



Top Closure for Wound Treatment

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Wound healing often takes a LONG TIME. The goal is to get to wound closure as quickly as possible, to prevent infection and other complications.

Infected wounds can take years to close, and sometimes they never do. For example: trauma wounds – they can get infected immediately and take a long, long time to heal.

The longer the antibiotic treatment we apply to the wound, the higher the chance of developing antibiotic resistant bacteria and the lower the chance for the wound to heal without complications.

Negative Pressure Therapy

The vacuum system was developed 20 years ago. It's the most important technology we have today to close the wound. But not every vacuum treatment is the same. Vacuum treatment is called Regulated Negative Pressure Wound Therapy. The regulation of the vacuum is a very important issue. Basically, this instrument is a pump that is regulated by a computer, generating the vacuum to be applied to the wound with various dressings.

2 negative pressure therapy myths:

- The vacuum promotes blood supply to the wound
- 125 ml is the best vacuum to promote granulation tissues

Both of these are found extensively in the literature... and both are not true.

We did an experiment to measure the topical pressure that the vacuum generates on the wound. The higher the vacuum, the higher the topical pressure. That means we should consider vacuum treatment as an ischemia forming process. That's critical in diabetic foot or trauma



cases – we should NOT use the vacuum since it will increase ischemia. For these cases, we should use the lowest vacuum possible. You can damage the wound and the skin with high pressure. We must use LOWER pressure. Necrosis can be caused by applying high vacuum to the wound.

What's the optimum negative pressure? The lowest possible.

Continuous or intermittent? Intermittent for sure, because continuous provides continuous ischemia to the wound. Alternating ischemia and perfusion is best.

Another factor in the vacuum system is the shearing forces it applies to the wound. This repeated motion of shrinking and expanding helps wound healing.

Oxygen and Negative Pressure

Another important issue with vacuum: we reduce the Po₂ (dissolved oxygen) in the wound. (Henry Williams discovered this 200 years ago). Important in infected wounds. Relevant to diabetic foot or chronic wounds, and also trauma cases.

What we designed: a way to provide oxygen to the wound, together with the vacuum, to increase the Po₂ in the wound according to the flow of oxygen, to 40, 60, 80. Regulated oxygen and raw NPT.

Why not use oxygen together with vacuum?

When you increase the Po₂ in the wound, you increase the diffusion of oxygen to the depth of the wound, which influences the bacteria inside the wound. Published this in 2010.

Alpha toxin does not generate in an atmosphere with Po₂ above 250. When we increase the Po₂, we can be assured the alpha toxin is not generated. This is a substitute for hyperbaric chamber.

Irrigation and Negative Pressure

How does the vacuum affect the surrounding tissue of the wound?

Did an experiment – created a wound on the back of a rabbit. We applied the vacuum and instead of flowing toward the regional lymph nodes, the dye flowed toward the vacuum. Phenomenon of the reversal of the lymphatic flow around the wound.



We were trying to see how bacteria is eliminated from the wound. Designed an experiment where we labeled the bacteria with nanoparticles of gold and inserted it into eColi. We created a wound and applied the bacteria to one end of the wound together with a vacuum. Here, we could follow the bacterial cloud and show the flow of bacteria toward the vacuum (without irrigation.) There was almost no flow of bacteria (5%) out of the vacuum during 120 minutes. By adding irrigation to the wound, we could prove extraction of bacteria from the wound (45% reduction of bacterial count.)

Because of this, we recommend **Regulated Oxygen And Irrigation Negative Pressure Assisted Wound Therapy**. Combine oxygen and irrigation. The original negative pressure is outdated! *Change it.*

Another issue with vacuum: possibility of bleeding (mortality can result from this bleeding.)

Use LOW VACUUM to reduce bleeding, along with dressing. We must see the bleeding before it gets to the container. We developed a sensor with alarm for bleeding so we can control it.

Antibiotics, Biofilm, and “Drip Irrigation”

(For 10 years, Dr. Topaz worked treating infected pacemakers)

All infected pacemakers were extracted in order to remove the pacemaker and move it to the other side. This is due to the inability to use IV treatment to eradicate the biofilm that develops on pacemakers. We developed a system to provide antibiotics in very high concentration to treat even biofilm. Many publications talk about irrigation of the wound but it's for limited time. It doesn't affect these biofilms. Within 48 hours, we can get substantial antibiotics to the pacemaker and maintain that concentration over 10 days-2 weeks, alleviating the need to remove or relocate the pacemaker.

1959 Israeli invention of drip irrigation – same idea - we need to apply the high concentration of antibiotics exactly where the infection is. This way, we can treat infected implants, joints and wounds.

Wound Closure

Now, we need to CLOSE the wound. Surgeons have been suturing for thousands of years. Even the ancient Egyptians did it with needles made of bone and threads made of hair.



But if we're talking about wounds that are too big to close naturally with sutures (would be too much tension), we have two options: skin grafts and flaps, or (in less extreme cases), stretching the skin.

2 mechanisms to stretch the skin:

1. Stress relaxation: (pulling and relaxing the skin – it stretches) The limitation here is the ischemia that we generate on the tissue. We can't pull too hard. In clinical aspect, we can pull for 4-6% (elongate it 4-6% only).
2. Mechanical creep: slow stretching of the skin – you can do this substantially, but it TAKES TIME. In plastic surgery, we use tissue expanders. But it could take up to 3 months to expand the tissue enough to close the wound. We don't often have that kind of time.

In 1995, I had to think differently. There were suicide bombing attacks in Israel – we had to treat these patients. Granulation tissues over the intestines. We could apply skin grafts, but we tried to stretch the skin. It failed because of the pressure on the skin. We could elongate it some, but not all the way. It took 4.5 months to close one of the wounds and send the patient home. If he wasn't young and healthy, he would have gone from one sepsis to another, with all the consequences.

We then developed the Top Closure. Two plates applied on both sides of the wound. We pull by mechanical creep, slowly stretching the tissue and bringing the edges together. We can adhere to the skin with glue or with sutures or staples and bring the wound edges together. With Top Closure, we generate 10,00 times less shear stress to the skin than with sutures. But if we apply tension sutures and pull it very hard, we can do it FAST with high tension!

Use the system with infected wounds. You cannot close infected wound with sutures, but you can do it with Top Closure and then open it back up to clean it. Use oxygen, irrigation and vacuum together with Top Closure.

We apply the Top Closure before surgery, with mechanical creep, stretching. Reduce the tension, reduce the stay in the hospital, close the wound.

During the surgery, we can do stress relaxation and stretch the tissue by 60%... DURING SURGERY! It takes 30-45 minutes. After surgery, the next day, we go for mechanical creep to bring the wound edges together WITHOUT SKIN GRAFTS. We can close huge wounds within 2-5 weeks. This is new technology that can stretch the skin and close the wound in a very short time, without flaps or skin graphs. Plus, tiny scars. We are using the viscoelastic properties of the skin like never before.



We were taught to do undermining, but it jeopardizes the flap; you have to put a drain in. We don't have to do any undermining with Top Closure.

This system reduces ischemia to the wound. We can also reduce the inflammatory phase (by raw NPT) but then we don't need the vacuum to grow granulation tissue. We can stretch the skin instead of waiting for granulation tissue, resulting in closing the wound MUCH faster. This is a substantial change, which reduces the antibiotic treatment and the complexity of wound.

We can close fasciotomy, severe trauma, all with Top Closure + raw NPT, even with minimal debridement because we don't get the typical infection. We can also avoid amputations with this system.

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