

# Testing and Training in Competitive Snow Sports: Purposes and Components

## **PART I: The Purposes of Testing and Training**

The fundamental purpose of T&T is explicitly identified as "**winning**", achieving optimal performance when it matters most. However, this ultimate goal is achieved through two interlinked pillars: **performance enhancement** and **health protection**. These are not competing priorities; they are mutually reinforcing foundations. Health is the basic requirement for performance, only a healthy athlete can deliver their full capabilities.

### *Performance Enhancement*

Performance-oriented T&T improves the athlete's physical, technical, and tactical capabilities through several mechanisms. **Physical capacity and fitness**, particularly aerobic fitness, enables better recovery and more high-quality training runs. **Skill acquisition** moves athletes from fundamental to complex sport-specific tasks, with technical improvements enhancing both outcomes and safety. **Mental and psychological factors** are equally important, with testing data motivating athletes when communicated effectively, and coping strategies contributing to optimal competitive mindset.

### *Health Protection and Resilience*

T&T functions as a protective mechanism enabling sustainable high performance. **Injury prevention** involves identifying modifiable risk factors: asymmetries, weaknesses, movement dysfunctions; and "closing the gap" between an athlete's physical ability and the peak forces they face. **Building resilience** occurs through gradual, monitored exposure to stressors that induce adaptation; the "training-injury prevention paradox" suggests that smart training acts as a "vaccine" against injuries.

### *The Purpose of Testing: Data-Driven Decisions*

Testing is not an end in itself, it is a tool to inform programming. **Results must inform action**. Testing serves to: identify deficits requiring correction; monitor response to training loads and adaptation trends; establish baselines critical for return-to-sport decisions; and educate athletes during assessment sessions. T&T also cultivates appropriate mindsets, particularly in youth, helping athletes manage stress, set goals, and navigate external pressures while developing risk management skills and personal responsibility.



## **PART II: The Components of Testing and Training**

The T&T components (the "What?") are the essential areas that must be addressed in athlete preparation. Because **no single parameter determines performance** in snow sports, T&T must be comprehensive, spanning off-snow to on-snow activities across five domains: Physical Skills, Motor Skills, Mental Skills, Sports Technique and Tactics, and Health Assessment.

### ***Physical Skills***

Physical skills represent the foundational "hardware" of the athlete: **strength, endurance, speed, coordination, agility, and mobility**. Strengthening the lower extremities, core, and neck is critical for both performance and injury prevention. Sufficient mobility, particularly in the thoracic spine, hip, and ankle, ensures athletes can assume necessary positions on snow. Aerobic fitness enables better recovery and more high-quality runs. Coordination training targets the ability to "decouple" body segments, as snow sports require motor commands to one segment to compensate for forces from another. Youth athletes emphasise general skills and technique-oriented strength training; elite testing includes loaded power tests, isokinetic analysis, and VO<sub>2</sub> max assessment.

### ***Motor Skills***

Motor skills represent the "software": the ability to utilise physical capacity efficiently and safely. Key domains include **balance, neuromuscular control, movement quality, and sport-specific activities**. Neuromuscular training improves knee joint stability, decreases harmful loading, and enhances landing quality. Movement quality and symmetry are paramount; athletes should strive for lower limb symmetry assessed through single-leg squats, drop jumps, and cutting tasks. Motor skills are acquired through diverse environments; off-snow dryland training builds foundations, while freestyle athletes acquire aerial skills in safe environments (trampolines, airbags) before progressing to snow.

### ***Mental Skills***

Mental skills are **just as important as physical aspects** for optimal performance, encompassing cognitive skills, emotional competence, and mental health. Cognitive abilities (attention, perception, memory, action planning) are critical given constantly changing snow conditions. Emotional competence involves developing coping mechanisms for sport-specific and life stressors, including fear of injury. The goal is Mental Preparedness: optimal sport-specific mental

performance characterised by trust, self-confidence, and "Day X" readiness. Training methods include visualisation, self-talk, and flow state education. Mental health screening using validated tools (SMHAT-1, SMHRT-1) should occur throughout the season, as depression and anxiety increase injury risk.

### ***Sports Technique and Tactics***

Technical and tactical components bridge raw physical potential and competition performance. Technique concerns **biomechanical efficiency and symmetry**, achieving proper turning (left and right with minimal lateral differences) and superior dynamic postural control. Alpine athletes focus on rotatory movements, edging, and pressure control; freestyle athletes emphasise aerial skills and landing technique. Tactics concern **situational adaptability**, possessing the technique to adapt to constantly changing conditions (ice, soft snow, ruts). T&T must also develop evaluation, decision-making, and risk management skills, including "fall behaviour reflexes". Learning to fall safely reduces injury severity.

### ***Health Assessment***

A thorough **Periodic Health Evaluation (PHE)** is required to determine the athlete's state of health and inform actions. PHE should minimally include medical history and physical examination, and may include cardiac screening, blood analyses, and screening for neuromuscular/functional deficits. Eye tests for visual clarity and contrast vision are highly recommended given vision's crucial role in snow sports. Mental health screening using validated tools identifies symptoms early, as detection and treatment may decrease injury risk.

### ***Integrating Off-Snow and On-Snow Training***

T&T must span **off-snow to on-snow environments**. Off-snow training builds raw physical and mental capacity. The philosophy is to create "a well-trained athlete" first who then becomes a skilled skier. On-snow training translates potential into technical execution under real conditions. Transfer requires intentional coordination between coaches and athlete education, while the link between gym work and on-snow performance may be obvious to coaches, it is "not so obvious to the athlete."

Effective T&T addresses both the "why" and the "what" as an integrated system. The purposes: performance enhancement, health protection, resilience building, data-driven decision-making, and mindset cultivation, are achieved through systematic attention to the components

(physical skills, motor skills, mental skills, technique and tactics, and health assessment). When these purposes and components work together in a **continuous, cyclic process** spanning off-snow and on-snow environments, athletes build the comprehensive preparation that competitive snow sports demand, pursuing excellence while protecting long-term health and career longevity.



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