<u>CompassSport Series - Fitness for Orienteering</u>

<u>Tapering: A Best Practice Review</u>

This series of articles is covering a range of topics within the field of strength and conditioning, with the aim of helping to develop the orienteer's physical conditioning, irrespective of age or ability. In this issue, we focus on the practice of tapering…

An area of fitness development that has received a growing level of interest from the sport science community in recent years is that of 'tapering'. Most individuals are aware of the need to reduce their training in some fashion prior to an event, particularly if it is regarded as of high importance to them, eg. British Championships, so that they feel fresh and ready for the race, but they may be unaware of exactly how to go about this in an optimal manner. The purpose of tapering is to reduce the physical and mental fatigue felt from training, so that the orienteer feels in a relatively 'recovered' state, but not reduce their training by such a degree that it begins to have a detrimental effect on their performance. It is a delicate balancing act, particularly for the elite athlete, and one that often requires many years of fine tuning to arrive at what is often a complex mix of science and art.

Physiological Adaptations

In terms of performance improvements, research has reported gains ranging from 3-11% (Houmard et al., 1994; Mujika et al., 2004; Zarkadas et al., 1994), following a period of tapering in endurance runners and triathletes, and this change appears to be down to a combination of physiological factors.

Mujika et al. (2004) reviewed 13 studies in this area and found that for tapers of 14 days or fewer there were significant improvements (~6%) in maximal oxygen uptake ($\dot{V}O_2$ max) and running economy (~8%) and this appears to come from an enhancement in haematological parameters, such as increases in haemoglobin and hematocrit improving the oxygen transport capacity of the blood (Yamamoto & Mutoh, 1988). Peak blood lactate is also increased during tapering (Jeukendrup et al., 1992; Mujika et al., 2000), which may be due to an increase in muscle glycogen of around 8-15% (Houmard & Johns, 1994; Shepley et al., 1992) or an increase in glycolytic enzyme activity (Neary et al., 1992). This has the effect of preventing fatigue, particularly during high-end performance, as witnessed in sprint races and when an orienteer puts in bursts of speed or effort, such as in hill climbing.

Sport-specific muscle power increases are often greater than any improvements in aerobic mechanisms and are reported by Johns et al. (1992) to account for most of the taper induced improvements in race performance. Physiological adaptations appear to come from increases in strength, speed of contraction, and power of both fast and slow twitch muscle fibres (Neary et al., 2003; Trappe et al., 2000; Trinity et al., 2006) and are reported as being the result of increased neuromuscular efficiency (Raglin et al., 1996) or changes in contractile mechanisms (Costill, et al. 1985), both of which could also contribute to improvements in running economy. Finally, research has also shown a 24% and 14.2% increase in type IIa fibre cross-sectional area in swimmers (Trappe et al., 2000) and cyclists (Neary et al., 1992), respectively, as training stress is reduced during the taper. There is thus a substantial body of evidence that tapering will result in positive benefits for any orienteer's physical performance, but the question now is how to practically design a taper that will optimise these gains.

Designing a Taper

This is potentially a complex procedure for any athlete to get right and it is often only through the result of many years of trial and error that an orienteer will arrive at what they feel is the best way of tapering for them. It is hoped that, by providing guidelines here based on the latest research, that this lengthy and difficult process can be shortcut.

The overriding factor, dictating the need for a taper and the benefits resulting from this, will be the competitive level of the orienteer and their weekly training volume. Not every orienteer will necessarily benefit from a taper, with those engaged in less than four hours a week of training probably not requiring a 'true' taper. Here 'fatigue is unlikely to accumulate from week to week and these runners can usually take a day or two off immediately before a race and be sufficiently recovered to race at their best.' (McNeely & Sandler, 2007). Research to support this statement exists in studies where participants, training 240 minutes per week, gradually reduced their training volume, intensity or frequency and no resulting changes in exercise performance or maximum oxygen uptake values were recorded (Brynteson & Sinning, 1973; Hickson et al., 1985; Hickson et al., 1982; Hickson & Rosenkoetter, 1981).

For orienteers who are engaged in a training programme of above four hours a week, the first factor in designing their taper will be to consider their approach to their season and whether they follow a periodised plan at all. If so, then this will probably be built around important races and tapers can be used selectively around these events. Different coaches advocate various approaches to tapering in the year, but it is felt that no more than '1 major taper, 1-2 moderate tapers and 2-3 minor tapers' (McNeely & Sandler, 2007) is the most an orienteer should look to build into their annual periodised plan.

The load of a training programme can be reduced during a taper, whether it be classed as minor, moderate or major, through the manipulation of a number of variables, such as 'training intensity, volume, duration and frequency' (Wilson & Wilson, 2008). During the discussions around best practice which follow, these variables will be used as the basis for the tapers.

Minor Taper

Used before races which have less importance attached to them, the design of the taper will depend on normal training volume in this part of their periodised programme. Orienteers training 6-10 hours a week are advised to take 1 day completely off before the event; those training 10-15 hours per week should use a 3-day taper and those more than 15 hours a week adopt a 5-day taper. The key for those orienteers in the last two categories is to keep the frequency and intensity of training high, but reduce the load through keeping the duration of the training sessions short. A sample minor taper is shown in table 1 below.

Duration	Day 1	Day 2	Day3	Day 4	Day 5	Day 6
1 day	Rest	Race				
3 days	Rest	Warm up, 5x2mins at 90-95% HRmax, Warm down	Warm up, 3x1mins at 90-95% HRMax, Warm down	Race		
5 days	Warm up, 3x10mins at race pace, Warm down	30-40mins steady state	Warm up, 7x3mins at 90%HRmax, warm down	Warm up, 5x2mins at 90-95% HRmax, Warm down	Warm up, 3x1mins at 90-95% HRMax, Warm down	Race

Table 1. Sample minor taper for orienteers

Moderate Taper

Used for secondary races, where a good performance is the aim, but the orienteer is confident of being able to compete well without needing to be completely rested, such as for selection races. These can be used as a learning experience for the individual to see how they respond to the tapering practice and whether modifications need to be made in the future. It is recommended to keep a diary during the taper of objective and subjective data on physical and mental parameters, such as feelings of recovery, muscle soreness, heart rate and general mood, to help with the design of upcoming tapers. Orienteers training 6-10 hours a week should use 3-5 days for tapering; those training 10-15 hours per week would adopt a 7-10 day taper and finally those on more than 15 hours training a week will use a 10-14 day taper. The design of the taper should follow the recommendations made below on the major taper, in terms of the frequency, intensity and volume of training.

Major Taper

Used only once a year and prior to the most important competition, eg. WOC, it is obviously vital that the orienteer gets this one absolutely spot on! Research by Mujika et al. (1996) has focussed on the optimum time duration for the major taper and found that 21 and 28 day tapers produced significant performance improvements, but not when this was extended to 42 days. Other research (Costill et al., 1985; Houmard et al., 1994; Shepley et al., 1992) confirms that major tapers of between 7-21 days result in improved physical performance. Mathematical modelling has also established that the duration of optimal taper should be in the range of 12-32 days (Morton et al., 1990), but has brought us no closer to understanding the exact duration required for athletes. The number of days required will be determined by, in all probability, 'the training volume and intensity leading up to the taper, as well as the fitness levels of the athlete' (McNeely & Sandler, 2007). In all likelihood, orienteers training 6-10 hours a week should use 7 days for tapering; those training 10-15 hours per week would adopt a 14 day taper and finally those on more than 15 hours training a week will use a 21-30 day taper. Let us consider the potential variables involved in this major taper now.

Volume

Research has indicated that training volume needs to be decreased by 60-90% during a major taper, with Houmard et al. (1990) and Houmard (1991) finding that 800m and 1600m running times were improved following a 70% reduction in training volume over a three week period. Increase in running economy values and a 3% improvement in 5km time trail performance has also been reported following a 7-day, 85% decrease in training volume (Houmard et al., 1994). Orienteers who are thus training between 6-10 hours a week should look to train for only around 3 hours during the week of tapering. The reduction in volume should be gradual and progressive during the taper period, as this has been demonstrated to have a more significant impact on performance than a rapid, single step reduction (Houmard, 1991). It is likely that a rapid taper can lead to detraining effects, particularly over an extended period of time seen in the longer tapers of 14 days or more. Table 2 below indicates the progressive taper model that orienteers should follow.

Training volume (hours/week)	Taper week 1 (% decrease)	Taper week 2 (% decrease)	Taper week 3 (% decrease)
6-10	60-75		
10-15	40-45	60-75	
15+	20-30	40-50	60-75

Table 2. Major taper: changes in volume

Frequency

It is important that the reduction in training volume is primarily the result of reducing the duration of each workout, rather than through decreasing the number of times that the orienteer trains per week during the major taper, particularly where the orienteer is engaged in training skill specific work, ie. running in terrain with a map (McNeely & Sandler, 2007). For those following a 10+ hours a week training schedule, maintaining a training frequency of 5-6 days per week during the taper allows the orienteer to retain the ‘feel’ of the cognitive aspects of the sport, but a reduction in the training duration per session will result in them becoming fresher, both physically and mentally, as the taper progresses.

Intensity

As the orienteer looks to reduce their training volume during the taper, the intensity of each session should increase. Shepley et al. (1992) compared low and high-intensity tapers and found that only the high-intensity taper resulted in increased performance, with improvements of 22% in running time to exhaustion and a 15% increase in muscle glycogen. Houmard and Johns (1994) also reported that training at an intensity of 70% $\dot{V}O_2$ max or less resulted in maintenance of performance, at best, and intensities of 90% $\dot{V}O_2$ max were required to see improvements.

The orienteer should gradually reduce the amount of steady-state work and replace this with short, sharp sessions, made up primarily of interval reps at 90-95% max. This will have the physiological effect of maintaining the efficiency of the biochemical processes and neural mechanisms involved in running, but the reduced volume will ensure that no significant musculo-skeletal fatigue is accumulated, which could have a detrimental effect on performance. These ‘race pace’ workouts give not only a physiological but also a psychological benefit to the orienteer, with McNeely and Sandler (2007) reporting that athletes have feelings of ‘speed, power and confidence that they can take with them into race day.’ Orienteers should try to conduct these sessions in terrain, particularly that similar to the race environment, to fine tune both the physical and cognitive aspects of their performance.

Table 3 below illustrates a sample final taper week for an orienteer who usually trains 10hr+ a week. Work:rest ratios should be around 1:1 to 1:2. Orienteers training between 6-10hrs a week can modify this taper by focussing on the interval sessions and reducing the overall amount of work done during the week.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
40 min at 70-80% HRmax	Warm up, 4x5min at 80-90% HR max, Warm down	Warm up, 5x4min at 80-90% HR max, Warm down	Rest or 20min at 60-70% HRmax	Warm up, 4-6x3min at 90-95% HRmax, Warm down	Warm up, 4x2min at 90-95% HRmax, Warm down	Race

Table 3. Example final week taper for an orienteer training at 10hr+ per week

Conclusion

This article has tried to give orienteers food for thought in the way that they prepare for races and it is important that each individual experiments with their approach, as what works for one individual may not for another. Some orienteers will respond well, both physically and mentally, to a taper and feel refreshed and energised. Others may struggle with a perception of reduced work and fret that they may be detraining, particularly during a long taper, and this psychological anxiety may offset any physiological benefits. Hopefully, through adopting a scientific approach and continually analysing and appraising their practice during tapering for competitions, the orienteer can arrive at a successful formula for consistent performance at major events.

Next issue we will take a deeper look at core training.

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