# The Breakdown on Taper

Now that we have grown our mitochondria and heart with endurance training, muscles and nerves with sprint training, and perfected our technique with motor learning...it's finally time to sharpen this Swimming Machine with TAPER!!

First things first: What is Taper? (Other than the most awesome time in a swimmer's life...) Taper is the time leading up to a big competition where athletes decrease their training, increase their rest and hope to ride their super compensating training adaptations to new personal best times.

Surrounding this time during the season, more myth than fact gets thrown around. And to be honest scientists don't fully understand all the changes that happen with taper. But regardless, a good taper (and a season of training) should result in about a 2-3% improvement in performance. Depending on the level of athlete, this can be an improvement from your best time, or from your season best time.

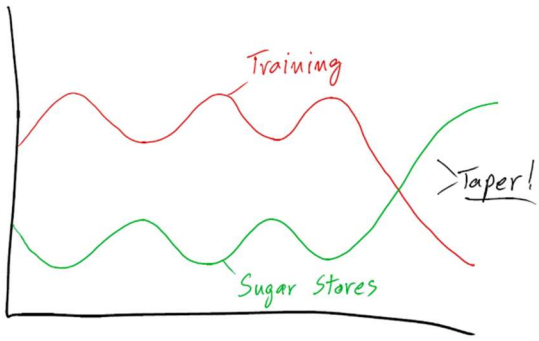
Let's take a look at Taper as if we were going through it right now and see if we can link up the changes we know are happening to how we feel in the water and in a race. We will also look at different types of Tapers to help explain what we do throughout the season

## Day by Day Changes During Taper

For months now, you have been putting in 1,000s of yards a day at high speed and have been feeling chronically run down, tired, dehydrated, and slow. But as Taper starts, the yardage is cut in half, coach is giving you extra rest between repeats and the number of workouts per week is quickly dropping.

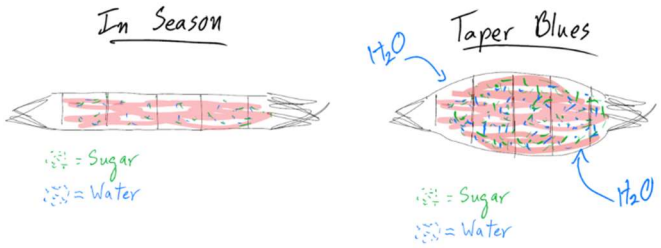
| In Season | Taper |
|---|---|
| - 9 workouts/week | - 5 workouts/week |
| - 6-8,000 yards/day | - 3000 yards/day |
| - Pace set: 20x100@2:00 Hold 60s | - Pace set: 5x100@2:30 Hold under 60s |

This sudden change is new to your Swimming Machine, and it thinks you are still training heavy. So it keeps trying to recover from heavy workouts even though Taper workouts are much lighter. This 'over-recovery' is what we are trying to achieve. And because different parts recover at different rates, Taper can be full of ups and downs and uncertainty. Let's pretend we are doing a two-week Taper and see what happens on a daily basis.



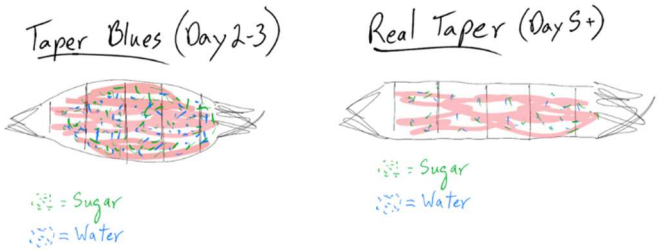

During workouts your muscles are using sugar for fuel, especially when doing fast stuff. This sugar is stored in the muscle cells themselves, but there is a limited amount that can be stored, it must be replaced after every workout which takes a solid 24-48 hours. Usually, workouts are so intense and frequent that the sugar stores (glycogen) in the muscle cells never reach maximum levels. But now that Taper has started and we are not burning nearly as much sugar with each workout, the levels rise much higher than usual, about 35% higher, even without carb-loading. This maxes out within the first two to three days.

By the third day of Taper, some people experience what has been called The Taper Blues. It happens more often with sprinters, guys and older swimmers. It feels like your whole body is contracting, stiff and even painful. Your swimming might take a serious dive and you feel like your technique is way off, your range of motion/flexibility is limited, and even easy swimming causes a lot of lactic acid to build up. It can be a very scary few days for swimmers and trick them into feeling they are not ready to race in a week. The question is why does this happen?! I thought Taper was supposed to be all good feelings.

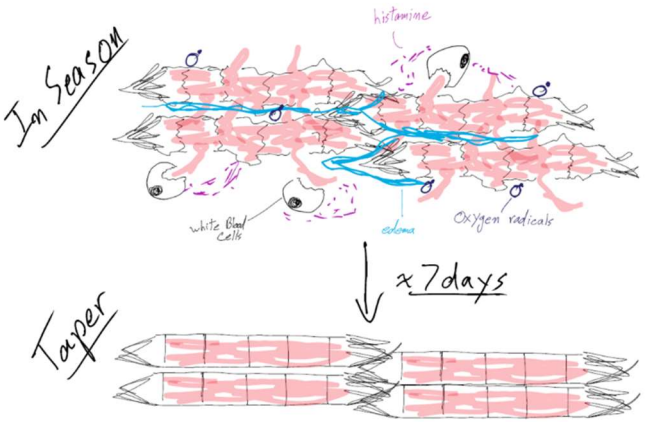



Here is what happens. All that extra sugar stored in your muscles comes with some baggage: water. Because sugar has a lot of oxygen molecules in it, that attracts water molecules to be stuck to the sugar. That's why sugar dissolves so well in water. For every gram of sugar you store, an extra three grams of water will be attached! That all takes space and adds weight to each muscle fiber and swimmers can see up to a 4lb weight gain when Taper starts. The result is a waterlogged, swollen muscle that all of a sudden has a lot of fuel available to burn. The swollen fibers don't stretch as well as they used to (the sugar burning/lactic acid producing engine) but run extra fast and create more power and lactic acid than your used to, making your stoke funky and painful, aka...the Taper Blues.

Your Swimming Machine has to get used to this abrupt change and needs to adapt all over again. But that's ok because we are still only a few days into Taper and have another week or so before racing starts. In a couple days, the muscles learn to deal with the extra sugar stored by re-modeling the connective tissue and muscle cell structure to give more room for the now swollen muscle fiber, brining back the flexibility and range of motion. That's when the real Taper begins! Unfortunately, it is unlikely that the extra sugar is helping us swim faster. Our races are too short (even the mile) for the extra sugar to make a difference. But the change happens anyway, and we need to be aware of some of the 'side-effects.'




At about day seven, most of the muscle damage that was occurring on a regular basis has healed. That muscle damage is caused by repetitive contractions (especially eccentric ones in dryland) and lactic acid overload. The cytoskeleton (internal structure) of the muscles and connective tissues outside the muscles fully heal during Taper, allowing more fibers to be used during swimming since they are now fixed, and your Swimming Machine doesn't feel as sore anymore. At the same time, enzymes that make up the hybrid engines (glycolysis and aerobic engines) fully adapt and your muscles are now producing the maximum amount of ATP (energy) they can. That means speeeed!



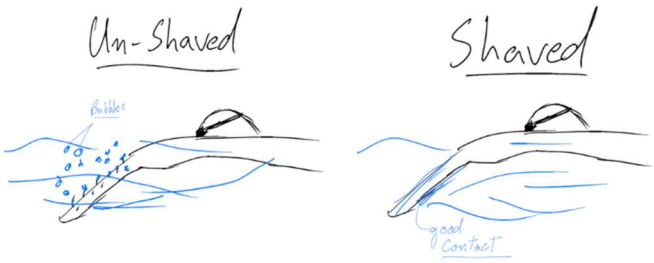

But wait, we are only on day seven. If all the molecular mechanics have recovered by now, why do we still not see maximum speeds and power hit until day 10 or even beyond? This is where our understanding of Taper starts to get fuzzy. Logically, seven to ten-days is about all your body needs to fully recover, but it seems there is more going on during the next seven days of Taper the keep changing to give us more speed and endurance. Here is a summary of some extra changes you can see in the second half of Taper:

1) Lactate levels decrease up to 13% at maximum speeds and decreases up to 30% at sub-maximum speeds. That means a better lactate threshold and easier swimming at fast-ish speeds.
2) VO2 and heart rate also go down when swimming at sub-maximum speeds which means your stroke efficiency is improved (and this was seen without shaving yet!)
3) At 14 days, overall swimming power increases 24%, slow fibers contract 37% faster and fast fibers contract 55% faster and with 114% more power (that's where our front-end speeds come in).
4) Blood volume and red blood cell mass increase as well, about 10% each. This is likely due to recovery from chronic dehydration and improved nutrition.

All of this results in a faster 'going out' speed and increased endurance with a longer 'time to exhaustion' during your race. Otherwise known as a perfect Taper. The unfortunate reality is that few swimmers ever hit their Taper perfectly, and this shows up in the research too. For instance, VO2max and buffering ability of the muscles apparently don't change during Taper. But this contradicts the finding that blood volume and red blood cell masses increase. The important thing to remember is that there is a lot of individual variability with how your Swimming Machine will respond to Taper, and that understanding what works best for you is all that matters.

Taper is almost over and we are reaching our final days. There is just one last thing to do to perfect this Taper: shaving down! By the numbers, shaving produces a measurable decrease in drag. In a 'push and glide' test, shaved swimmer's deceleration was reduced 12%, their distance per stroke increased 12%, and their stroke efficiency improved which translated to 9% lover VO2 and 20% lower lactate levels when swimming at sub-max speeds. In summary: drag was less.


Another physically noticeable advantage to shaving is your grip on the water. When you are racing and moving quickly past the water around you, it becomes more and more difficult to accelerate and push water behind you, especially if your have a lot of little bubbles stuck on the hair of your arms and legs as you swim, preventing good contact with the water. Removing that hair through shaving will help eliminate those bubbles, increase your skin's contact with the water at faster speeds and tempo, therefore it will allow you to increase your power. You brain also receives an endorphin rush when the water touches your newly unearthed nerve ending (shaving removes the top layer of dead skin cells to allow 'fresh' nerve endings to be exposed) which makes you feel super-human!

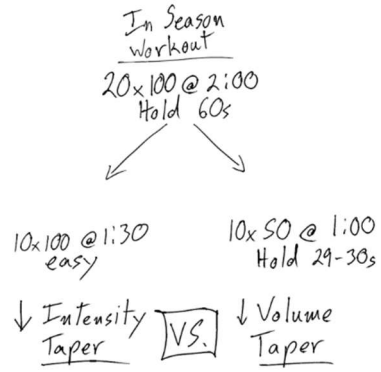



**Types of Taper: Minor, Major, Retaper**

Before we get into the different kinds of Taper for different meets during different times in the season, let's go over a well debated question.

In the past, there was big debate about how Taper should be done and whether athletes should reduce intensity or reduce their volume and maintain intensity during Taper. Another way to ask the question is: should sprints and pace work be done during Taper? Or should total rest be achieved by just swimming endurance and easy recovery sets for two weeks?

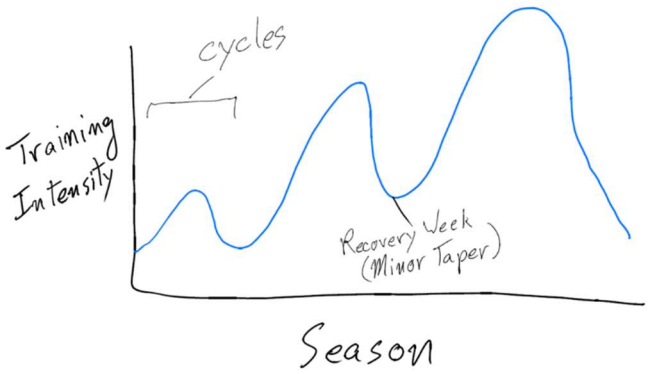
The answer came in a great experiment with two groups of swimmers and a control group. One group cut their volume by 65% and never performed any swimming faster than 60% of race pace (which is pretty easy swimming). The other group cut their volume by 90% but would swim race pace repeats daily. The number of repeats (100s) was reduced by one every day until they were finished.




Not only did the reduced intensity group show NO benefit in their Taper, it wasn't even better than the control group that just sat around for two weeks! They did not swim faster, they did not last longer in the race (despite maintaining volume) and their biological numbers were no different than the control group. The reduced volume (high intensity) group on the other hand showed great improvement, and in fact most of the numbers listed above come from this experiment and have been replicated and confirmed to be true.

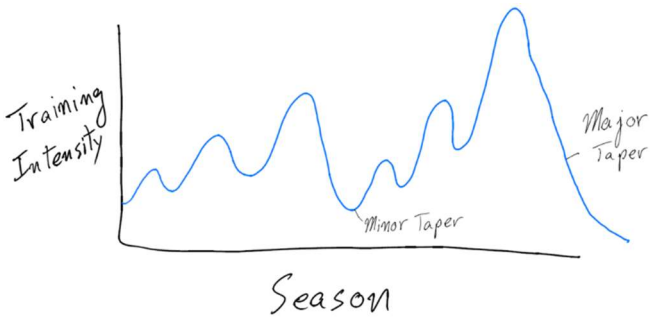
So we have our answer, we need to Taper with lower volumes, and maintain the same intensity. No matter how long Taper is, racing and pace work need to be included. It doesn't have to be a lot, about 15% of the total workout yardage, but it needs to be there...PERIOD!

Not every meet in the season needs a big two-week Taper. If we did that...we'd spend all our season in a perpetual Taper. Most teams will perform a mid-season Minor Taper (sometimes called a drop taper, but that's not technically accurate, we'll talk later), and an end of the season Major Taper. Let's talk about the Minor Taper first.

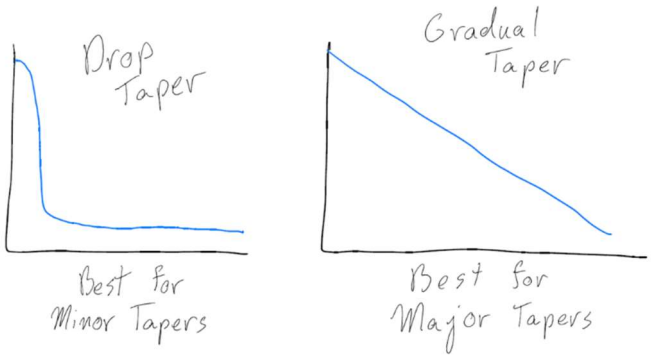



A Minor Taper is usually about 5-7 days long before a big-ish mid-season meet. If we follow our rough timeline from above, we can see that 5-7 days is enough to fully biologically recover: refuel the sugar storage, rehydrate and fix any broken muscles or connective tissue. Most coaches plan their season in cycles which include a week of lower than average yardage and intensity to promote recovery after a few hard weeks training. Minor Tapers are usually synced up with these 'recovery weeks.' This way, you can still maintain all the gains you've been working on and swim fast without blowing it all on a two-week Major Taper.

A Major Taper is usually 10-21 days long and leads up to the end of season championship meet. By the end of this Taper, the body has recovered and then re-learned how to swim with a fully functional and recovered Swimming Machine and creating efficient powerful stroke techniques. After this period, aerobic adaptations are not going to improve. In fact, they will quickly regress after the Taper and competition is complete if maintenance yardage is not performed. This 'window' period of full aerobic adaptation + full recovery is what we are after during a Major Taper.



How long does the window stay open? That depends on a few things. The window will stay open longer for swimmers who have spent more time training prior to Taper. Sprinters usually keep their window open longer than milers because they do not need the aerobic adaptations to do a single 50 or 100. The rule of thumb is that is takes two weeks to Taper, then the window is open for another two weeks.




Now what's with this Drop Taper thing? Drop Tapers are not Minor Tapers. A Drop Taper is where you suddenly drop the yardage within the first few days, and then maintain low yards throughout the Taper, no mater the length. Lately, more research is going into the 'gradual' Tapers, where the yards are dropped slowly over the course of the Taper. This has shown promise in being better than Drop Tapers. However, because Minor Tapers are so short, they are often referred to as Drop Tapers.

The final type of Taper is the Retaper, where you have to perform well in two end-of-season championship meets that are a few weeks apart. A classic example is the US Olympic Trials and the Olympic Games, which is four weeks later. Essentially, you Major Taper for the first meet (make sure you make it on the Olympic Team), recover for a couple days, then up your training again for a few days, and then re-Major Taper for the second meet (win Golds). Needless to say, this is not easily done well and requires an athlete who knows a lot about how their body feels and is going to feel in the next few days or weeks. Like everything else in our sport, practice makes perfect.

Before you go off resting for your next meet, a couple words on what NOT to do during Taper. Do not, under any circumstances, try doing something new. That means no 10 mile hike over the weekend, no new equipment, no new strokes you haven't already been practicing and most importantly no new dryland activities. Dryland as a whole is usually the first to go during Taper, which is reasonable. After all, we aren't racing on land. But it may be beneficial to treat your dryland training with the same Taper attitude as you do in swimming. Instead of cutting everything out, just greatly reduce what you are doing, but maintain the intensity. For instance, instead of doing 8 sets of box jumps at 36 inches, just do 2 sets at 24 inches for the first week, and then cut it out completely in the last week to give your Swimming Machine a chance to make full repairs. The exception is core work, which can continue as normal until about 5 day before the meet.

Now...go forth and dominate your championship meet!

References

*Taper - Super Compensating*. www.smartswimtoday.com. (July 9, 2019)