

use of all levels of pressure and specific levels of rate of flow, I was immediately challenged regarding the danger of swelling the face of the body we were using for demonstration. The body had a very long laceration caused by an auto accident. This cut started about the middle of the forehead and continued down the face over the nose down through both lips, to the cleft in the chin. The audience continued with comments, as you can probably imagine, challenging me about swelling this area, which seemed to them to be unavoidable. I then realized I would have to demonstrate even higher pressure than I probably would ever have used on this case. I remember that it was time to put up or shut up. The body was unautopsied. I injected up the head at 175 lbs of pressure with approximately 3 oz per minute. NO SWELLING and a very quiet audience.

I know I have consistently mentioned that swelling is not caused by high pressure, and I want you to remember it is rate of flow that is the MAIN problem of embalming swelling.

I was very fortunate to study many years under Don Sawyer, a man way ahead of the times, with an enormous knowledge of the art and science of embalming. He was my friend and my mentor and he taught me that embalming with controlled pressure and rate of flow, as well as always using pulsation, is the best technique to distribute chemical evenly to all bodily tissues. It also maximizes drainage and tissue saturation to create a natural, presentable embalming result for family and friends.

I hope this information is helpful to those of you looking to improve the quality of your embalming. There is, without a doubt, much more to discuss, perhaps one on one. If anyone would feel comfortable discussing any of this information further, please feel free to call Dodge and they will contact me to arrange for us to talk at your convenience.



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Embalming Using Elevated Pressure and Lower Flow with Pulsation

By Bill Martin

Before we talk about pressure, we must first understand what causes swelling during the injection of preservative chemical solutions. All bodies will accept a rate of flow that will allow even distribution of chemical without swelling. Whatever that rate is, one thing will always be true: none of them will assimilate chemical at the same rate of flow. If you think about that, you now know that a low rate of flow will give you the most even distribution of preservative chemical. If you consider that you cannot compress a liquid, you will understand that pushing a solution into a system at too high a rate of flow will

cause the chemical to seek the area of least resistance and therefore cause tissue distention. Thus, a low rate of flow will always allow better results. It often seems reasonable to increase the rate of flow if distribution is not as thorough as we think it should be because we have been taught, erroneously, that increasing the pressure would cause swelling. Remember, you cannot compress a liquid so trying to increase vascular pressure by rate of flow will eventually, if not immediately, cause an embalming disaster.

Drainage and distribution will most often be increased with elevated pressure and low flow with pulsation.

Over the years and even today embalmers will use a drain tube to increase vascular pressure by closing the drain tube. If your injector will not develop sufficient pressure to help distribution, this technique will help you, but only to a minimum level, as the solution cannot be compressed. You must not leave the tube closed too long. Most of us have used that technique to help with drainage and actually were able to help distribution somewhat if the procedure is done correctly. You are taking a big risk if you try to help distribution by closing drainage, especially if rate of flow is already too high. Drainage and distribution will most often be increased with elevated pressure and low flow with pulsation.

Embalmers continue to question the use of pressure embalming. I think it is important to clear the air regarding this subject. I can say this with strong emphasis: pressure does not cause tissue swelling during embalming. Rate of flow is the one and only reason tissue will swell. Pressure, when set on your machine, cannot cause swelling because swelling cannot occur until the rate of flow valve is opened. Simple enough. Even then, swelling will not occur unless the rate of flow is set higher than the body can assimilate the chemical solution. The chance of swelling is much greater at a lower pressure with the rate of flow set too high. Keeping in mind that we cannot compress a liquid no matter what the pressure is, it stands to reason that elevated pressure will move a low rate of flow through the system at a safer rate. This rate will also move clots and, in general, enhance drainage along with much better tissue profusion. Therefore, embalming will be efficient with much better tissue appearance and the remains will generally be much more recognizable by the family and friends. Bodies with overly firm tissue often will have distorted facial features.

Another good reason for elevated pressure with low flow is when the person has been deceased for a length of time and when the remains have been refrigerated before

we embalm. The body's resistance to good distribution is much greater after approximately two to five days of refrigeration. After approximately five days, if the body is not frozen, it usually does not maintain such strong resistance to distribution of the embalming solution. By then the blood clotting is not as much a problem, the blood returns to a more fluid condition and, of course, settles out into the dependent areas of the body. During embalming, we hope to see some bleaching of the dependent parts of the body, but because of postmortem staining, clearing will not be complete. Elevated pressure with low rate of flow will always help clear some areas of blood accumulation that otherwise would not clear.

After considering these observations, what is the definition of high and low pressure and moderate or what I call elevated pressure? It is safe to assume that most of us have been taught the danger of high (which usually means anything above 20 pounds) pressure. If we try to open our minds and accept the fact that rate of flow is the cause of tissue distention, it makes sense that high pressure cannot be defined to fall in any particular range. Again, remember rate of flow will always be the reason for

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swelling because if pushed into a system too fast, swelling of the most vulnerable soft tissue will usually happen first, i.e. the eyes, lips, neck area, and most facial features. Pressure does not push chemical into any area fast. High rate of flow is the only setting that can cause swelling at any pressure setting.

For the sake of discussion, I will suggest you consider specific numbers that will help you understand low, elevated, and high pressure. I consider any pressure setting that is below 40 psi to be low. I have used the term "elevated" to describe pressure settings that could be considered moderate. Those settings would be 40 lbs. up to 80 lbs. Again for the sake of discussion, high pressure would be 130 to 150 lbs.

Whatever pressure setting you select, hold the rate of flow low to approximately 8 to 12 ozs per minute, until you establish good drainage. Then you may raise your flow if needed. I have found that I have the greatest amount of success when I always, always, always use pulsation. Depending on the condition of the body, about 5 to 6 ounces injected up into the head would usually be safe, with pulsation.

Unfortunately, most embalming machines have a very

low pressure range. Because of this problem, elevated pressure will usually be impossible to attain. If you are unable to move up to a machine that will allow more variable levels of pressure, you will be unable to maximize the effects of good chemical distribution and enhance drainage. I would strongly urge you to consult with your funeral home manager or owner and step up to the level of embalming that will increase the quality of your work by increasing your options for the types of bodies that we are faced with today and better serve your client families.

I recently met with a customer who shared with me a situation he was involved with that required embalming of a body that was radically discolored and in advanced stages of decomposition. Areas of the deceased had been exposed to the elements which allowed greater decomposition and other areas were very dehydrated. The varied conditions of the tissue of this body required decisions that we usually do not face very often. Because of these conditions, the embalmer realized a stronger solution would be required to complete the embalming. Other considerations were that the body was to be shipped and the family wanted viewing. I am not sure if viewing was going to be available for the public, but the family was sure they wanted to see the body. The point here is that when he started the injection process he soon found that pressure below 100 lbs was not going to give him distribution good enough for thorough tissue profusion. He was able to maximize the pressure capability of his injector by going to 150 lbs which eventually gave him excellent tissue saturation at all points. He did need to use multiple injection points and was able to realize total distribution with total tissue profusion. The most interesting part of all of his work was that the head was injected with over 100 lbs pressure without swelling. "No swelling?" I said. His response was, "I used a very low rate of flow with pulsation and waited for the results to reach the level of fixation that I wanted."

I remember that it was time to put up or shut up. I injected up the head at 175 lbs of pressure with approximately 3 oz per minute. NO SWELLING.

As we know, trauma, particularly head trauma, will allow tissue swelling always when using a high rate of flow. One incident of this nature I can recall was during an embalming demonstration/clinic in the prep room of a mortuary college facility. After opening comments regarding the