CRITICALLY EXAMINING THE GENERIC NEED TO MANIPULATE TRAINING DOSAGES IN ORDER TO ACHIEVE PERFORMANCE OBJECTIVES WHILST MINIMALISING ASSOCIATED NEGATIVE CONSEQUENCES

BY

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Dick (1989) defines fitness as "the successful adaptation to the stressors of one's lifestyle," yet distinguishes between that and training by stating that, "training provides the athlete with the basic means to adapt to his/her particular stressors through controlled exercise." The main difference between the two is the extent of control and prescription of exercise. Yet there are certain components that are indicative of both; for example, Dick (1989) expresses the notion that the "principles of training which apply in designing fitness programmes apply equally to elite performers as to recreational performers," irrespective of the sport. Indeed it is the interpretation of the individual's needs, incorporating his physiological, technical and psychological variables encompassing the aspects of trainability and actual fitness objective, that establishes the type, intensity and duration of his training.

Gandelsman and Smirnov (1970) divided sports up into seven groups, depending upon their physiological and skill similarities and the need to attain a specific level of performance. Using these criteria, rugby union needs to concentrate on perfecting the strength and speed of a skill performed in a competitive contact environment. Training design would, therefore, need to encompass these aspects, together with the differing positional requirements of each player, if peaking is to be realistic and attainable.

Whilst there are a number of physiological and technical elements that all players can benefit from, the individual needs of a prop forward are considerably different from those of a full back. The prop would need to develop his strength, power and technique within a scrum situation to enable him to withstand the huge forces that are created whilst, at the same time, applying pressure on the opposing player. The full back, however would need to work on acceleration, speed and lines of run so as to be effective when coming into the line of attack.

In fact, the essence of training in rugby union is for the player in whatever position to be able to sustain high levels of skill at high speed over the full eighty minutes of play - and sometimes beyond that when 'added-on' time and/or extra time is part of the equation.

For elite performers, this must focus on the goal of periodization and the optimisation of training through the manipulisation of short and long-term cycles, training components, and training thresholds. It is the progressive adaptation of these and the avoidance of negative aspects within training that enable an athlete to 'peak' for competition in pursuit of a legal competitive advantage.

Generalised Theory of Training.

The extent of an athlete's "total dynamic physiological state" (Hazeldine, 1991), where the element of control is manifest in the pursuit of peak performance, shall depend entirely upon training structure, progressive adaptation and understanding of psychological factors. Dick (1989) outlines the rudiments of structure by stating that:

> *"Training programmes must be planned to meet the stressors of the athlete's lifestyle and chosen sport as well as the athlete's capacity to adapt to these demands. A programme of training may then be planned to improve that capacity, where adaptation is the raising of the athlete's functional capacity due to external loading, with there being a relationship between loading and adaptation, but only where loading is systematic and progressive*."

To establish a systematic approach would be to introduce the method of periodization considered by Bompa (1999) as "the process of varying a training programme at regular intervals to bring about optimal gains in physical performance." This programme is, however, dependent upon the performance objective and may be structured around just one competitive season, such as single periodization or double periodization which has the fundamental difference of having a second season with "a greater potential for an increase in annual performance" (Matveyev, 1966). The Matveyev ideology of periodization was based around the concept "that the competition year be divided into three in order to enhance the basic objectives of training." It is these training objectives that characterise the periodization cycle thus: "the organisation of a training schedule is aimed at peaking the athlete at a specified time/race in a competition period." (Dick, 1989)

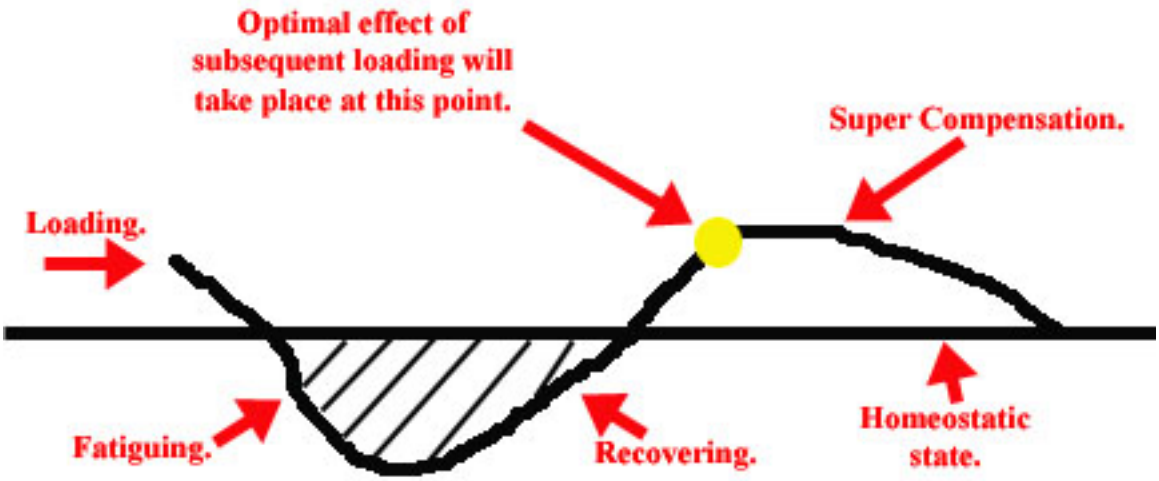
For adaptation to take place within the periodised cycle, it is necessary to enforce the first and second laws of training, those of overload and specificity. For any overload, "it is necessary to provide a progressive heightening of the stressor to oblige the body to seek a high status of adaptation," and also, where "adaptation is specific to a stressor, the affect of a stressor is specific to the individual athlete." (Dick, 1989)

The training effect and rate of adaptation are characterised by the microcycles within the periodised unit. They dictate the load, extent and density of the training unit, which will need to be manipulated to stress the body to a greater extent as progressive adaptation takes place, unless preparation for a major competition is needed when training loads will be reduced.

From individual training units, through to microcycles and macrocycles, the individual training effects are crucial to the athlete and "loading must challenge the athlete's present status." (Dick, 1984)

The immediate responses to these stressors highlight the athlete's short-term responses to the loading and enable the coach to monitor performance. The body reacts to these loads during the second phase, where the residual effect during recovery suggests that progress is being made as the body adjusts to repair the damage and bring about a homeostatic environment. The body adapts to the stressors and prepares for the stimuli to be progressed; this is super compensation, (Yakovlev, 1967, Figure 1.)

Figure 1. Super Compensation Curve (from Yakovlev).



For progressive overload to occur, subsequent loading needs to take place at the peak of the super compensation cycle. This is where training has its optimal adaptive effect, considered by Matveyev (1966) as "not so easily apparent in mature athletes as in young ones." Loading at any other time in the cycle would cause less than optimal adaptation, the exception being endurance training where "loading is to be introduced following incomplete recovery." (Dick, 1984.)

For Yakovlev's super compensation curve to have optimal effect, sufficient recovery must take place between repetitions and sets (Intra Units), and from one training unit to the next (Inter Unit). In fact, loading and recovery should be seen as one whole process where there might be an alternating hard/easy training structure. Similarly, if fatigue is too great then of course recovery will take considerably longer. It is, therefore, important to ensure that each training unit is complemented by active recovery where regeneration can take place.

A further training objective would be to change the training units from day to day whilst also maintaining a routine where variety uses different areas of the body and, as Craig (1973) suggests, "protect the athlete from overuse injuries." Time off during the transition period (Inter Micro/Macro cycle) should allow for full physiological and psychological recovery through the gentle reduction in loading or the active participation in a range of activities.

The Relationship between Components of Training and Principles of Development.
Of all the training laws, overload is the fundamental feature of physiological development. There is a need to manipulate the training variables within a micro cycle, to reflect the

performance objective and to establish the thresholds at which the athlete must work in order to adapt progressively and attain optimal performance.

On overload, Bompa (1999) interprets intensity as “the qualitative element of training” and Dick (1984) sees it as the “strength of a stimulus or concentration of work executed per unit of time” in an attempt to maximise training benefits.

For a training unit to be established, the strength of the stimulus must be decided upon. The percentage maximum of this stimulus will greatly affect the extent and density of the exercise. It will impact upon the number of repetitions, or “work intervals within one set” (Bompa, 1999), and the number of sets that can be completed at that intensity or resistance. However, the athlete must perform sufficient repetitions to guarantee the training effect. The proportion of rest-to-work intervals, their length as well as the sequence of muscle usage and muscle actions, will also determine the suitability of the training unit. This will only be made possible through the strict, yet accurate, prescription of exercises and their loads.

Percentage extent of loading or intensity must be above a certain threshold before adaptation takes place and it must be recorded throughout the training cycle in order to establish a pattern. “Progressions of loading in pursuit of progression of performance improvement” (Dick,1989) would also be identified, thus allowing loads to be increased by establishing a higher intensity, a greater extent and an increase in both the duration and density of the exercise.

Typical guidelines for athletes’ work rate would be (1) the percentage of their maximal heart rate pertaining to a specific target heart rate or (2) to complete a number of repetitions in relation to one repetition maximum. Likewise, the Galvanic skin response, percentage VO2 max, Borgs RPE and range of heart rate (resting – maximum) can also be indicators of intensity, but it is to be remembered that these are very specific to the type of activity undertaken - as Carl (1967) suggests with his “spheres of intensity.”

Physiologists have suggested levels of intensity that are required before adaptation takes place. For example, Karvonen (1957) states, “Training at 60% of the athlete’s range of heart rate is required in order to increase maximum oxygen uptake,” and that, “at least 30 minutes of a stimulus are required at a given intensity for significant improvements in aerobic endurance to occur,” where the extent of a training programme or training session is indicative of the outcome. For example, Dick (1984) identifies “that a minimum of two minutes duration at a relatively high intensity are required for adaptation to occur in an athlete’s acid-base imbalance.”

A session which emphasises high intensity effort equalling or approaching that required in competition, ‘Tempolauf’ (a training approach used to emphasise high intensity effort equalling or approaching that required in competition to accustom the athlete to the tempo or pace of that competition) must enable the athlete to remain focussed and motivated whilst recognising the benefits of his actual performance mirroring his optimal performance. Beyond this, training effect can be lost. Another feature would be ‘frequency’, the number of times per week that the training is undertaken, because, for super compensation to occur, sufficient recovery from fatigue must take place.

Control and Negative Consequences.

For success to be implicit within a training programme, the coach must have a unique knowledge and understanding of the principles associated with training structure and an awareness of appropriate stressors, ratios and regeneration periods necessary for sustainable performance enhancement.

Peaking only occurs when the structure and organisation of training demands meet or occasionally surpass the working capacity of the athlete. Under these circumstances, individual training factors will demonstrate improvement (Bompa, 1994). Exposure to training at this intensity introduces fatigue, which under normal circumstances is removed within 12-24 hours.

The balance and variety of such sessions are vital, as are adequate active regeneration sessions, as accumulation of stressors overload the athlete and cause the syndrome of over stressing, “arising from a cumulative effect of many stressors” (Dick, 1989). Without sufficient recovery or regeneration to restore capacity, then the athlete’s performance will continue to deteriorate until the point where over-stressing causes progressive fatigue.

Fatigue induced during high intensity training schedules reduces the capacity of the neuromuscular and metabolic systems to continue working during physical activity. As a result, muscles fail to be stimulated due to the inhibition of nerve impulses. Coaches and athletes must not, therefore, introduce too high an intensity too soon within a training schedule, as too many stressors are being placed upon the body at one time. By overlooking the importance of alternating work and regeneration periods, coaches are exposing the athlete to high intensities when he is already fatigued.

During a long season within rugby union, in which the player might have been involved in club games, internationals and summer tours, stressful and taxing conditions accumulate within the body. As a result, injuries will become more frequent and the possibility of peaking will be greatly reduced. A fatigued athlete will not recover sufficiently to enable overcompensation to occur and, through the continual exposure to these high intensities, a state of exhaustion known as overtraining or burnout will occur, decreasing both work capacity and performance of the athlete. Care must, therefore, be taken to assess previous programmes before prescribing a new training regime.

When overtraining is identified, training must be stopped or reduced immediately, irrespective of the causes, and active regeneration periods must be introduced. Only once the athlete has overcome the fatigued syndrome should he then begin training at low intensities. In mild cases, training needs to be toned down, with all testing and competitive elements removed.

Coaches and athletes need to be educated to ensure a full understanding of training principles and the alternating of regeneration and work intervals. By employing suitable recovery techniques, it is possible to enhance an athlete’s ability to recover and, therefore, adapt physiologically. A feature of all training programmes should be the ability to alter the training programme in anticipation of overtraining.

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