Using Session-RPE to Monitor Training Load in Swimmers

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SUMMARY

THE ABILITY TO MEASURE AND CONTROL THE INTERNAL TRAINING LOAD (TL) OF ATHLETES IS IMPORTANT TO OPTIMIZE ATHLETIC PERFORMANCE. HOWEVER, AT PRESENT, THERE ARE NO METHODS AVAILABLE FOR EVALUATING INTERNAL TL DURING SWIMMING. THE SESSION-RPE METHOD IS A PRACTICAL, NONINVASIVE SYSTEM USED TO QUANTIFY THE INTERNAL TL PLACED ON ATHLETES. THIS ARTICLE DISCUSSES HOW THE SESSION-RPE METHOD MAY BE USED TO MONITOR SWIM TRAINING AND ULTIMATELY IMPROVE THE TRAINING PROCESS OF SWIMMERS.

INTRODUCTION

The ability for coaches to titrate increases in physical training loads (TLs) with appropriate recovery is of critical importance for optimizing athletic performance (18). However, despite increases in coach education and an increasing focus on well-designed, evidence-based training programs, there still remains a relatively high occurrence of injury, illness, and undesired competition outcomes in athletes (17). It has been widely recognized that accurate monitoring of TL may improve an athlete's preparation for competition. However, in sports such as swimming, few simple methods are available for coaches to monitor the physical TL of their competitive swimmers.

Many swim coaches rely on their previous experience, intuition, and perception of how hard an athlete is training when determining the amount of physical training that should be undertaken by each athlete. However, because of the complexity of interactions between the components that make up a swimming program (e.g., endurance, technique, speed, and strength), a coach's perception and intuition may not be the most reliable method for accurately monitoring physical TL. Therefore, the major difficulty lies in establishing the training stress imposed on the athlete by each component of the training program.

CURRENT METHODS

There are a variety of methods available to coaches for monitoring physical TL in athletes. Typically, the majority of coaches prescribe training programs in terms of an external TL. External TL is defined as the work completed by an athlete (i.e., distance swum) and is measured independently of their internal characteristics (i.e., their physiology). For example, in swimming, coaches often prescribe training based on distance and/or time (eg. 10 × 100 m at 1:40 min:s holding 1:05 min:s). However, it is the relative physiological stress imposed on the athlete (internal TL) and not the external TL completed by the athlete that determines the stimulus for training adaptation (19). An example of the same session using a measure of internal TL may read 10 × 100 m on 1:40 min:s holding ~90% HRmax. It is widely recognized that the physical stress imposed on an athlete during each session is related to both the volume and the intensity of the exercise bout. In swimming, it is difficult to accurately measure the stress imposed on a swimmer during training using traditional measures such as HR.

The most widely accepted methods for evaluating internal training intensity in endurance athletes uses heart rate (HR) as a measure of exercise intensity (1,7,13,16). However, using HR to measure exercise intensity in swimming has several limitations. For example, the HR response is a relatively poor method for evaluating intensity during high-intensity exercise such as weight, interval, and plyometric training (9). These types of high-intensity training sessions are common in a typical swim program. In addition, we have found that the likelihood of technical failure when using traditional HR monitoring methods in an aquatic environment is increased. Because of these limitations, we suggest that there is a need for an alternative method that is simple, valid, and reliable for quantifying training loads in swimmers.

KEY WORDS:
periodization; swimming; monitoring training; quantifying training; aquatic exercise

THE SESSION-RPE METHOD

The session-RPE method is a simple system for monitoring internal TL in athletes. This system requires athletes to subjectively rate the intensity of the entire training session using a rating of perceived exertion (RPE) according to the category ratio scale (CR 10-scale) of Borg et al. (2) (Table 1). After each training bout, the athlete is asked a simple question, such as "How hard was your workout?" The athlete then indicates the intensity of the training session by referring to a numerical value according to the RPE scale. This intensity value is then multiplied by the total duration (minutes) of the training session to create a single measure of internal TL in arbitrary units. To ensure the athletes report a global RPE for the entire training session, the RPE is taken 30 minutes after the completion of the session. We have presented an example of how to calculate internal TL using this method in Table 2.

Previous authors have used psychometric tools such as RPE and the Profile of Mood States to monitor training in swimmers (10–12). However, to our knowledge, no authors have used the session-RPE method to quantify TL in swimmers. A major advantage of quantifying training load using session-RPE compared with other reported methods is that it is simple and relatively easy to interpret. Furthermore, studies have shown session-RPE to compare favorably with more complicated methods of quantifying training load in endurance (9), team sports (4,12), and resistance-trained athletes (5). On the basis of the collective research, it appears session-RPE may provide a suitable method for evaluating internal TL in swimming; however, at present, there are few data available to support this suggestion.

Table 1
The 10-point rating of perceived exertion scale (2)

Rating	Description
0	Rest
1	Very, very easy
2	Easy
3	Moderate
4	Somewhat hard
5	Hard
6	
7	Very hard
8	
9	
10	Maximal

Table 2
Example of calculating internal training load with session-RPE

Internal TL = session-RPE × duration (minutes)
If an athlete indicated that an exercise bout lasting 60 minutes was hard (RPE = 5) the internal TL for that session could be determined using the following calculation
Internal TL = 5 × 60 = 300 AU

AU = arbitrary units; RPE = rate of perceived exertion; TL = training loads.

Recently, we examined the usefulness of using session-RPE for quantifying internal TL in swimmers during a 4-month training period (20). During this study, more than 160 individual swim training sessions were examined. We found a significant correlation between session-RPE and commonly used heart rate methods (e.g., Banister's TRIMP [r = 0.74 ± 0.15], Edward's TRIMP [$r = 0.75 \pm 0.15$], and the LT Zone method [$r = 0.77 \pm 0.13$]) ($p < 0.01$) for quantifying internal TL (7,13,16). However, the correlations between session-RPE and HR-based methods were slightly lower than those reported in previous investigations in endurance-based athletes ($r = 0.75–0.90$) (8).

These findings may be attributed to differences in training methods undertaken by competitive swimmers. For example, a large percentage of swim training is prescribed by coaches in the form of interval-based workouts. Interval training has been associated with an increased reliance on anaerobic energy contribution compared with steady-state exercise (6). Therefore, because HR have previously been shown to be poorly related to high-intensity exercise, this may explain the reduced strength between the HR and RPE methods observed in this study. Our results also showed that session-RPE to be only moderately related to distance measures for quantifying physical TL ($r = 0.65 \pm 0.20$, $p < 0.01$). This result was somewhat expected, because distance measures taken independently do not take into account the total stress of exercise. For example, it would be far less stressful for a swimmer to perform 10 × 100 m at an aerobic intensity than it would for the same swimmer to perform 10 × 100 m at maximal intensity.

We have also recently investigated the ability for the athletes to perform each training session at the load intended by the coach (20). This was achieved by comparing the coaches estimated duration and RPE measures after each exercise bout with the values reported by the athletes. Our findings reveal significant differences in the athlete's subjective measures of training intensity compared with coach estimations ($p < 0.003$). Interestingly, the athletes tended to report greater intensities during sessions designed to be easy (RPE ≤ 2) and reduced intensities during sessions designed to be hard (RPE ≥ 5). These results demonstrate a lack of communication between athletes and coach and a poor control of training variables placing athletes at an increased risk of maladaptive training. This observation provided important feedback to the coach that was then used to modify the training practices of their swimmers (i.e., closer

attention was paid to providing appropriate motivation and instructions to their swimmers during training sessions).

PRACTICAL APPLICATIONS

To achieve successful swimming performances, athletes must complete periods of intense physical training interspersed with appropriate recovery periods. Typically, a swimming program involves a combination of interval training, steady-state training, and dry-land training. Previously, it has been difficult to quantify the internal training stress from the variety of training modalities and compare them on a common scale. Fortunately, the session-RPE method provides a simple, noninvasive method for quantifying and comparing internal TL in a wide range of exercise conditions. We have listed below the advantages of implementing session-RPE for quantifying physical TL in swimmers.

SUMMATING TRAINING COMPONENTS TO CALCULATE OVERALL INTERNAL TL

A typical swimming program consists of a variety of different exercise stimulus (e.g., steady-state, interval, and dry-land training). The session-RPE system allows coaches to evaluate and compare the training stress imposed on individual athletes during each component of the training program. Figure 1 demonstrates how individual components of a typical swim program can easily be summated to show the effects of each component on the total internal TL.

DETERMINING WHETHER ATHLETES PERFORM TLs PRESCRIBED BY THE COACH

Our findings, supported by other research (10), show that athletes frequently undertake training sessions at an intensity that is different to the intensity prescribed by the coach. It appears athletes often train too hard during recovery sessions, which inhibits their ability to obtain the desired intensity during more difficult training sessions. The session-RPE method may provide coaches with a method for monitoring the intensity of each training session, ensuring increased intensity during high-intensity workouts coupled with improved recovery periods. Figure 2 shows a graphical representation of the pitfalls associated with athlete training intensity compared with the intensity prescribed by the coach.

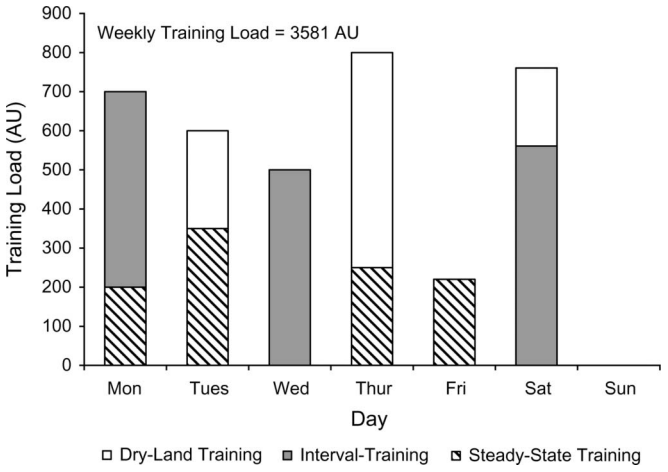

Figure 1. Summating training components to show overall internal TL.

IMPROVING PERIODIZATION STRATEGIES

A decrease in the day-to-day variability in training load (i.e., alternated hard-day, easy-day training) may increase the incidence of illness in athletes (8) and have a negative impact on performance (3). For example, Bruin et al. (3) observed reduced running performance in race horses where "easy" days were increased in a program that combined easy and hard training days. At present, there are few studies to support these findings; however, it does appear that a decrease in day-to-day training variability, together with an increase in overall training load, may contribute to negative training effects in athletes.

The session-RPE training monitoring system provides a simple method for quantifying the training dose of each exercise bout. This information can easily be graphed with a spreadsheet software program (e.g., Microsoft Excel) or through specific on-line training diaries (e.g., www.trainingload.com) to ensure appropriate day-to-day variability between training sessions is met. An example of how this can be done is shown in Figure 3, which shows how session-RPE can be used to improve

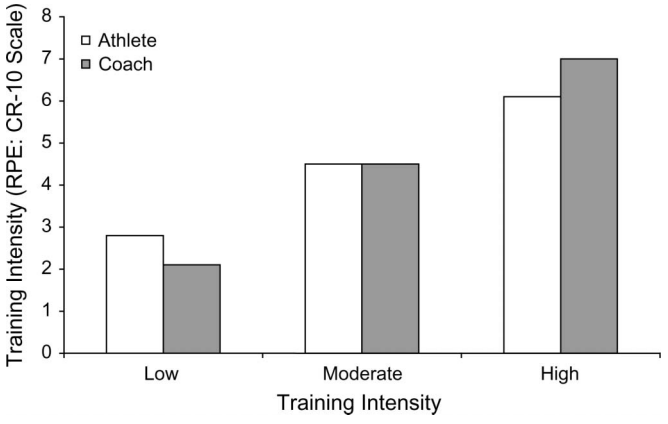

Figure 2. A graphical representation of the mismatch in training intensity which may occur between athlete and coach.

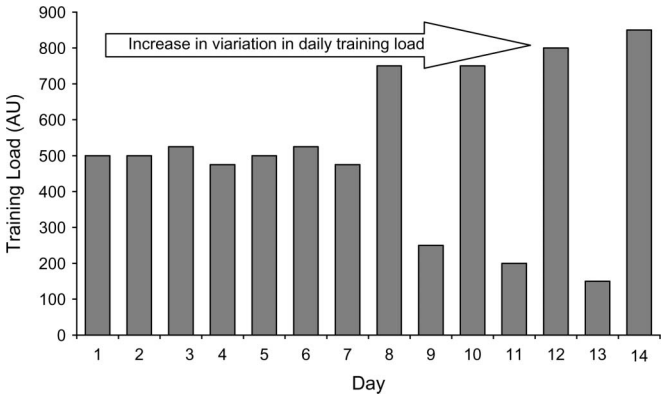

Figure 3. Example of how training loads can be modified to improve the variation in day-to-day training load.

training load placement with no change in overall training load between the first and last 7 days.

MONITORING INDIVIDUAL TRAINING LOADS

The ability for athletes to adapt to increasing training loads is largely an individual process (19). Inappropriate increases in training load with inadequate recovery have previously been linked to increases in the incidence of illness (10) and with a negative impact on performance (3). Swimming training usually is completed in a squad environment in which similar training stimulus is prescribed to a group of individuals. Therefore, for a given exercise bout, some athletes would perceive the workout to be more stressful than others placing them at an increased risk of maladaptive training. Session-RPE allows coaches to closely monitor the internal TL of each athlete and more clearly identify athletes who are coping or not coping to the set external training loads.

MONITORING TRAINING LOADS AFTER A BREAK FROM REGULAR TRAINING

Often athletes will ignore the effects of reduced fitness and strength after a prolonged break from regular training. The session-RPE training monitoring system allows coaches to prescribe appropriate loads and avoid the negative effects of returning to regular training loads too rapidly.

SUMMARY

To obtain optimal performance in competitive swimming, athletes must undertake periods of heavy training loads interspersed with appropriate recovery periods. Unfortunately, until now, swim coaches have not been able to accurately measure the internal TL undertaken by their swimmers. The session-RPE training monitoring system may be a useful tool for swimming coaches to monitor internal TL in athletes. This method can be used to provide coaches and athletes with instant feedback regarding the internal training stress imposed on an athlete from each exercise bout. This information can then be used to improve periodization strategies, improve session execution and ultimately improve swimming performance.

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