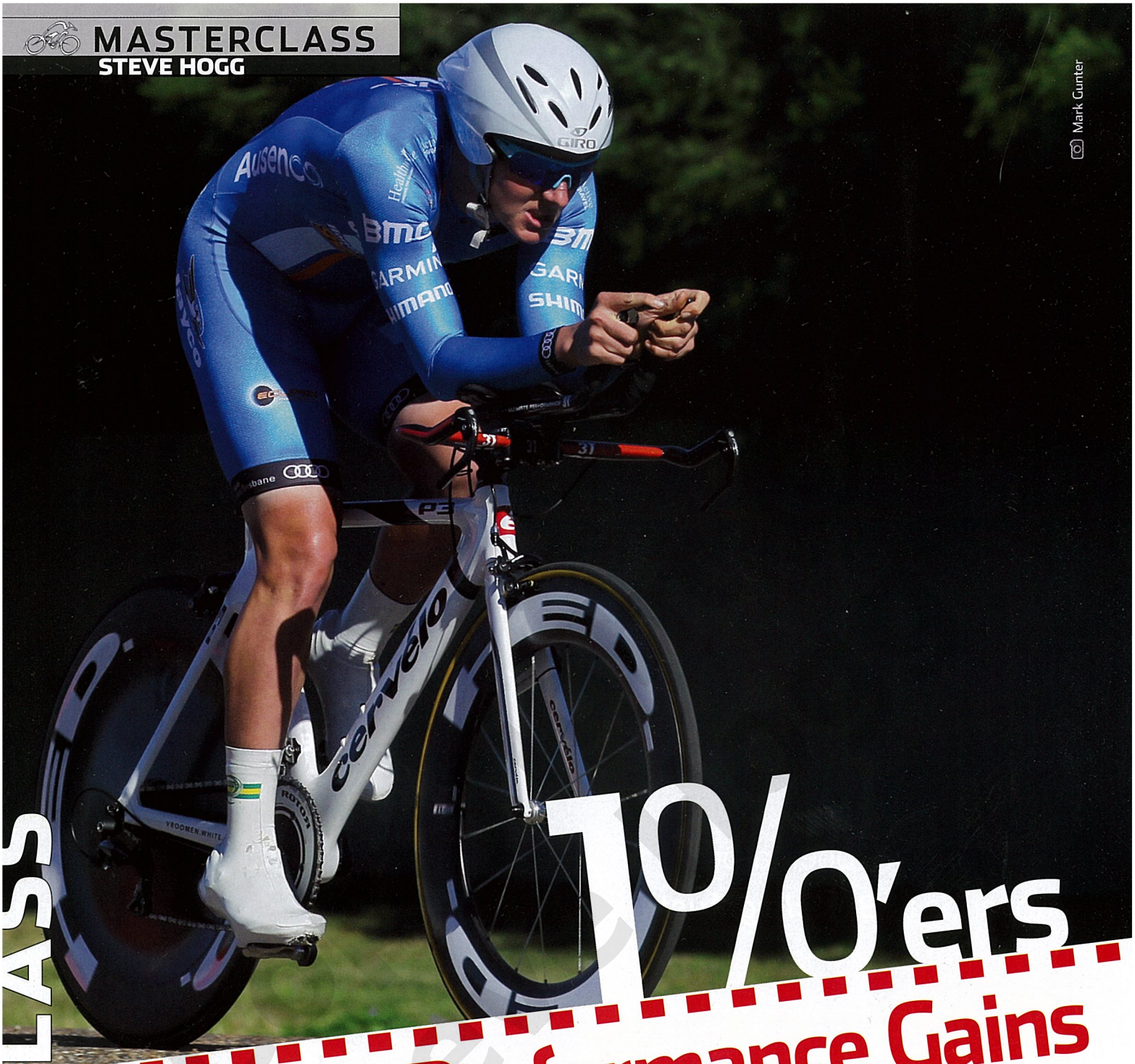


Mark Gunter

1%'ers
Power & Performance Gains

Every cyclist wants to improve their performance. The basic paths to improved performance include use of optimal equipment and ensuring its appropriate maintenance, and improving bodily function and training efficiency.

Either of these paths lead to questions of cost/benefit for each of these area. How much faster will higher grade, higher-cost bearings make me? Should I change to (or from) compact cranks, and will the alternate make me faster? Is aero always faster? Are fatter tyres faster than thinner tyres? Will spending time and effort on functional exercises off the bike allow me to perform better on the bike?

What follows are some of the answers to these and other questions about bikes and bodies that can help in effectively improving performance.

Equipment and Expenditure

Balls and Races

Hybrid ceramic bearings are claimed to improve performance by reducing friction and increasing bearing life. Ceramic bearings are much harder than steel bearings. Ceramic bearings are available for rear derailleur jockey wheels, bottom brackets and wheel hubs. Some of the performance claims made for ceramic bearings may be true, but not all ceramic bearings are equal. If you're considering stumping up the not inconsiderable amount of money for 'proper' ceramic bearings, then there are several things you need to make yourself aware of before purchase.

i. The roundness of the bearings is graded. The lower the number, the rounder the bearings. So Grade 3 is rounder than Grade 5. Simply, a rounder bearing has less rolling resistance than a less round bearing. For bicycle applications (low speed/heat) Grade 3 is what you should be looking for. Some manufacturers use Grade 2 ceramics as a bearing option in their hubs and are to be congratulated on going for quality, but in my opinion, there is no perceptible performance difference between Grade 2 and Grade 3 bearings while riding a bike – but there is an increase in cost. There are many Grade 5 ceramic bearings out there in the market place. These are lower quality and in real world terms, not worth the expense because the super hard, less round Grade 5 ceramic bearings tend to chew out the softer steel races that they run in more quickly than higher grade bearings and present no real upgrade from a quality steel bearing set. If you are going down the ceramic bearing upgrade route, the best advice is go for at least Grade 3 or don't bother.

ii. Balls are only part of the low friction bearing equation, with another component being the race (ring shaped bearing track) that the balls roll in. This is where the word 'hybrid' comes in to the description. Ceramic balls + hardened steel race = hybrid bearing. If a steel race is too soft to cope with the increased hardness of the ceramic balls, premature wear will occur. Races are graded by ABEC numbers. In this case a higher number is harder, better, and longer wearing than a lower number. You should be looking to buy ceramic bearings with a minimum race hardness of ABEC 5, though ABEC 7 is better.

iii. Bearing seals play a part in the perceived smoothness of bearings. Seals are there to keep water and dust at bay, but they also contribute to friction. Ideally, seals need to be of low friction design while still being relatively water- and weatherproof. Some are, some aren't.

To summarise – bearing friction as a component of total bicycle rolling resistance is very small. Probably the ideal application for ceramic bearings is on the velodrome. Track racing is the only Olympic sport timed to the thousandth of a second and when you are talking tiny fractions like that, any advantage matters.

If your bike has cartridge-style bottom bracket and wheel bearings, and you elect not to upgrade to ceramic, here's a performance tip that will help. Firstly, use quality bearings. Next, pop off the contact seals with a razor blade and add a small drop of gearbox or diff oil and refit the seals. Cartridge bearings are designed to be run at much higher rotational speeds and temperatures than those generated by bikes. That means that the grease they are packed with can get pushed out to the sides of the bearing path because it is not being heated enough to be semi-molten. That drop of transmission oil is just enough to cause the bearing grease to partially liquefy which allows the bearing to be more effectively lubricated.

Classic vs. Compact

At first glance compact vs. classic cranks might seem a strange topic to discuss in a performance context. The major difference between compact and classic cranks is chainring size. While there are other options, the most common examples of compact cranks use a 50/34 pairing while the most common classic example is 53/39. If comparing these chainring combinations while using the same rear cassette ratios, the compact crank will always have a lower bottom gear and the classic crank will always have a higher top gear. Which is more advantageous to you will depend on your riding profile and the terrain over which you routinely ride. That's not what I'm talking about though.

'Roll out' is the term used to describe how far a bike will travel for one revolution of the cranks in a particular gear. Compact cranks will always have more frictional losses for a given roll out, ie, overall gear ratio. The smaller chainrings of the compact crank will necessitate a smaller rear cog for any given 'roll out' equivalent to a classic crank. That means that the chain, which contains more moving parts than any other bike component and which is often less than perfectly lubricated, has to make a tighter turn around the smaller rear cog and the smaller chainrings. How much does this add up to?

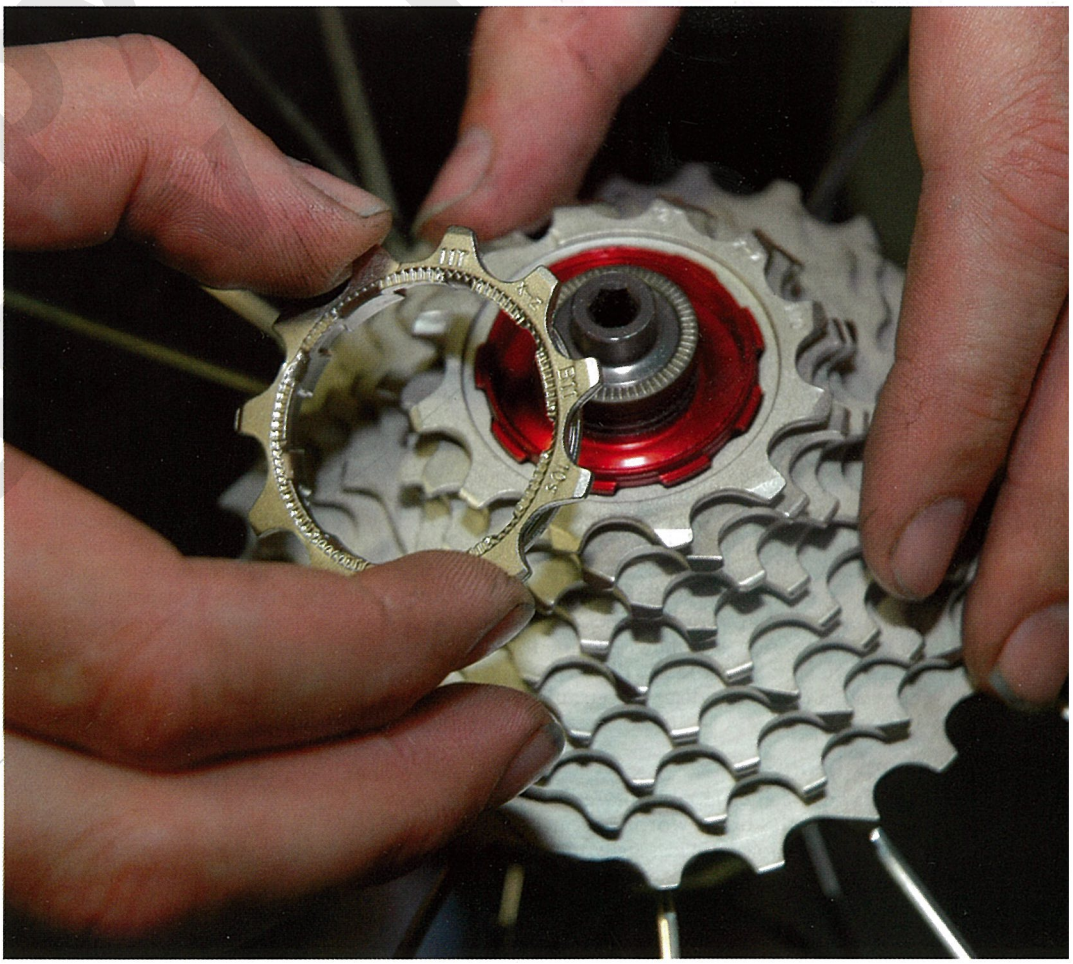
I don't know. Though my gut feeling is that it would have a more significant impact than that of ceramic bearings. So if you want the most efficient drivetrain performance in a mechanical sense, one aspect of that would be to use classic cranks.

Aerodynamics

On flat ground the vast majority of the power you produce on a bike is used to push air aside. Increase in wind drag is disproportionate to the increase in speed. Doubling road speed creates four times the wind drag, which requires eight times more power to overcome. That is why riding at 20kph feels very easy while riding at 40kph means real work. One example is that to increase speed from 40kph to 50 kph requires the rider to increase power output by just over 95 per cent.

This disproportionate need for power for any increase in speed makes it easy to understand the lure of aerodynamics. If a rider uses equipment that can reduce their wind drag, increased performance should follow. Well set up aero bars will make more difference to rider performance than all of the other equipment a rider can use. But hey, we're talking road bikes, which rules aero bars out. Wheels and helmets are the next greatest sources of drag.

Increasing aero rim depth also increases sensitivity to side winds, particularly for the front wheel, which places a limitation on what is practical. However, there have been advances in this area with both Hed and Zipp leading the way with wider aero rims that are not as susceptible to side winds as narrower rims of similar depth. Helmets can make a relatively large difference to wind drag but the type of helmets that have a low drag coefficient are designed for low drag first, cooling second. That means that a low drag, aero helmet is not a practical choice for a road rider on anything other than a cool day. How many bunch riders do you see wearing aero helmets?



Other measures that can be taken are to wear snug fitting clothing or even a skin suit, shoe covers or fit aero bidons. Frankly, within the confines of a bunch, whether shoe covers, skin suits or aero bidons make a difference is a moot point, though the possibility exists. The human body creates something like 90 per cent of total bike and rider drag. More about that later.

Drivetrain Cleanliness

For those that are chasing every last bit of performance, here's a test for you. Don't clean your bike for six weeks of regular riding. By all means wipe down the chain and periodically apply lube, but leave it at that. After six weeks has elapsed, give your bike, including the drivetrain, a thorough clean. That means removing the chain and chain rings and perhaps your rear derailleur jockey wheels as well. Now ride your newly cleaned and lubricated bike and the difference between a clean and dirty drivetrain will be obvious.

Crank Length

This has been covered in more detail in other articles but is worth a recap. A longer crank doesn't necessarily mean greater performance. Yes, a longer crank is a longer lever arm to push against. But effective pressure can be maintained for less degrees of crank rotation. If a rider increases crank length by say 5mm, then to preserve the same overall seat height as measured from pedal platform (at the bottom of the pedal stroke) to top of seat, the seatpost has to be dropped 5mm further into the frame. That will also mean that the rider's knees move 10mm higher at the top of each pedal stroke. Five millimetres of this because of the longer crank arm and the remaining 5mm because of the seat post drop. This increased bend in the knee at the top of the pedal stroke means that the crank arm has to advance further past top dead centre before the rider can apply a given degree of mechanical advantage to the crank arm. Realistically, changing crank length up or down by the typical single-length increment of 2.5mm will have little effect on a rider's performance. On the uncommon occasions when it does, then that rider is already at or near some individual tipping point of performance. Bike riding means a lot of crank revolutions. If you are in any doubt about your crank length, err on the side of caution. A crank length that is slightly too short is usually easier to live with than one that is slightly too long.

Tyres and Tubes

Probably the simplest and least expensive way to gain an improved performance feel is to fit fast tyres and tubes. That usually means the lighter and/or more expensive end of most tyre manufacturer's line-ups. I've got a predisposition for 'Open Tubular' type construction tyres rather than vulcanised tyres with glued on tread strips, but all of the large tyre manufacturers have lightweight offerings that feel noticeably faster than their more durable, heavier, less expensive tyres.

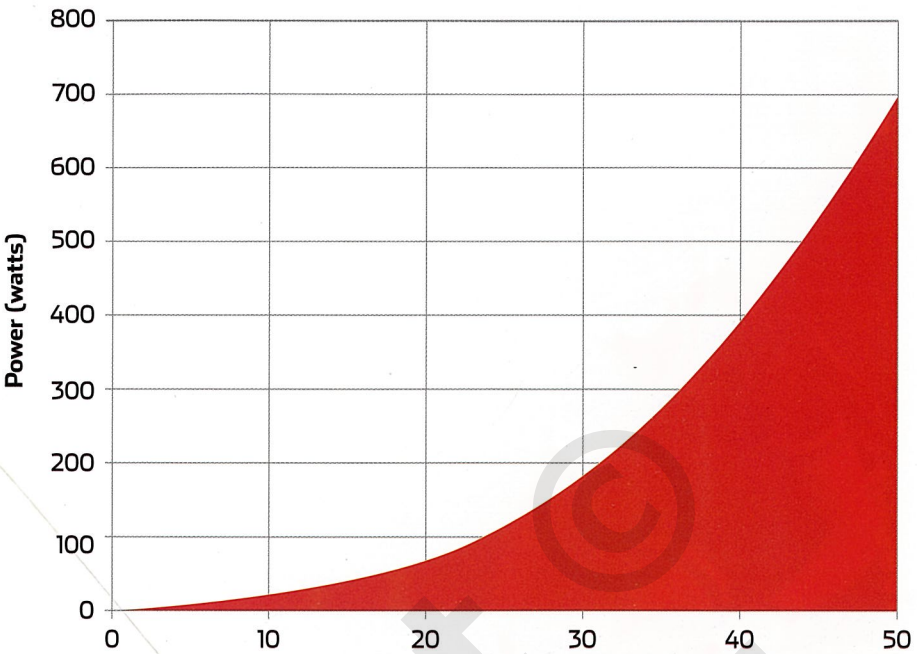
In most cases, low rolling resistance and high performance also equals less puncture resistance. If you are a city dweller and don't want to spend a lot of cycling time repairing flats, it is more practical to choose a tyre that has a balance of performance and durability and keep the top of the line tyres for those special days or events. My personal favourite of the 'all-rounder' type is the Michelin Pro Optimum. It is a 700c x 25mm tyre and is big for the nominal width. That means that it doesn't need as much pressure as a narrower tyre to feel 'fast'. At my riding weight of 73kg, Michelin recommend only 90psi for the Pro Optimum. I have other bikes and wheels with other brands and models of tyres that are inflated to 110–120psi. By comparison the Pro Optimums give a noticeably plusher ride for the same seat-of-the-pants performance feel. This can make a large difference to comfort during an all-day ride. Comfort + efficiency = performance.

Another thing to consider with tyres is cross section diameter. All major manufacturers agree that with identical construction a wider tyre is faster than a narrower tyre. At least up to the point

where the greater contact patch area creates additional drag to negate this. What this means is that 'fat' 25mm tyres are faster than 'skinny' 20mm tyres – all other things being equal. Assume a small bump of a certain size being hit hard by a tyre. Both fat and skinny tyres have to deform by the same amount to absorb that small bump. But that same size deformation is a lesser percentage of cross sectional diameter on a fat tyre than it is on the skinny tyre, meaning that the fat tyre preserves a greater proportion of its roundness. The rounder the tyre stays, the faster it rolls – all other things being equal.

Now magnify that effect by the thousands of small bumps that are contacted in a normal ride and you will understand the advantage.

Tubes made from both butyl (black rubber) and latex are available. Of the two, latex tubes are faster but come with a large price premium and are less durable. Use your tyre levers clumsily and you will pinch or tear a latex tube easily. Still, if performance is your thing, latex tubes are the way to go providing you exhibit a bit of mechanical empathy when fitting or removing them.



Drag increase exponentially with speed.

Exercise and Efficiency
Stability and Control of Movement

This is for some a less attractive option than spending money on equipment because the rider has to get off their backside and do something, but the potential gains are much greater. The functionality of the human on top of the bike is a greater performance limiter than lack of high end equipment. This is because most cyclists aren't particularly functional.

With a reasonable position the only part of the rider that should move at steady rate is their legs. Extraneous movement saps performance. Too much effort is going into movement not directly related to applying load to the pedals. When you see a rider who moves around with every pedal stroke, then in simple terms what you are seeing is a rider who has greater ability to apply force to the pedals than they have to resist the application of that force.

Every time a cyclist presses on the pedals there is an equal and opposite reaction force generated that presents a potential challenge to on-seat pelvic stability. If the rider's ability to resist that reaction force is not good, then there will be pelvic and torso movement with every pedal stroke. The only option left to them in an effort to regain some semblance of on-seat stability is increased upper body effort; tensing of the arms and shoulders. This won't stop the movement of the pelvis but it will help control it to a point, though only at the cost of a lessening of breathing efficiency. The respiratory muscles need to relax to allow full breathing. This can't happen when most of them are engaged in resisting pedalling forces, bearing weight or being forced into a stability role.

There have been a number of articles in Bicycling Australia recently about 'core strength' that go to the issue I am talking about – the lack of core strength. Add in the effects of old injuries and a chair-bound lifestyle and it is little wonder that most riders aren't particularly functional. One of the best books for cyclists on this subject is Tom Danielson's Core Advantage by Alison Westfahl and Tom Danielson. It is focused on the needs of cyclists with enough technical detail to be educational without detracting from its readability.

Aerodynamics vs. Efficiency

The rider contributes around 90 per cent of the total wind drag created by the bike and rider combination. Anything the rider can do to reduce that wind drag through a more aerodynamic position will aid performance. There is nothing for free though, and invariably, the most aero position is never the fastest position. The fastest position is the most aerodynamic one that the rider can comfortably maintain for the intended ride length without impinging on breathing efficiency or reducing stability.

Slamming the stem to its lowest point is a popular option amongst young riders. Lower isn't necessarily faster. Front-end height of the rider is less important in an aerodynamic sense than torso extension. There is no value in having your bars low if you have to excessively flex your back or compromise your stability to reach down there. You will breathe more efficiently and be more stable as well as more aerodynamic if you ride with your bars slightly higher and your back as extended as possible within the bounds of comfort. If you have to force it, you're doing something wrong. It should be easy!

If the bar height that allows this doesn't meet whatever aesthetic ideal of position that you hold dear, don't despair; start the process of improving how you function so that you can comfortably meet both your style and performance aims.

Placing hands in the drop bars may not be as aerodynamic as riding on the brake hoods with horizontal or near horizontal forearms. The near vertical position of the entire arm length when the hands are placed in the drops creates more drag in many cases than having forearms horizontal with hands on hoods. That assumes that upper body posture doesn't change. Former American track star Colby Pearce once told me that in his case, riding with forearms horizontal and hands on brake hoods was worth 20+ watts to him at 50kph compared to riding with hands placed in the drops. Your position and experience may vary but it is something to think about in extended solo efforts.

Training Consistency

There is an increasing number of 'serious social' riders. These are the people who consistently clock up the kilometres but who don't race. Many of them are time poor. From what I can see, four training sessions weekly is the most time efficient in the sense of results versus time allotment. Yes, five, six or seven sessions are better again but with each additional session there is a proportionately smaller gain. Better to train consistently rather than be haphazardly intermittent.

If you are a serious social rider, I'll leave you with one last thought. The greatest problem I see with fitting clients is their level of dysfunction. Many riders would perform at a higher level over a year if they missed one ride a week and put that time into some sort of functional improvement regime; yoga, pilates or anything similar, whether in a class or informally at home.