Considerations of training load in relation to loading and unloading phases of training

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Overview

This white paper can be used by coaches, performance support team members and organisations in the national high performance sport system as a resource to guide conversations relating to holistic approaches to well-periodised and individualised training load planning following unloading. In 2015, the first version of this white paper was published as part of a multi-disciplinary project including the AIS Disciplines of Medicine, Strength and Conditioning, Sports Nutrition, Physiology, and Physical Therapies. Version 2 has been developed in consultation with representatives from the National Institute Network and National Sporting Organisations with input from experts in the wider professional sport and university sectors.

Background

Sports performance is multifactorial in nature with exercise training, recovery, heath, nutrition, psychological skills and skill acquisition as key factors in athletic preparation.[1] Systematic training prepares the athlete for the demands of their sport such that physical abilities and sport specific skills are enhanced.[1] Well-planned training loads promote structural and metabolic adaptations that underpin training outcomes such as improved physical performance, injury and illness resistance, and optimised mental and physical health. Rest or 'unloading' may be defined as a substantial decrease in training load from the normal. A decrease in training load can be absolute (no training) or relative (as percentage drop from normal load e.g. 30%). Long periods of absolute rest cause a detraining effect and a reduced physical capacity.[2]

Mathematical modelling and retrospective data analysis have assisted coaches, sports science and sports medicine personnel to better understand the training dose-response relationship in elite Australian athletes. Key findings support previous anecdotal evidence:

- Effectively planning load and monitoring the individual training response can enhance training exposure and improve performance.[1]
- Consistent training availability increases an athlete's capacity to perform in both team and individual sports.[3]
- There is an increased risk of illness and/or injury when reloading after a planned, or unplanned period of unloading if the volume,[4] intensity and frequency of training are accelerated quicker than the athletes ability to adapt to the training stress.
- The time required to return to a full training load is proportionate to the length of the reduced workloads and the amount of training completed during the unloading period.[2]

It should also be noted that key findings do not preclude athletes from periods of relative or complete rest. Rather, it highlights that in line with the principle of progressive overload, it will take longer for an athlete to return to the previous level of training if they have a period of reduced training load. Moreover, at an individual level in a real-world setting, it is important to understand the context of loading and unloading of training for each sport and athlete. Unfortunately, there are no hard and fast rules, or formula that can accurately prescribe training or predict a performance outcome due to the vast variability in attributes of individual athletes. Therefore, it is the aim of this document to highlight factors that should be considered when an athlete is returning to training from either a planned or unplanned break, tapering, or returning from illness and/or injury.

Key considerations in developing return to training strategies

1. Interdisciplinary planning of strategies

Planning and periodisation identifies how key training variables impacting on the acquisition and maintenance of optimal physical standards are integrated with periods of planned rest as an athlete works towards their performance goals. Effective planning can be enhanced by an interdisciplinary approach that is led by the coach of the program with collaboration from the performance support team (including but not limited to Physiology, Medicine, Strength and Conditioning, Physiotherapy, Nutrition, Psychology, Biomechanics, Skill Acquisition and Athlete Wellbeing and Engagement and other relevant practitioners). Using the collective expertise and experience of the coach, athlete and performance support team members, the following considerations can be made including (but not limited) to:

Understand the athlete and their readiness to train

Training history and environment

- ☐ What is the training, biological and chronological age of the athlete?
- ☐ What is their long term and recent training history?
- ☐ How has the athlete previously coped with the expected load and reloading process?
- ☐ What was their typical fatigue and recovery response to training dose and how may recent reductions in training alter these usual responses?
- ☐ What specific physiological/structural capacities were maintained during unloading and which may have diminished?
- ☐ Was their training environment accessible in this period?
- ☐ Are they able to train individually or with team members?

Health and nutrition factors

- ☐ What is their current mental and physical health?
- ☐ Are there any relevant historical injuries or illnesses which may influence their response to training?
- ☐ Is the athlete periodising dietary intake to reflect variable training loads and nutrition related goals?

Current physical, technical, tactical and cognitive skill level

- ☐ What is their current physical, technical, tactical and mental skill level?
- ☐ What are their current strengths and weaknesses?

Context and individual factors

- ☐ What contextual factors are important to them? (Key competition dates, whole of life considerations such as work or study, etc.)
- ☐ What are their belief systems regarding their own training capacities and response to periods of unloading?
- ☐ Which behavioural traits and patterns are typical of the athlete when in return to training, training and competition phases?
- ☐ Are there any non-sport demands on the athlete – school/work/relationships/finance/family – that may influence planning and their response to training?

Understand the load

- ☐ What is the external load considered by coaches and performance support team members required to achieve performance and what internal load this might be expected to induce?
- ☐ How will training dose be measured? How will the response be monitored (e.g. wellbeing, physiological metrics)?
- ☐ Are there specific aspects of their regular loading that present higher risk than others (e.g. total running distance versus high speed running/sprinting distances)?
- ☐ How well is the athlete adapting to training?
- ☐ Any specific provocative loads or progressions to be considered from an injury perspective?

Understand the training needed for a successful performance

- ☐ What are the specific physical standards and training load required for the sport? How does the athlete currently compare to these?
- ☐ Does the athlete have any identified deficiencies which require appropriate training strategies to address?
- ☐ What level/phase of training do they need to return to (e.g. base phase, competition preparation)?

2. Considering the many forms of loading when training

Training load is multifactorial in nature with elements of the session placing physical, physiological, technical, tactical and cognitive stress on the athlete. It is important to understand not only the overall load placed upon an athlete, but how the load will stress each specific physical, structural and/or psychological system – combined with an understanding of what type of load the athlete has recently completed. Particularly during re-loading as non-sport specific exercise completed during a period of unloading may not adequately prepare an athlete to be able to tolerate sport-specific loads. For example, a swimmer returning from a post-season break may have maintained a 40% training load through non-sport specific activities (e.g. cycling on a stationary ergo) without completing any sport specific movements (such as swimming itself). Likewise, when hockey players return to training, not only should the frequency, duration and velocity of high-speed running be carefully considered, but also changes of directions (angle, planned and unplanned) when returning to previous loads. This is of importance when

athletes are returning to sport specific movements with a higher injury burden (i.e. the egg-beater kick for water polo players), or a change in environment (i.e. running on trails compared to on track) that may add additional stress to the athlete. A clear return to both the overall training load and a sport specific training plan should be developed, implemented and monitored to mitigate the likelihood of injury and/or illness and to optimise performance.

From an injury viewpoint when reloading, the stress on connective tissues including bone, tendon and the myo-tendinous junction needs to be carefully managed. Factors to be considered include:

- Athletes who have a previous injury are commonly injured again to the same or different body area.[5 6]
- Athletes who eventually achieve training loads in a well-controlled manner which prepare them to meet the demands of the sport during rehabilitation are less likely to sustain a subsequent injury on return to play and improve their readiness to train.[7]

Appropriate measures of training load should be used, comprising of (where possible) both internal and external load variables, as well as sport-specific loads (e.g. high-speed running distance, number of throws, etc.), to ensure performance is maximised through safe reloading practices.

3. Understanding and monitoring the individual training response

Understanding the athlete's psychophysiological and musculoskeletal response to the training is important. As the athlete's response to an external training load is variable and is based on the interaction of numerous factors that drive adaptation and recovery (e.g. sleep, psychological state, nutrition, life stressors).[8] Additionally, athletes can tolerate different 're-loading' training loads depending on their genetic pre-dispositions and previous training history. Regular review of athlete reported validated subjective questionnaires[9] (e.g. Acute/Short Recovery Stress Scales,[10] or Health Problems Questions (OSTRC-H))[11] and other training response measures[12 13] (e.g. neuromuscular function, heart rate measures, submaximal fitness testing) can facilitate a deeper understanding of the acute individual athlete recovery/fatigue response and health status. Moreover, the integral role of coach observation and expertise in understanding athlete performance has been highlighted.[14] It is important that programming and load management decisions are responsive to this collective information from the athlete, coach and selected objective measures. Lastly, where monitoring of internal and/or external loads are not possible or feasible, monitoring of the response may still provide value to decision-making processes. This knowledge can then help implement a 'criterion-based' and iterative progression and/or modification of training load relative to their response and health status in line with the overall objectives of the periodised plan (see Figure 1).

Summary and conclusion

A coach-led collaborative effort between all team members supporting the athlete is recommended to ensure that progression of load following an unloading period is appropriately planned and contextualised with their individual responses to training. This approach captures the multifactorial nature of the training-dose relationship and promotes a safe return to the training loads required for optimal performance.

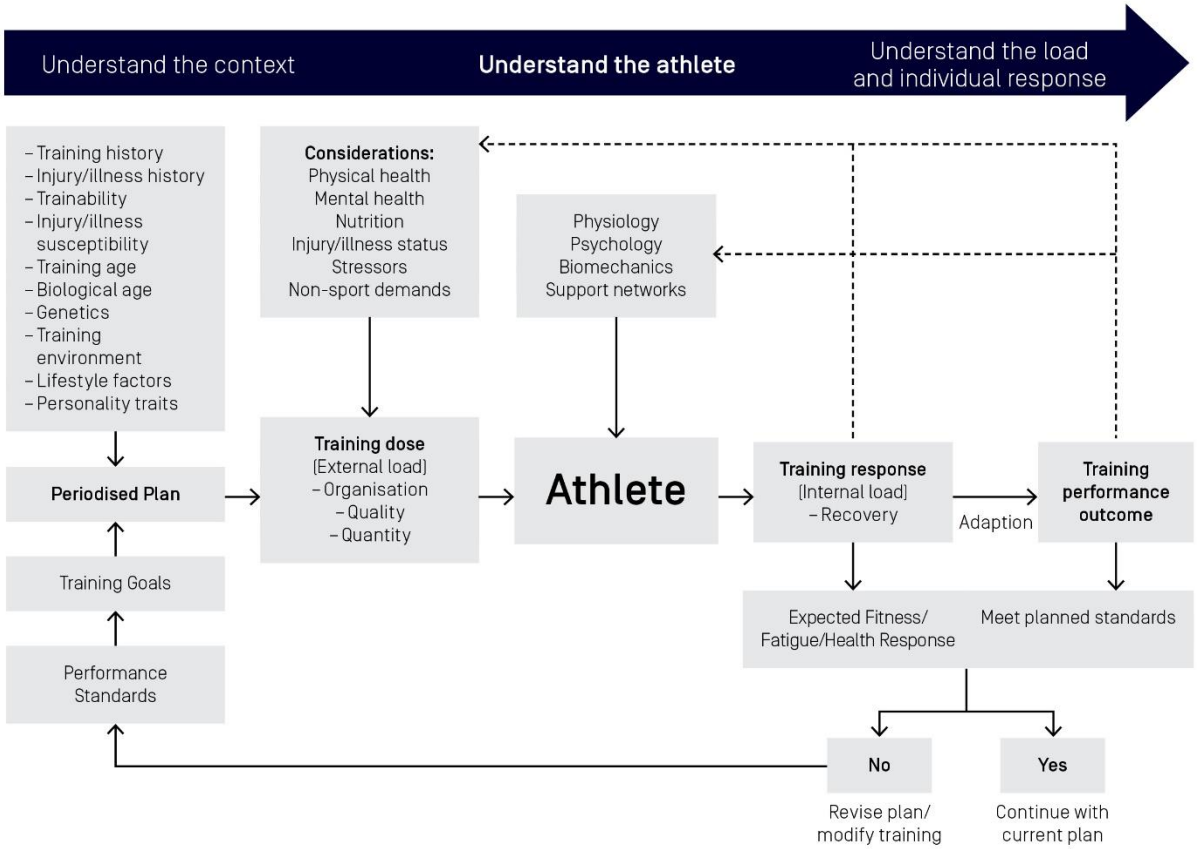

Figure One: Individual characteristics, training dose, performance and planning considerations of training load in relation to loading and unloading phases of training

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