

Part 2. Molecular Ergonomics, Taking the Garbage Out!

So as the man in the septic tank replied to the passer by who asked how he had fallen in?
- “It matter less how I got here, how I get out is all that counts!”

I personally classify computer injuries as Mechanical Onset RSI's (MORSI), because it is the mechanical activity performed on computers while using badly designed tools that is the causal factor of impairment. This is to distinguish it from clinically mediated RSI, where an underlying clinical condition has resulted in impairment that typically impacts the users ability to use the computer. The fact that physicians see and diagnose both groups is a consequence not a cause.

The reason for an endemic appearance of RSI's is as a result of activity in a poor posture, without an adequate exercise regime that results in a metabolic skew that leads on to a biochemical imbalance. The chemical enemy within, so to speak, has always been there but until now our work habits have meant that Nature has been able to hold it mostly in check. She hasn't had the opportunity to adapt us to this change yet and she need not if we adapt our tools. So, thankfully, the natural order of things, “Survival of the Fittest”, can be superceded by technology within a social order that does not require a “cull” of individuals who cannot adapt to change. Computer tools, posture and exercise regimes are the management vectors of RSI and any extinction should be limited to any bad tools we use; they should go the way of the office ashtray.

One objective in writing this was to bring focus and a biochemistry perspective so that we do not treat muscles or limbs as isolated structures subject to individual focus when formulating ergonomics strategies. They are a blvd in our body's lunar community. It is appropriate to look at them singularly when it comes to treatment, though “united we stand, divided we fall applies” when it comes to ergonomics strategies.

My second objective was to explain why RSI occurs, not what it is. RSI isn't muscle damage, it becomes muscle damage, neither is it a clinical condition, it manifest itself as a clinical condition. RSI, in simple terms, is a method of working badly!

The computer tools and protocols we use are to RSI what the virus is to having the flu, they are the cause and RSI is the generic label we attach to the consequence. RSI is an embedded clear and present danger on every computer that is not optimized for the biochemistry of its operator, period! The possibility to get RSI is not an “if” or a “how” but a “when” and the ways it manifests itself are legion!

If you sit on your hand it makes it numb because it cuts off the circulation, it tingles when the circulation returns, we all know that so we don't do it. Those who sit their hands on computers and employ current art, go numb and then later start to tingle, have just gone through the exact same cause and consequence. Until the bottom “biochemical” line is appreciated that bad posture and working protocol means bad biochemistry then people's perception of computers and their use will not be sufficiently impacted to precipitate the changes necessary to avoid this problem before it becomes one.

Our own success in helping those afflicted is tempered by the knowledge that there will be many more to come unless this awareness is had and the reality is that the same tools and protocols that bring relief to those with MORSI will also prevent others from developing it. Likewise treating those who develop clinical RSI to then send them back into the same environment that caused it is like fixing up Christians to throw them back to the lion's. Breaks and exercise protocols that increase respiration are well established and are as important as the tools we use, but they do not protect users from the impact of the poorly designed tools we use and the length of time we use them. The computer mouse market is now confused with "Ergonomic Products" many developed with single-issue objectives. They solve a problem in isolation, so appear to fix though without consideration to the body whole.

Claims of product efficaciousness are initially borne out because of what I would call "New Posture Syndrome!" Changing to a new posture relieves, short term, the stress on the "distressed" tissues. The initial relief gained far outweighs any "new" fatigue experienced even though now in another bad posture. It is the technology equivalent of Posture Compensation, the body's response to if it hurts in one position use different muscles to adopt a new one while the damaged muscles try to repair. Unfortunately over time products that subscribe to this can cause new problems to appear. We have much anecdotal evidence on this fact from a website survey we conduct and are hearing from many so called "vertical mice type product" users abandoning them after a few weeks use, adding to the further distrust and fatigue of the "E" word when used by product manufacturers.

So where does Molecular and Macro Ergonomics Converge?

The answer is found under the concept of "Functional Neutral" which is "Biochemical tick over". Muscles are engines that in life are never switched off. Just like a car engine we rev them higher to work them harder. If we can find a posture that allows muscles at risk to "idle" while we are still doing the same work then they will give us years more problem free service than having them in the red zone all the while. It is also true that a bigger engine employed at lower revs last a whole lot longer. This is why we have designed a mousing system that allows users to leave their "small engines", forward of the elbows, at idle speeds and use the "V6" muscles of the upper arm to do the work.

Functional Neutral as an objective is best appreciated from an understanding of differing working postures that in Macro Ergonomic terms are called Static and Dynamic Posture.

Dynamic Posture (DP) is working under a regime in which muscles are cyclically tensed and relaxed; in our engine analogy, revved and allowed to fall back to tick over. Though this maybe very repetitive the fact that muscles are not under constant load (revs) means that there is a rest interval in between each muscle tensioning event (a Nano-break) so allowing for biochemical recovery. Muscular contractions, in uninjured hands, typically aid circulation in limb extremities by acting as a pump. This is because when muscles

contract they squeeze down on the blood vessels within them, forcing the blood out. When they relax the blood vessels open once again and fresh blood is pulled in.

Keyboarding and clicking mice buttons is employing DP. It is believed that DP, in isolation, is unlikely to cause MORSI, a premise supported by the fact that old “mechanical” typists (their machines not them) were not so prone to these problems. The mechanical mechanisms being slow meant typists took Nano-breaks between each character they typed. They also moved their hands around more and had no opportunity to use wrist rests so their muscles became adequately developed for the task they had to do. Wrist rests act as a tourniquet cutting of blood supply to the wrist and increasing pressure in the Carpal Tunnel by 50%. They also create “dependency” as the muscles they support loose tone through lack of use so now the user rests more heavily on to the wrist rest, the weight of their own wrist and arm cutting off their blood supply further.

So DP and thereby keyboarding and mouse clicking is effectively exonerated as a primary RSI culprits though DP in the presence of injury can aggravate and can lead to an over development of the flexor (opening) muscles of the hand, relative to the extensor (closing) muscles, causing the hand to claw. An appropriate break and exercise regime will help prevent this occurrence and if “claw hand” is present it is easily remedied with Orthotic exercises. Though separate mechanical problems can possibly be attributed to the wear created by performing “left mouse clicks”. People on average click 5,000 to 10,000 times a day, 80% or more are likely to be left clicks, so in the course of a year the index finger can click a million times, give or take. (We also estimate that if you add up how much force is applied by the thumb to grip a mouse during the course of a year, if applied all at one time it would be in excess of 750 tons! We also travel some 60 miles a year over a mouse mat!)

While I am sure that some will strongly debate DP complicity in RSI there is empirical proof, that seems to go unnoticed, in the fact that usually and predominantly the mousing hand becomes injured first and worst! Postural Compensation could explain shoulder and neck muscles problems that can occur on both sides of the body. The neck and shoulder problems on both sides are often cited as proof of keyboarding being the culprit. A hand that cannot easily pronate, due to a developing mouse injury, will cause the elbow to start to stick out putting extra strain on the shoulder, which can, due to postural compensation, translate into these types of problems. Also “work tension” itself could be a factor due to a reaction to a developing problem. Look around the office at 4:30 pm and note who rubs what part of their arm or hand. Ask them what the problem is and they will ask you what you are talking about, they, pre some “crunch” event, are typically unaware that they are self-massagers!

The most pernicious problem is believed to be Static Posture (SP), working under a condition in which muscles are tensed and held tense (continues revs), which is the posture adopted when gripping computer mice. Any amount of grip applies revs to some extent beyond tick over. When muscles are wholly or partially tensed they constrict the blood vessels passing through them reducing the volume of blood in the muscle and increasing resistance to its flow.

One irony due to blaming the keyboard is that software developers have switched much of their program functionality over to the mouse. Add to this the increasing dependency on the predominantly mouse mediated Internet for both work and hobby related activities then you have hour upon hour of constant grip, high revs and flagging biochemistry.

RSI is not a piston breaking, a total and obvious failure, it is a conspiracy of time, work habit and an accumulation of the failure of many, many individual cells.

So in designing tools and techniques that will better facilitate our biochemistry what choices do we have, what objectives do we set and how do we achieve them?

There is no fix all answer just choices, which range from: - modification of human biochemistry, leave the tools and protocols alone modify the work or modification of how we work and use tools that compliment our biochemistry. The first choice is obviously not possible and the second would typically impact productivity and increase costs, so therefore the only practical solution is evolve work methodologies and design better tools.

In terms of an objective: We seek to maintain, were possible and not at human expense, current computer use productivity levels while removing the causal factor, Static Posture. Another reality that has bottom line productivity impact is that when ergonomists fix a problem for an RSI sufferer, the solution is also a “fix it before it happens” for those not yet injured. This is because RSI is unusual in that you cannot repair it, you can only remove it. Removing it then allows any therapy and the body’s biochemical healing mechanisms to work.

In terms of a strategy for such an objective: The best-known practice is that of Functional Neutral. Biochemistry as close to tick over speed with small muscles being at or near idle, but this, in the case of computer mouse usage, requires working without gripping. Functional Neutral Position objectives are easy to understand, measure and so achieve. As a simple creature I find it easier to work in concepts: -

It isn’t where your hands are in the air that counts:

It’s where the air is in your hands!

By ensuring that tissues are sufficiently aerated (supplied with oxygen) we know the “trucks” are getting through and so, ergonomically, we can consider less the other and more complicated aspects of the biochemistry involved.

The difference between getting it right and getting it nearly right is, because of the time and the amount of work we do with these devices, the difference between working and hurting.

I mentioned that most muscles could only ache in their own defense. Professor Alan Hedge of Cornell University gives what is for me a most eloquent summation of the objective of Ergonomics with an impact I see as Biochemical.

If you don't tire, then you don't go on to ache.

If you don't ache then you don't go on to injure.

**Tom Large
President & CEO
Designer Appliances Inc**