

ESSAY: PRESSURE AND SHEAR RELIEF AND THE JARIK FLUID CUSHION

The purpose of this essay is to explain the theory behind pressure and shear relief and how the JARIK Fluid Cushion is designed to neutralize these forces, to help prevent pressure sores.

First, what is a pressure sore? Quite simply it is an open wound caused by dying, necrotic tissue that has been starved of its natural blood supply. The size of the visible wound is small compared to the underlying problem, as the tissue dies from the inside out.

The implications of a pressure sore for a wheelchair user can be months of bed-rest, waiting for the wound to heal. During this time, the person's active life literally comes to a halt. Or worse, the wound can become infected, leading to a systemic infection that often causes death. In fact, pressure sores are the number one killer of people with spinal cord injuries in developing countries.

The two biggest causes of pressure sores are pressure and shear.

PRESSURE

Let's start with pressure. To demonstrate the effects of pressure, with two fingers, press against the top of your other hand. Lift your fingers, and notice the blanching of the hand. This pressure is enough to slow or stop blood flow. If you were to hold your fingers there for a few hours, the tissue would start dying from the loss of blood flow.

Think of the capillaries that supply this blood flow as a series of tiny hoses carrying blood. When you step on a water hose, you slow down or stop the flow of water. The problem is that capillary blood pressure is only about 35-40mm of mercury, so it's very, very easy to slow down the flow of blood.

Now that you understand pressure, imagine the buttocks as they rest on a cushion. Worse yet, imagine a paraplegic or quadriplegic buttocks, where the normal muscles have atrophied from lack of use, and the seat bones or ischials protrude as they do on a skeleton with no tissue. In order to relieve pressure, the cushion has to be able to conform to a very boney buttocks. If it doesn't, the seat bones will take two to five times as much pressure as the areas around it, and the probability of a pressure sore is magnified. Stated differently, the boney seat bones of a paraplegic or quadriplegic will, on average, be exposed to 70-150 mg of pressure on a conventional foam cushion – several times the pressure of blood flow!

Now, look at the design of the JARIK Fluid Cushion. A molded foam base is cut away at the area of the seat bones and tailbone. Over that area, we place our fluid pad. During sitting, the viscous fluid flows away from the seat bones and tail bone, to completely conform and to evenly distribute pressure over the entire seating area.

As a result of uniform pressure distribution, peak pressures are often cut in half compared to conventional cushions. Less pressure means less chance of a pressure sore.

You've probably noticed the wrinkles in the fluid pad and wondered whether they could cause a sore. The answer is NO, because the thickness of the wrinkle is absorbed into the fluid. Press your hand on the wrinkle and you cannot feel it.

So why are there wrinkles? If there were not wrinkles, think of what would happen when a bony prominence sits on the cushion. The fluid would want to conform, but the surface material would act as a hammock, preventing conformation, as the bony prominences could not freely enter the fluid. As a result, the bones take most of the sitting weight. But with the wrinkles, the surface material collapses, allowing true immersion into the fluid. The bones now take a lot less pressure.

SHEAR

The wrinkles also relieve shear forces. What is shear? Most people think of shear as friction, but that's only part of the story. Shear is caused by movement during sitting. For example: when shifting positions, or transferring into the wheelchair - or the back-and-forth rocking of the seat bones as a person propels his chair.

To better understand shear, try a simple demonstration. Take your knuckle and press it into a conventional foam cushion. Feel the pressure? Now, gently rock your knuckle forward and hold it there. Rock it back and hold it again. Do you feel the movement of your tissue against the bone? That is shear. It is pressure plus movement plus friction, causing the tissue to move against the bone. Think of shear as doubling the effects of pressure.

Now, let's go back to our hose analogy. If pressure is like stepping on the hose, then shear is like bending or kinking the hose - which is exactly what is happening at the capillary level. And we all know that it is much easier to stop water or blood flowing in the hose by bending it - which is what shear does.

And finally, let's go back to the wrinkles in the fluid pad. As the sitter shifts positions, the surface wrinkles of the pad move with him, thereby transferring the shear forces to the fluid. Without the wrinkles, shear forces would not be relieved. And notice also that the same wrinkles are designed into the outer cover, so that it also conforms to the seat bones and moves to relieve shear forces.

WRITTEN STUDIES

Of course, theory is one thing. Practice is another. Which is why I encourage you to access two studies on our website. The first, coordinated by the Indian Spinal Injuries Centre in Delhi India, tested the JARIK Fluid Cushion on 81 patients, mostly spinal injured. It found a strong preference for the JARIK Fluid Cushion on 11 of 12 cushion attributes, including pressure relief. The second study, conducted at Denver General Hospital in the United States, showed sitting pressures on a very bony paraplegic to be significantly lower on the JARIK Fluid Cushion as compared to a

high quality, dual density memory foam cushion. Furthermore, JARIK pressures were comparable to the two leading pressure-relief cushions in the world - the JAY (which I also designed) and the ROHO.

SITTING STABILITY AND BALANCE

I now want to quickly review the other benefits of the JARIK Fluid Cushion, starting with sitting stability and balance.

As a part of their disability, people often lose function or muscle control in different of parts of their bodies. This makes it harder for them to maintain their balance and to sit upright. It makes it harder to propel the wheelchair. It often makes it harder to take a sip from a glass of water.

The sitting base is the starting point and the fulcrum point from which all stability and balance is derived. Instability there is accentuated in every part of the body. To better promote stability, balance and function, the JARIK Fluid Cushion is designed for the utmost stability. A contoured foam base literally cradles and holds the hips to the back of the wheelchair. The viscous fluid in the pad moves only when you shift positions. Otherwise, it maintains your shape, to hold you comfortably and firmly in place. The result is a noticeable improvement in stability, balance and function.

POSTURE

Sitting posture is also a critical element in cushion design. Assuming you've read the first essay on Posture and the Contoured Foam Cushion, I won't repeat all the common posture problems seen among wheelchair users. But I will point out the following:

- Slouching postures are discouraged by the contoured foam base and the non-skid bottom, which help prevent the hips from sliding forward.
- Pelvic obliquities and scoliosis are discouraged by a dual-chamber fluid pad that does not allow fluid shifting from one side to the other.
- Proper leg positioning is encouraged by firm support under the legs and a central abductor (a mild leg separator built into the cushion base). Plus, the cushion comes with optional leg positioning wedges that can be used to separate or unite the legs, as desired. For most people, simply dropping the footrests provides enough leg support to avoid using the leg accessories, which necessarily interfere with transfers.
- The Fluid Cushion comes in a variety of widths and lengths to allow proper fitting. In addition, the base can easily be shortened or narrowed to custom sizes by using a serrated knife.

EASY MAINTENANCE

My last subject is proper maintenance of the JARIK Fluid Cushion. For complete fitting and maintenance instructions, please download our User Manual from our website.

All components of the cushion are washable. Remove the outer cover to wash and dry. The fluid pad and base cover can be scrubbed with soap and water and rinsed with a wet cloth. The inside base is protected by a second, urine proof pouch and should never require maintenance.

The most important part of the maintenance, however, is checking the fluid level – to prevent bottoming out. This is very important. To do this, sit on the cushion without the cover for one minute. Lift yourself off the cushion and push with one finger at the lowest part of the fluid. For most people, there will be ½” or 1cm of fluid or more before you can feel the underlying foam base. If there is less than this, the pad is in danger of “bottoming-out.” To correct, simply detach the fluid pad and re-attach it closer to the center of the base. This will concentrate more fluid under the area that was bottoming-out. Now sit on the cushion again and recheck the fluid level as you did before. If it is still “bottoming-out” then do not use the cushion and see if you can try a narrower size. NOTE: Bottoming out will not occur on heavy patients, but on the thinnest patients who tend to displace the fluid to the sides. Also, do not increase the fluid level unless you need to, or you will actually increase sitting pressures.

I hope this essay has helped you better understand pressure relief, sitting stability and posture and how a well-designed cushion can help improve sitting safety. I encourage you to contact me at: rickjay@jarikmedical.com if you have and further questions or comments.

Rick Jay
Founder JARIK Medical