrimental effect on explosive movements and strength output

0 **Stretching**: post game (static)

0 **Foam Rolling**: pre/post game
Recovery:

Nutrition/Supplements

0 **Pre game**: meal, hydration

0 **Post-game**: protein, electrolyte drinks (90 mins)

0 **Supplements**:
  - creatine
  - protein powder vs. branched chain amino acids
  - pre workout supplements
Case Study: Mike Weaver

0 NHL Defenseman, Florida Panthers
0 12 year NHL experience, 36 years of age
0 176cm - 85kg
0 Bilateral shoulder injuries in past, right MCL injury during 2012-13 season
0 Average 23 minutes on ice, penalty kill specialist
Case Study: Mike Weaver

Assessment:

0 **Fitness:**

  0 **Strengths:** conditioning, heart rate control, lower body endurance, core strength and endurance

  0 **Deficiencies:** lower and upper body strength, speed

0 **Biomechanical:**

  0 Poor shoulder range of motion due to previous injuries, weak upper body posture

  0 Anterior pelvic tilt
Case Study: Mike Weaver

Strength and Conditioning Program (Off-season)

0 3x/week, 75 minute sessions
0 All workouts begin with dynamic warm up and end with static stretching and foam rolling

0 Day 1: Lower Body Strength and Core: 5 rounds
   0 Single leg exercise: Rear foot elevated Split Squat + Single Leg Deadlift 6-8x / side
      0 Paired with Box Jump 8x
   0 Plank with 20kg on back 1 minute
   0 Side Plank with feet elevated 1 minute/side
   0 Belly Press hold 20 seconds/side x 5
Case Study: Mike Weaver

0 Day 2: Upper Body Strength and Speed work: 4 rounds
  0 Sled Sprints 40m x 5 with 45 seconds rest between
  0 Weighted Pull Ups 8-10x - 4 sets
  0 Swiss ball Chest Press 6-8x – 4 sets
    0 Paired with: Medicine Chest Pass + Sprint 20x

0 Day 3: Lower Body Strength and Conditioning: 4 rounds
  0 Single Leg Exercise: Glute bridge + Step Ups 6-8x/side
  0 Plyometrics: Weighted Split Squat Jumps: 10x/side
  0 1 minute hill run on treadmill, 30 second rest x 5
Day 3: Lower Body Strength

Exercises

1 Legged Glute Bridge

Step Ups
Case Study: Mike Weaver

0 Active Off – days: 2x
  0 Postural correction via rehabilitation exercises and yoga

0 Rest Off – days: 2x
Summary: 3 C’s

- COMPREHENSIVE
- CUSTOMIZED
- COMPLIMENTARY