

Peristaltic, Venturi, or SPEEP: A New Choice of Pump Systems

Three-pump system for phacoemulsification and vitreoretinal surgeries combines the established peristaltic and Venturi modes with a unique option, the SPEEP.

Fluidics plays a major role in ophthalmic surgery systems and is key to achieving good surgical efficiency. The machine pumps work on two different ways to control fluidics – flow-based (peristaltic) and vacuum-based (Venturi). Understanding how these different pump systems work is crucial for each surgeon to positively support their surgery routine.

The peristaltic and the Venturi pump systems are now well established in eye surgery, and Oertli's OS 4 surgical platform puts both pump types at the disposal of the surgeon, who can select the one best suited for the work at hand. As well as this, the OS 4's 3-pump system includes the SPEEP pump – a unique innovation developed by Oertli to combine the best of the two standard pump systems.

Here, we take a deeper look at the characteristics of each pump system and outline some of the applications for which they are best suited.

Peristaltic

Professor Matthias Bolz of Kepler University Clinic in Linz, Austria, calls the peristaltic pump the “the small intestine” of machine pumps. “As soon as you start to move the wheel, you squeeze a certain volume through the aspiration line to the drainage bag,” he observes.

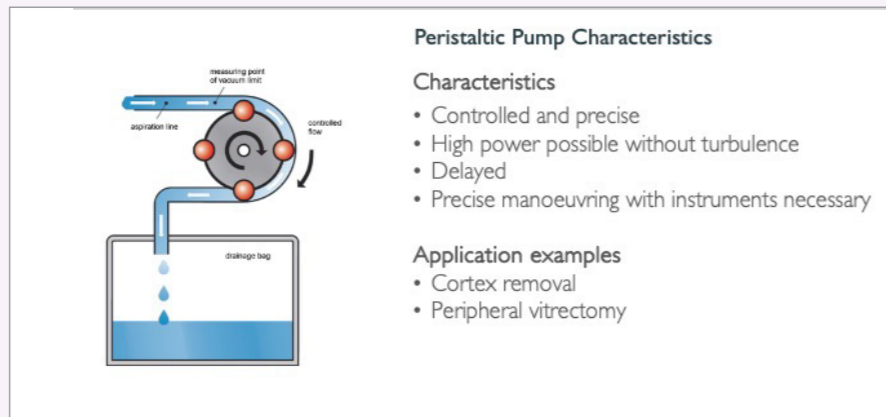


Figure 1: The peristaltic pump

The linear flow is adjustable with the pedal – “the faster the wheel moves, the more volume you will squeeze into the drainage bag” – although the vacuum can only be controlled by setting a vacuum limit, which tells you when the machine should stop. “The higher the flow, the more speed you will have in the eye. The higher the vacuum, the more force you will have,” explains Bolz. With the peristaltic pump, the passive vacuum can only be built up by occlusion and is not adjustable, but this means that the flow can be very finely tuned. This high level of linear flow control and precision creates positive results, especially with maneuvers requiring a high degree subtlety. Peristaltic pumps, then, can be effectively applied to procedures

such as cortex removal and peripheral vitrectomy, etc.

Venturi

Venturi pumps, by contrast, quickly create the vacuum by an air current, but the flow is not directly controllable. These pumps are more suitable for fast-action than work that requires a lot of subtlety. The Venturi is “the vacuum cleaner among pumps,” says Bolz. “It pushes compressed air through a tube with a high lumen into a tube with a small lumen, increasing the velocity of the air immediately and causing a negative pressure in the draining cassette. This is the same effect as a vacuum cleaner.” The higher the power, the more speed you will have in the eye, notes Bolz,

and the higher the effect, the faster the vacuum will rise.

“The big difference between peristaltic and Venturi is that you don't need to have occlusion to build up the vacuum,” Bolz continues. The Venturi pump is very direct and precise, and it has a very logical response behavior. Bolz compares it to driving a car – “as soon as you press the pedal, you immediately have vacuum.” By directly controlling the vacuum and indirectly controlling the flow – the reverse of the peristaltic pump process – the surgeon can achieve much more speed. In this way, suggests Bolz, the Venturi is suitable for more experienced practitioners.

SPEEP

To combine the advantages of both the peristaltic and Venturi pumps, Oertli has developed the SPEEP pump. This innovation is a modulation of the peristaltic pump. The rotation speed of the wheel is fixed and the surgeon only adjusts the vacuum using the pedal. “As soon as you press the pedal, the wheel starts to move immediately – and very fast,” explains Bolz. The more pedal deflection, the more vacuum is released. As with the peristaltic pump, linear vacuum is only achieved by occlusion. “The difference is you can release the pedal to reduce the vacuum, and at this point the wheel will turn in the opposite direction, which is not possible with a standard peristaltic pump.”

The SPEEP pump is highly controlled; it has high power with less turbulence and is slightly delayed but with less time delay than peristaltic. Application examples include cortex removal, polishing, peripheral vitrectomy, and retinal detachment etc..

Essentially, says Bolz, “the SPEEP pump offers both the peristaltic and Venturi systems in one, but with less turbulence than the peristaltic and more speed than the Venturi.”

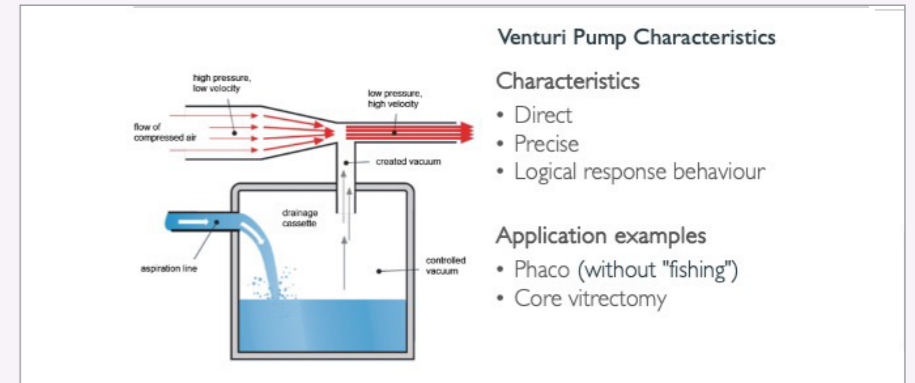
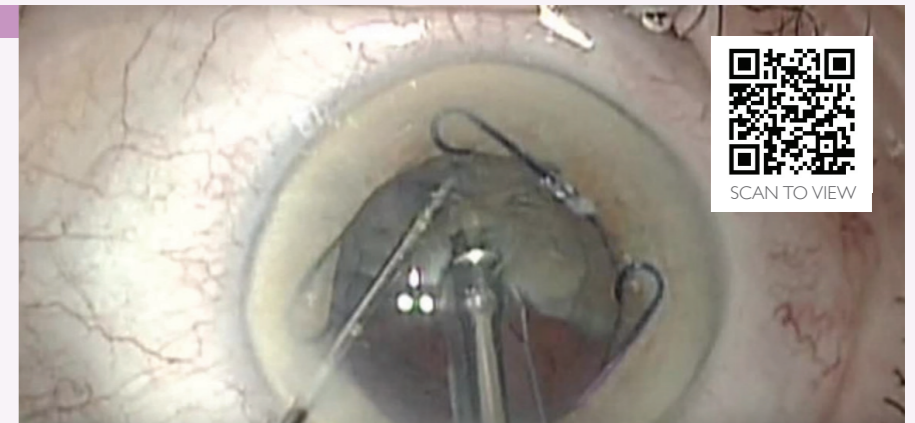


Figure 2: The Venturi pump

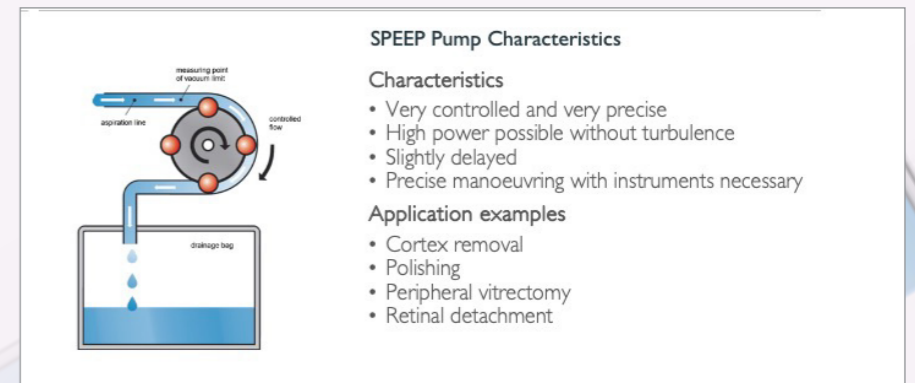


Figure 3: The SPEEP pump