THROTTLE, POSTURE, AND RELATED MOTORCYCLE ERGONOMICS

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I'll start by talking about the throttle grip and ways of improving it. After, I get into some other biking ergonomics issues.

The throttle grip

The throttle is a study in ergonomics and mostly how not-to-do things.

The right-hand handlebar mounted throttle grip is a means of adjusting speed and "talking" to the carb or EFI. Working with the carb or EFI is not a simple matter of pointing the throttle to the desired speed. Rather, it adjusts the size of the passageway feeding the cylinder(s). Thus it requires constant fine adjustment to urge acceleration or deceleration in a highly complex transfer function, accommodation to wind and grade, and to modulate the ride and acceleration — or even exhaust noise levels — in various additional ways.

But the throttle grip is also a means of steering and keeping yourself braced to the bike in a proper riding position. The need for precise adjustment and the structural requirement conflict since you can't do fine adjustment while supporting yourself with that same hand.

As a means of fine adjustment, the bike throttle is at best a poor compromise. You are required to hold the throttle against the butterfly or slide spring force for minutes or hours. The force of return inside the carb or throttle body has to be strong enough to pull the *whole* mechanism closed against a worst-case combined resistance of the cables, one-into-two box, and handlebar mechanism. Worse than the return spring force of a butterfly valve, is the resistance of a slide valve, especially during engine braking when the vacuum is very high.

In the interest of fast action particularly on fast or high revving bikes, the amount of rotation of throttles has been getting smaller, often less than a quarter turn. Yet for most driving, your control area falls within the first quarter turn, nearly all the required adjustment is in just a few degrees of rotation, requiring yet finer and finer hand adjustment.

The throttle grip diameter is too small for proper ergonomics. Being small, you have tension on your hand structure because it is wrapped around a small grip. This leads to pain. Moreover, with a small grip diameter, you have insufficient leverage against the throttle spring. That should be pretty obvious when you think about it. You can buy all kinds of aftermarket grips, choosing the one that best balances for you: grip diameter, sensitivity to road feedback, feel to the touch, absorption of high frequency buzz, durability, temperature issues, esthetics, cost, and more.

Psychologists generally recommend customizing to the individual. To do so, shape your grip to your needs by using bicycle handlebar tape. This is an oval cross-section rubberized cork tape made for the purpose of customizing; by making the winding pitch wider or narrower… you make the grip diameter thinner or thicker respectively. This tape comes in many colors. I had some leftover red-pink tape that I used. Do not use this color unless you can tolerate other bikers poking fun at you. Be sure to get the cork tape because it is far more human-right than the plastic imitation. Two layers will decently enlarge and shape the diameter of the grip for your comfort. Try to can create a personalized barrel profile just right for your hand. You will find a mere 15% enlargement of the diameter to be very beneficial in reducing pain, sharpening your throttle control dexterity, and introducing the human-right feel of cork.

The need to battle the throttle return spring can be addressed in several inadequate and one good way. First the wrong-headed approaches.

The most wrong-headed approach is to reduce the force of the return spring. The return spring *must* be able to close the butterfly or slide under *all* the routine or fault conditions of any likelihood. Your call on this may be lighter than the manufacturer's — who don't want their liabilities left too exposed — but great restraint is needed in lowering the force. Going to a racing push-pull cable system introduces different issues although the human-factors principles are similar.

The last thing you want to add in your battle with the spring is friction! This friction is nothing but an ADDED demand on your hands ALL the time, whether advancing or reducing the throttle. Moreover, the friction impairs your ability to skillfully and finely manipulate the throttle. Yet that is exactly what the Throttlemeister and generations of various friction gimmicks do. In good driving, the throttle is in constant motion. Therefore, you are continually fighting the extra friction. True, you can lock down the throttle to give you a needed brief rest break while driving. That can be beneficial although not a sound way to drive any distance.

Various plastic devices can be snapped-on to add leverage to the throttle. These can be helpful but never seem to be in the right spot for me much of the time. I end up holding my wrist in awkward positions and thereby gain new pains to replace the old pains.

An excellent solution is a throttle counter-force spring. It adds no friction. It counter-acts the throttle return spring from the handlebar end and therefore does not compromise the ability of the return spring to close the butterfly or slide. It can be made stronger if you have a slide or weaker if you have a butterfly.

When you reduce the force needed to manipulate the throttle, you are then able to move it faster and with greater precision. That's because you have converted the throttle from a

beast that is fighting you all the time, to a kind of simple pointer-like device. Lightening the force is as beneficial on the street as on the track.

The spring force can be set to equal the return spring; some authorities would consider this unsafe because the throttle might remain open if you came unstuck from the bike. It also befuddles dyno operators during their test runs!

An excellent 50-cent solution is possible when you have anti-vibration bar-end weights or can make something like that. See the picture below.

Not sure you like the looks? Paint the spring green, put it inside a flexible black tube, or plate with gold. The choice is yours.

Take a light spring and attach heavy threads to each end. Wrap one end around the outside end of the grip and hold it in place with a turn or two of the tape of your choosing — I like black plastic electrical tape. Wrap a turn of tape around the bar-end weight to protect the finish. Then pre-load the string and secure the thread with another piece of tape. That's it except that you may want to fine-tune the pre-load by moving the thread or by simply turning the bar-end weight!

A spring can also be placed inside the handlebar, held from rotating by some means at the inner end, and pre-loaded with a twist or three before attaching to the throttle grip with a split-pin or bolt underneath the rubber grip. My thanks to the brilliant Bob Fleischer for some of these ideas.

Whichever spring you use, the issue of how to make the tension constant needs to be addressed. The throttle return spring force increases as the throttle is advanced. But the counter-force spring pull diminishes. Therefore, you need some care in (a) selecting the spring rate and (b) providing enough pre-load so that the counter-force spring pulls as constant as needed over the full range of motion. For a few dollars, you can buy a whole handful of springs, a few feet of heavy thread, and electrical tape, and then see what works best for you.

I've been experimenting with a strip of Teflon wrapped around the bar-end weight under the spring. It reduces friction and helps get the entire length of the spring into action even from the first crack open. But a little bit of friction can be a good thing in that it helps keep the throttle steady while you wave at oncoming bikers with both hands overhead.

The throttle counter-force spring, bar raised without barbacks, and other trick items, esp. for an R1100S, can be seen at:

http://home.ica.net/~barkow/Bike%20Stuff/Bike%20write-ups%20and%20pictures/Bike%20pictures/

Now I will turn to various other ergonomic issues.

Riding position

At the gross level, you should ensure you have a good riding position, one that doesn't oblige you to take too much force on your hands. The basic postural structural element is the foot-to-knee strut. With your feet firmly on the pegs, you should be able to press your knees against the tank in classic Brit bike fashion. This is aided by something quite rare today, kneepads glued to the tank that help locate or index your knees and gives them a purchase. If you have that "leg strut" set strong and good and if you do your pelvic tilt exercises and have a fit lower back, the rest of your body will be suitably supported.

Windscreen

For some, riding with the wind against their chest provides some support but it can only provide good balance for one speed (that has to be real fast) and wind condition (provided it is also fast and you are facing into it). For those who tour or drive long distances, a windscreen that permits a more upright posture is needed. I rather like being about 45 degrees up – a nice balance of sporty and long-distance posture. But 45 degrees will still require a nearly full-height windscreen, as is evident from the trigonometry of the situation.

Choosing a windscreen height is an exercise in postural ergonomics but also involves wind noise. Without going into detail here, there are two schools of thought that, in turn, relate to your helmet style and your use of noise plugs in your ears. For the best windblast and noise reduction, you need a windscreen that propels the wind over your eyebrow level. If that size windscreen does not suit you, you need a windscreen that directs the windblast to your chest so that your head is well above the turbulence. But keeping the turbulent blast on you chest is a halfway measure that is not as good as shaping the blast over your head.

Some riders of a heroic cast of mind (read: too much testosterone) say they are comfortable, nose to the tank, for 1000 miles. I am not sure how they are able to twist

their necks to see behind. It defies human anatomy. For sure, some folks are gluttons for punishment, especially if seems macho. But then, some folks think there's no risk to themselves or others when they drive cars while talking on a cellphone or after driving 10 hours in a day.

I suppose you could you go fast enough so that the wind on your chest is equal to the muscle force that would otherwise be necessary to keep you supported. But you'd have to maintain a constant speed in a constant wind for it to be constantly effective. In any case, there should be minimal force on your hands, providing your "leg strut" is secure or the wind is blowing hard.

Bikes rate oddly poorly for air drag, comparable to some cars actually. I suspect you will go faster with a windscreen and upright posture, than almost any other posture without a windscreen. Seen many unfaired bikes racing?

Your fitness is important

I should add that bikers do need to be in good shape with the four fitness elements of cardio-vascular, strength, flexibility, and balance. Not least crucial among the foundation elements of fitness is flexibility, particularly for older riders. If you can't twist around and see clearly straight behind you, you better work on your flexibility. Try it right now! Now tell the truth, did you have to cheat by twisting your shoulders? No-can-do that kind of cheating when riding because your hands are on the grips, eh.

Vibration and fatigue

Interfering with the transmission of vibration to your body and the consequent acceleration of fatigue especially on long trips is a matter of separating you from the vibration. While vibration to the hands is easy to notice, you need to access some road feel even while blocking buzzing vibrations. It also is worthwhile to have soft soles on boots to interfere with the transmission of vibration there too. As with many such nuisances, the best place to address undesirable sensory impingements is at the source.

Notes

Thera-Gloves
I don't have much hand pain when riding, but some pain after a long day over a hot keyboard. At the 2007 January, Toronto bike show, I bought two pairs of "Thera-Gloves" which are heavy Spandex fingerless gloves, like support-hose but from above your wrist down to where your fingers start. They really prevent any hand pain I get at the keyboard and I'm a natural skeptic. These don't interfere even with typing so not likely to be any hindrance under riding gloves. They cradle your hand like a flight suit. Might be quite beneficial for bikers who have problems.

Sold by a New York State firm. I'm impressed and I'll be demo'ing them to my ergonomics clients. I have no commercial interest, of course.

http://thera-glove.com/

BTW, when you buy a pair you can also re-use the left glove on the right hand by means of a thumb transplant. Only kidding about that but the left glove can be topologically transmuted into a right by an inside-out transformation (and feels exactly the same).

Maybe I shouldn't say what I paid at the show but it was us$24 (including tax) for two pairs. Must be somewhat more regular retail and with shipping (they weigh about .01 ounce).

Pinches nerves
If like any long-term biker, you've landed on your head, hopefully with a DOT or Snell helmet on, then you've certainly scrunched your spine since it has all those gel-pads between the vertebrae. If so, you've condensed the space where the nerves run off from the main spinal cord to do their work (such as down your arm). If condensed only a little, then no nerve pinching — consider yourself lucky. If condensed more, then the nerve is being touched and you feel it down your arm - the further down the arm then the bigger the pinch must be. This can be real painful although the pain is a phantom since you feel it at, say, your elbow, but the damage is in your neck.

But the gel-pad regenerates and the nerve adjusts to the new shape of the hole (AKA foramina) and the pain starts disappearing up your arm bit by bit. Like lower back pain, you get better whatever you do. Swimming jet-propels that process, shortening the pain phase and reducing the occasional recurrence.

About seeing a surgeon, you know that old "joke" that goes "if your only tool is a hammer, every problem looks like a nail." For sure, I am not denying that some back conditions require surgery and nothing else will help much. But there's good reason to think there's been too much surgery for back problems.