CONTINUING EDUCATION REQUIREMENTS

Course Title:

# INTRODUCTION TO TRAINING THEORY PRINCIPLES 1

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CER Topic Area:
SPORT SCIENCES

CER Course Number:
SCI 204

*This course is presented by the*
**PROFESSIONAL SKATERS ASSOCIATION**

# COURSE INTRODUCTION

## Notice:

By signing on to take the course/exam, you certify that you are the person signing on and personally completing this course/exam. False statements made by anyone taking this course/exam may result in disciplinary action, up to and including, expulsion from the PSA both for the person taking the course/exam and the person listed as the taker of the course/exam. Successful completion of this course/exam is worth 1 credit towards the U.S. Figure Skating Continuing Education Requirement (CERs).

## Course Objective:

Upon completion of CER SCI 204, The coach will be aware and informed about key training theory principles to consider in a seasonal plan appropriate to skaters learning to compete. The course will assist coaches in understanding training programs by describing exercise physiology and biomechanical principles to accommodate individual skater characteristics and figure skating demands; understanding a safe and effective conditioning program; incorporating rest and recovery strategies into training practice.

## Course Outline:

**Part 1: Physiological Demands in Figure Skating**
- Athleticism
- Metabolic Demands

**Part 2: Alignment and Movement Mechanics**
- Foot
- Knee
- Hip
- Shoulders & Head
- Trunk and Shin Alignment

**Part 3: Stability, Strength, and Power**
- Foundational Strength

**Part 4: Volume Loading Considerations**
- Training Volume
- Training Load
- Monotony
- Strain

**Part 5: The Role of Recovery**
- Recovery
- Active recovery

**Part 6: Conclusion**

# PART 1: Physiological Demands in Figure Skating

To be a good skater it requires the "balance of a tightrope walker, the endurance of a marathon runner, the aggressiveness of a football player, the agility of a wrestler, the nerves of a golfer, the flexibility of a gymnast and the grace of a ballet dancer" (Provost-Craig & Pitsos,1997). This quote by Johnny Heater made at the U.S. Figure Skating championships sums up the underlying components which make up figure skating.

The remarkable thing about figure skating is that to the spectator, it looks completely effortless. The skater appears to float over the ice, launching into multi-rotational jumps with the greatest of ease. Pairs, ice dancers and synchronized skaters lift their partners and teammates over the heads, sometimes with only the balance of a singular hand and perform graceful positions with poise and balance. At the end of a 4-minute program, their strength and endurance often look just as strong as when they first began. However, what the spectator does not see is the massive physiological demands the athlete is undertaking to execute and perform such skills.

Figure skating blends the demands of a middle-distance track runner with the athletic and flexibility requirements of an Olympic level gymnast. In order to execute the demands of the sport, figure skaters require all of the following:

| Athleticism | |
|---|---|
| **Agility, Balance & Coordination** | The nature of the sport of figure skating requires the athlete to maintain balance, often on a single blade, while changing directions, accelerating, jumping, spinning, and constantly changing their center of gravity. Coordination is critical for connecting all parts of the body to achieve technical moves, and to emote choreography. Elements often happen in 100ths of a second and proprioceptive awareness is essential to be proficient in movement. Proprioception being defined as the body's awareness in space. |
| **Strength & Power** | The basis for skating skills such as jumping, spinning, and skating with excellent acceleration and sustained speed. Having appropriate muscular strength and power can help improve explosiveness of jumping, control body stability and improve skating quality. |
| **Flexibility:** | Many basic skating positions require a minimal amount of flexibility to complete. Positions such as sit spins, lunges, spirals, split jumps, lifts, etc. require flexibility along with stability, strength, and power to execute. |

## Metabolic Demands

Skaters train 1-2 different programs that range from 2-4 minutes in length (dependent on skill level). During the program, the skater is often at a maximum heart rate and Vo2 max, dependent on both the aerobic and anaerobic energy systems. Metabolic demands, and cardiovascular fitness focus on the cardiovascular and pulmonary systems working efficiently by training different energy systems within the body. The energy systems used can be broken down into the following:

| Energy System | Duration | Type of Activity |
|---|---|---|
| **Anaerobic- ATP-PCr (Alactic)** | 6-10 seconds | Very high intensity, short duration without the use of oxygen; active at the onset of all activity |
| **Anaerobic Glycolysis** | 10-90 seconds | High-intensity, short-to-moderate duration activities without the use of oxygen |
| **Aerobic – Oxidative Phosphorylation** | >90 seconds | Low-to-moderate intensity, long duration |

The **Aerobic system**/oxidative system uses oxygen to deliver energy to working muscles in exercise bouts that last longer than 90 seconds. The **Anaerobic system** depends on phosphocreatine and glucose to deliver energy in high intensity bouts under 90 seconds. When an athlete is well conditioned, they are able to fight fatigue for a longer period of time, thus delaying the onset of lactic acid in the muscles which can be a contributing factor in missing key elements such as jumps, centered spins, steps, etc. When an athlete is well trained anaerobically the body is more tolerant of lactic acid that builds up in the muscle fibers during intense exercise. An example of the breakdown of energy systems used in a in a senior free skate program:

- **Anaerobic-ATP-CP 5%**
- **Anaerobic Glycolysis- 30%**
- **Aerobic- 65%**

Monitoring an athlete's heart rate can be a resource/tool in developing cardiorespiratory fitness for the athlete. An athlete's maximum heart rate can be identified with the following equation:

**Max HR = 220 – athletes chronological age**

**Heart Rate zones** are then identified to show the level of intensity of the training session.

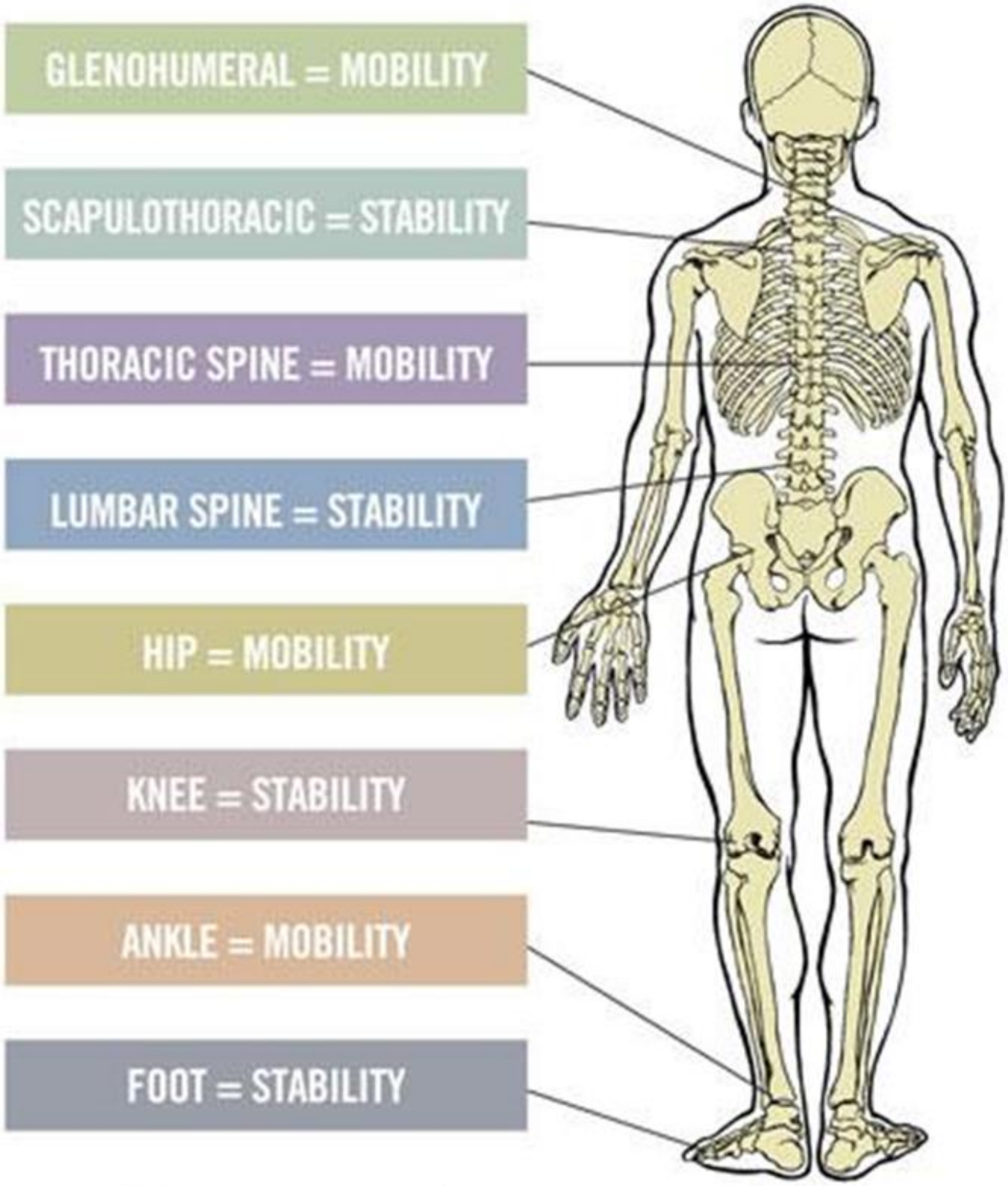
| Zone | Percentage of Heart Rate Max | Intensity |
|---|---|---|
| Zone 1 | 50-60% | Very light |
| Zone 2 | 60-70% | Light |
| Zone 3 | 70-80% | Moderate |
| Zone 4 | 80-90% | Hard |
| Zone 5 | 90-100% | Maximum |

While the majority of the skater's on-ice training day will be spent in zones 1-3 the skater will reach peak HR zone during program run throughs, which accounts for a fraction of their overall training time. Interval training and lactic stacking can be beneficial in metabolic development for a skater as they prepare for their competitive season.

## Musculoskeletal Needs

Understanding the musculoskeletal needs can benefit the skater to build a solid foundation that will better prepare them for the increasing demands of on-ice skills and increase resilience to injury. Musculoskeletal needs may be identified through assessments and clinical evaluations that address movements patterns, mechanics, strength, and stability.

Maintaining mobility and stability up the kinetic chain is important to prevent injury and compensatory movement patterns. The limited mobility of a skating boot, along with the constant anterior pelvic tilt during on-ice training can create tightness, imbalance, and compensations. Addressing mobility and stability needs is essential for an off-ice program.




**Mobility and stability of the kinetic chain**

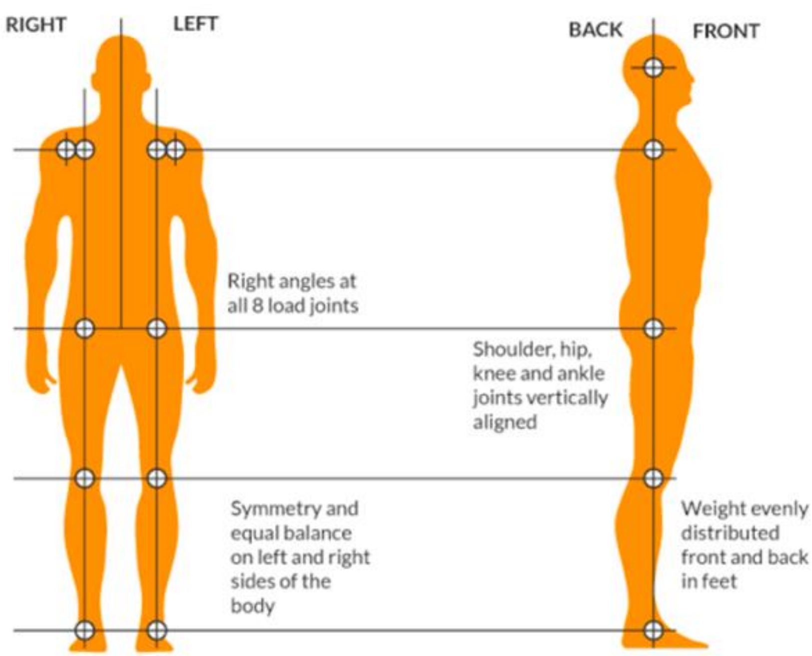
# PART 2: Alignment and Mechanics

When building a skyscraper several steps are taken prior to the construction and completion of the building. Starting first with an architect and a blueprint. The blueprint will take into consideration the needs for structural integrity. Next, the building must be built on a solid foundation. This involves putting a great deal of time and attention into the details from the ground up. Once the foundation is established the building is constructed meticulously to ensure everything is aligned so the building may withstand the test of time and external factors such as wind and extreme weather conditions. The same principles apply to the development of an athlete.

A plan is first set in place on the specific goals the athlete is striving for which creates the blueprint. Next the foundations of athleticism are put into place with precise alignment and mechanics to ensure that the athlete is physically able to withstand the increasing demands of the sport.

While this concept may sound a bit overwhelming when working with multiple athletes, the basic principles of alignment & mechanics can be simply broken down and applied to any athlete.

When the body is properly aligned, the joints and muscles will move more efficiently, thus creating greater potential to properly execute sport specific skills.
Alignment runs up the kinetic chain starting with the foot and leading up to the knee, hip, shoulder, and ear.



| Alignment | |
|---|---|
| **Foot** | The foot will support the rest of the body's positioning. While skaters are in their skates, their feet are wrapped up tightly while dynamically balancing on a quarter inch blade with an elevated heel. Identifying proper balance on the feet outside of the skate can help promote proper alignment. The alignment of the foot can be identified as a tripod where the weight is equally distributed on the big toe, little toe, and heel of the foot. |
| **Knee** | Keeping the center of the kneecap in alignment with the middle toe. When this alignment is off, and the knee collapses inward it can cause compensations in movement patterns that can lead to muscular inefficiency, imbalance, and increased risk of injury. |
| **Hip** | Maintaining the hip in a neutral position can be compared to 'keeping water in a bucket' Imagine the hip is a bucket of water, filled to the brim, when the hip is neutral the water is level. When the hip tilts forward (known as anterior pelvic tilt) the water will spill out. This can be caused by tightness in the front of the hips and extension of the lower back. The water can also tip out to the side when the hip is dropped or to the back when the hips are pushed forward. |
| **Shoulders & Head** | Proper alignment is defined as keeping the shoulders stacked over the hips and the ears lined up over the shoulders. This can be found challenging in today's world as so many of us are rounding our shoulders (tightening the front of the chest and weakening the back of the shoulders) while looking at cell phones and computer screens. |
| **Trunk & Shin Alignment** | Maintaining parallel angels during movement patterns with the trunk (straight line from the shoulder to the hip) and the shins (from the knee to the ankle) |

While using proper alignment, the athlete is then able to translate this to basic movement mechanics such as:

1. Squat
2. Lunge
3. Hinge
4. Brace
5. Push
6. Pull
7. Step up/Step down
8. Jump/Land

Development of these mechanics in an off-ice setting with proper alignment will contribute to the development of on-ice skills.

Examples include the following: Single leg squat for a sit-spin, hinging for a spiral, pushing a partner in an overhead lift, pulling a free-leg overhead in a spin position, bracing to check a landing position, etc.

# PART 3: Stability, Strength, and Power

A training program will progress in nature with each attribute supporting the next training phase.

**Alignment supports Mechanics**
**Mechanics support Stability**
**Stability supports Strength**
**Strength supports Power**

Once the alignment and mechanics are in place, the athlete will train stability and a strength foundation. This type of training allows the body to progressively build tolerance to perform high intensity loading in the next phase, including on-ice training. Stability is defined as the ability of the surrounding soft tissue to support a joint through a range of motion. When stability is compromised, movement patterns may be compensated. Strength, the ability to generate or produce force, can be broken down into different training approaches such as foundational strength, hypertrophy, maximum strength, strength endurance and explosive strength.

## Foundational Strength

Foundational strength begins with using the body as resistance often through the basic movement patterns listed in the preceding paragraph. Implementing stability and foundational strength training early in the off-season will prepare the athlete for higher intensity loading that will support further strength development and power.

Strength gains do not necessarily mean an increase in muscle size, known as hypertrophy. Sometimes people will refer to the change in muscle size as ‘bulk.’ The misconception that strength training will result in ‘getting bulky’ will make some athletes more apprehensive to participate in strength training.

Strength training can result in neuromuscular strength gains, where the muscles actually get ‘smarter’ without changing in size. These neuromuscular gains allow for greater force production. The take-away here is that increased strength will support the development of power and speed.

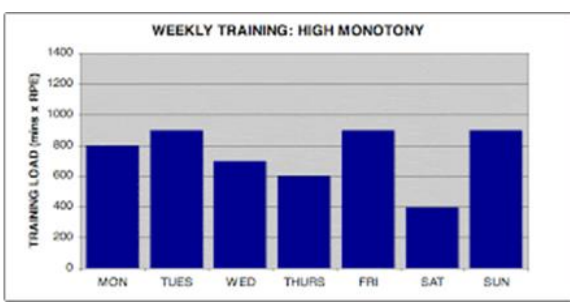
- Power being referred to as the ability to exert muscular strength quickly.
- Speed can be defined as the rate at which someone moves.

Both power and speed are continual components of on-ice and off-ice development. Strength will promote the development of both power and speed. Creating an off-ice training plan that has meaningful progressions to address foundational strength, relative strength and speed strength will produce more meaningful results and adaptations. Off-ice training plans and implementing stability, strength and power are topics for other courses.

# PART 4: Training Load Considerations

As a coach you understand the physiological, musculoskeletal, and metabolic needs of the skater. There is also the need to teach proper alignment, and movement patterns to establish an athletic base, along with teaching a system of on-ice skills. How do all these needs systematically organize themselves into a skater's training program? This often comes with questions such as "How often?" and "At what intensity?"

| | Training |
|---|---|
| **Training Volume** | Will be referred to as the total amount of training. This includes total number of sessions (on-ice sessions & off-ice), jumps/throws/lifts, and total training time. |
| **Training Load** | Is a measure of volume + intensity. This may be measured either subjectively such as feelings of effort or objectively with metrics such as monitoring heart rate, jump counts, or tonnage of lifts in the weight room. When looking at a skater's weekly program there is also a level of Monotony. |
| **Monotony** | refers to the degree of variation of a skater's training. Monotony= Daily Training Load/Standard Deviation of Weekly Training Load |
| **Strain** | Refers to how hard the athlete is working based on their accumulation of work over-time. Strain= Weekly Training Load x Monotony |





The two charts illustrate an equal training load during a one-week period. Variations in the training load over the course of the week will ultimately affect the monotony and strain on the athlete. The example where the training load has less variations and higher monotony also results with much higher strain.

# PART 5: The Role of Recovery

## Recovery

Recovery is important to athletes both physiologically and psychologically. In the past 10-15 years there has been a significant increase in research examining both the effects of recovery on performance and potential mechanisms. What used to be viewed simply as 'rest' or 'stretching' after a training session or competition has evolved into several different approaches and techniques that increase the quality and rate of recovery.

Adequate recovery has been shown to result in restoration of physiological and psychological processes, so that the athlete can compete or train again at an appropriate level. The amount and type of recovery needed is dependent on the type of exercise performed and at what level of intensity. Simply stated, when the athlete trains under a level of stress, such as strength training, there is damage and micro-tearing to the muscle tissue. There may also be a build-up of lactic acid or other inflammatory particles in the muscles. Time is needed for the body to repair and recover.

Although you can't speed up the time, there are techniques to enhance recovery during that window of time. Once the body is adequately recovered the athlete is then able to undertake new training variables which ultimately leads to increased performance. Recovery techniques can be categorized as either passive or active. Passive recovery requires no movement at all, such as laying down or sleeping which allows the body time to rest: Examples of passive recovery include:

- Hot or cold plunge/bath
- Sleep
- Massage (with licensed sport massage therapist)
- Compression therapy (i.e., Normatec gear)
- Meditation
- Recovery nutrition/Hydration (with a licensed sport dietician)

## Active Recovery

Active recovery involves physical movement, which sometimes can be identified as low intensity exercise, but is done with the purpose to help the body recover from previous stress at a higher intensity. An active recovery has been reported to reduce the lactic acid buildup in muscles, increase blood flow to muscle tissues, remove metabolic waste from muscles and reduce muscle tears and pain. Active recovery techniques may include the following:

- Foam rolling/soft tissue mobility
- Walking/light jog/cycling/leisurely swimming
- Stretching- active cooldown

# PART 6: Conclusion

When planning for recovery, find the best combination that is practical, appropriate and suits the needs for the athlete. A great place to start when addressing recovery is to make sure that the athlete is getting adequate sleep. Sleep is incredibly important for both recovery as well as growth and development. When training is at a higher load and intensity, recovery techniques are even more critical to allow the athlete to meet the demands of their training schedule. Another key role to recovery is that of hydration, nutrition as well as emotional and mental recovery.