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WATERLESS EMBALMING: NEAR-ANHYDROUS ARTERIAL INJECTION ACHIEVED.

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ABSTRACT: The misnamed and misunderstood concept of waterless embalming is reexamined in depth from a current and historical perspective. The advantages and disadvantages are evaluated in light of modern embalming theory. The concept of near-anhydrous arterial injection is presented and explained as the closest embalming methodology to "true waterless" embalming. Using near-anhydrous arterial injection chemicals results in near-anhydrous arterial injections approaching 90% chemical with very small amounts of residual water present. Classic dilution embalming, pseudo-waterless embalming and near-anhydrous injection solutions are contrasted and compared. Near-anhydrous arterial injection is seen as the only viable methodology approaching a "true waterless" embalming. Final commentary and a summary completes the article.

AN INDUSTRY THAT IS STEEPED IN TRADITION, IS JUST THAT.

STEEP(ED), v.t. to immerse, saturate or imbue with some pervading, absorbing or stupefying influence; to soak or stew in your own liquid until extracted or exhausted.

-JHB

INTRODUCTION: So-called waterless embalming has always been misdefined, misconstrued and misnamed. There never has been and never will be "true" waterless embalming, it is practically impossible in the real world. The difference in water content from classic dilution embalming and so-called "waterless" embalming in the past is essentially trivial and not even a concept in total injected water in most cases. It has been used as a marketing gimmick to drastically increase the usage of various additive embalming chemicals under the guise of being a technological leap forward. The embalming results from this old-style or pseudo-waterless injections are sometimes better in severe cases, but in the vast majority of normal to near-normal cases, little difference can be seen.

"True" waterless or near-anhydrous arterial injection solutions would be and are a definite technological advance in that all or essentially all residual water is eliminated from the arterial injection resulting in elimination of water impurities, reduced injection volumes, and superior results with edematous or wet bodies where additional water injected exacerbates embalming problems. Champion has developed a near-anhydrous arterial injection procedure with the introduction of PLASMA Injection Factor. PLASMA allows, for the first time, a true "near-waterless" arterial injection with total injected chemical approaching 90%. The result is far superior, faster arterial embalming with deeper penetration and increased tissue saturation levels without the introduction of unneeded or unwanted water as an inert carrier. Near-anhydrous arterial injection has been achieved. But first, let us delve into the history of the "waterless" concept itself.

HISTORY: The mythology of "waterless" embalming has been bouncing around the industry for years now. It had it's heyday in the late 60's, 70's and 80's when the travelling embalming seminar ("with body present" considered de riguer) was a thing to behold. In an industry where essentially nothing changes and there hardly is anything to talk about anyway, the buzz about "waterless" was significant and the sales pitch that was snuck in the side door was impressive. As a kid, I remember sitting in the back of one of these seminars and watching the miracle of just using all embalming fluid instead of dilution water unfolding before my very eyes. I eagerly rushed back to the embalming room and tried it several times and — behold — nothing seemed any different — absolutely nothing. Oh, well. Gone, forever, are those halcyon days of what I light-heartedly and in jest refer to, as, the travelling dog-and-pony show era. The waterless buzz continues to this day, although significantly reduced now to a murmur. After all these years the newness of the concept has seriously wore off as just about everybody has heard about it and the interest in technical training and information, especially of an embalming nature is at an all-time low and continuing on a rapid decline (death spiral would be a better name). The dismal attendance at the few, if any, remaining embalming/technical seminars that recycle the same old tired ideas is silent witness to this trend. The ponies are all gimp-legged and out to pasture and the dogs are toothless and confined to the porch. And as it is written, these things too shall come to pass. And another tradition becomes — well, — steeped. And, perhaps, that is good.

THE MYTH: Waterless never was waterless, in fact it wasn't even close. I exhaustively investigated this fallacy in an earlier Champion Encyclopedia article and demonstrated that the reduction in total water injected was pitifully small and borderline insignificant. I encourage you to read this earlier article

as it sets the facts straight concerning pseudo-waterless embalming mixtures. As all embalmers know, formalin and basic arterial fluids are at least two-thirds water or more. This is the chemical facts of life regarding formaldehyde gas dissolved in water, and there is no way around it. Consequently, just using various embalming fluids and their additives will not seriously reduce the amount of water you are injecting in the final dilution. This fact is played out in the empirically observed results of comparison embalmings. In the vast majority of normal to near-normal embalmings, no noticeable differences in the embalmed bodies are noted when you embalm with conventional water dilution or use pretend or pseudo-waterless embalming. Only in the most severe or difficult embalmings does a difference start to appear. In these types of severely compromised bodies, any reduction of dilution water, even if small, would be a positive contribution toward a successful embalming result. This is predominately the reasons that I and The Champion Company have never recommended or endorsed the concept of pseudo-waterless style injection, except in the most severe of cases.

There is one other curious fact that is found if you look closely at the recommended quantities and dilutions of various arterial fluids and the typical additives in pseudo-waterless embalmings. Since you have no dilution water, you substitute bottles and bottles of various water conditioners, buffers, rectifying chemicals, pH setters and humectants for the dilution water, but at the same time you use 2-4 times the typical amounts of arterial fluid as in a normal body, yet the embalming results essentially mimic the embalming results of a conventional water dilution embalming. Some recommended amounts of high index arterials actually approach what would be an anatomical final dilution. What is going on here? What is happening is massive neutralization of available formaldehyde in solution by the excessive amounts of embalming additives, therefore, requiring drastic increases in total formaldehyde present to overcome the neutralization. This is essentially driving around with your parking brake on. You need to add a lot more formaldehyde in solution because you have skewed the pH, neutralized and complexed out a significant amount of the bound and unbound available formaldehyde for protein fixation. You use a lot more of all chemicals, but you really don't get anywhere faster or better in the vast majority of embalmings. This also explains why the only time pseudo-waterless style embalming seems to be better is in severe or extreme cases, where any increase in formaldehyde (complexed or otherwise) and any reduction, even if slight, in water injected would be a help. Consequently, except in these severe/extreme cases, The Champion Company never endorsed the "waterless" technique in its classic industry embodiment. With a modern solution to this problem, all that is about to change.

THE MODERN SOLUTION: Near-anhydrous arterial injection, where a very significant reduction in total injected water is involved in the embalming is definitely a superior embalming methodology for numerous reasons. Near-anhydrous arterial injection comes as close as is reasonably possible to a true form of "waterless" embalming. Near-anhydrous arterial injection virtually eliminates the negative impact of dilution water in embalming. Gone are the hard and heavy ions and dissolved impurities inherent in dilution water. The temperature variants of tap water, processed or otherwise, are eliminated, allowing consistent and reproducible embalming results. Near-anhydrous injection virtually eliminates injected water and results in superior embalming results with edematous bodies, swollen or bloated bodies, wet or moisture laden bodies in general and bodies with potential leakage problems from weeping tissue moisture.

Until now, there has been no embalming method that could even come close to a near-anhydrous injection embalming. With the introduction of Millenium New Era PLASMA Injection Factor all that has finally changed. PLASMA is itself 95% anhydrous, with the only water present in the carrier being that which is inevitably married with the chemical components themselves. When coupled with normal quantities of arterial fluids and co-injects, the final injection solution approaches 90% anhydrous. This is a phenomenal reduction in total water injected and a drastic decrease from traditional dilution embalming and pretend/pseudo-waterless injection procedures. Table 1 delineates this drastic elimination of water in arterial injection and compares the relative water content in the three styles of injection.

	Normal Dilution Embalming	**Pseudo Waterless Embalming**	**Near-anhydrous Injection**
Total Water From Fluids	22-24 ounces	54-62 ounces	16-18 ounces
Total Water Added	80-85 ounces	—0—	— 0 —
Total Water per Typical Injection	102-109 ounces	54-62 ounces	16-18 ounces
% Water Present in Total Injection	80-85%	60%	12-14%

Table 1
Water Present In Various Injection Solutions (Averages per Gallon)

PLASMA's carrier component base is an alcohol/glycol mixture buffered to essentially a neutral pH for maximum effective embalming and compatibility with all arterial injection fluids. Isopropyl alcohol in the formulation acts as an effective solvent, sanitizer, diluent and carrier and is a reasonable low-impact exposure hazard in embalming rooms when utilized safely and correctly. It is present in many of Champion's formulated fluids and is especially complementary to glutaraldehyde-based embalming chemicals. The glycol utilized is propylene glycol which is compatible with arterial chemicals and their additives and a very safe chemical, in general. Propylene glycol is a lower molecular weight glycol with a minimal exposure impact when used as a diluent in embalming solutions. You are already familiar with this chemical as it has been famously used for theatrical fog and smoke effects for years. The pleasant, somewhat sweet smell of this aerosolized chemical is the basis of the fog creeping across the stage and

dissipating into the auditorium in your favorite play or stage show. The chemical is also the principal ingredient in alternative antifreeze solutions that are pet-safe (traditional antifreezes being, of course, lethal to dogs and other animals) and overall drastically lower in environmental impact. Propylene glycol even has food, flavorings and humectant additive uses in lotions and bubble baths and is recognized by the FDA as essentially safe in food, medicine and cosmetic usage. It typically can be found as an ice-cream texture enhancing additive. One other interesting use is as the paint solvent/carrier in paintballs for wargames. The exposures in embalming rooms are essentially minimal for this chemical. Glutaraldehyde is utilized in small quantities in PLASMA Injection Factor as a booster aldehyde for increased sanitation and improved embalming results in general, as glutaraldehyde exhibits deeper tissue saturation and more controlled protein reaction chemistry, than does formaldehyde, which is harsh and over-reactive especially in arterial fluids. My primary focus and goal at The Champion Company in any formulation or reformulation is safety and exposure reduction for the embalmer, first, always and foremost, period. PLASMA Injection Factor is truly a minimal impact exposure concern for embalmers and does not add significantly to the existing levels of exposures in embalming rooms.

Table 2 demonstrates the drastic reductions in total water injected in near-anhydrous versus traditional and pseudo-waterless embalmings, with reductions of easily 70-85%, according to circumstances. This is as close as we will ever get to "true waterless" embalming solutions. Final dilutions of aldehyde preservative is standard at approximately 1.2-1.5% with barely a quart, or slightly more, of water along for the ride in the entire embalming procedure. This is an astonishingly small amount of water present in an arterial injection. Table 3 outlines these facts and confirms the total embalming solution water content as 34-42 ounces (essentially a quart) with the total solution being 87+% anhydrous (i.e., approaching 90%) or water-free. This is an extreme reduction in water content of modern arterial injections in any embodiment. The necessity of rectifying/water conditioning chemical additives is eliminated as well as humectant additives being used. Only reasonable and normal amounts of standard arterial fluids and their corresponding co-injectants (such as BETA Factor) need be used along with PLASMA Injection Factor. In fact, any or all of the dilution water can be substituted out as the embalmer sees fit. As much, or as little, PLASMA Injection Factor can be used to replace some, any, or all the water in an arterial injection.

Near-anhydrous injection utilizing PLASMA Injection Factor as the carrier/diluent will result in a faster, deeper penetrating, more rapid tissue saturation, particularly with glutaraldehyde potentiated or glutaraldehyde/based arterial chemicals. Glutaraldehyde/formaldehyde blended arterial chemicals will yield excellent arterial embalmings with this method. Better dye tissue saturation, penetration and retention will also occur with the result being a more cosmetically appealing embalming. Utilizing PLASMA on edematous or moist cases will result in superior embalming results with increased action of proven edema chemicals, such as XEROS. Recommended arterials would include LEX, DiFORM40, PK/PLX, JaunDial, or FAX, all of which are glutaraldehyde/formaldehyde reduced exposure blends which emphasizes the sanitizing and embalming ability of glutaraldehyde without sacrificing the rockhard firming action of traditional formaldehyde embalming. The result is superior embalming with significantly reduced overall exposures, especially to formaldehyde, which is the major exposure problem in embalm-

ing. Specialist with XEROS would be recommended for edema with PLASMA making up the remaining dilution volume. PLASMA is completely compatible with OMEGA Decomp Factor and would potentiate OMEGA type embalming action in decomp or delayed embalming situations. An ideal cavity to complement near-anhydrous arterial injection, would, of course, be CAVITY 48, which is itself very low in water content and duplicates or exceeds the action of an index 50 cavity chemical without formaldehyde to deal with as an exposure hazard. Formaldehyde just does not need to be in cavity chemicals in any modem embodiment, as extreme levels of cavity embalming can be achieved with glutaraldehydes

Normal Dilution Embalming		**Near-anhydrous Injection**		**% Reduction**
102-109 ounces	➡	16-18 ounces	➡	85%
Pseudo Waterless Embalming		**Near-anhydrous Injection**		**% Reduction**
54-62 ounces	➡	16-18 ounces	➡	70%

Table 2
% Reductions In Water Injected

and other chemicals with total overall chemical exposures drastically reduced. In fact, formaldehyde just doesn't need to be present hardly ever in modern embalming, except as a drying agent in arterial edema embalming and to generate rockhard firming/skin-tightening/drying action. A small amount of formaldehyde, late in the injection, is more than sufficient to duplicate or mimic a typical oldstyle embalming, where the corpse is rockhard and dehydrated. Other than that, formaldehyde just doesn't serve any viable purpose in modem embalming. Formaldehyde is the most serious exposure hazard in the embalming room - always has been, always will be. This sad fact will never change, and to ignore the reality of it is sheer stupidity. The calculus of relative value derived from formaldehyde in embalming versus the increased total exposure hazard just does not compute. As far as formaldehyde goes, use a little of it arterially and lose the rest of it - your embalming results will be drastically improved and your total chemical exposures significantly reduced — a true win-win situation.

Realistic Total Water Present in Near-anhydrous Injection	➦	34-42 ounces
Percentage of Solution that is Anhydrous	➦	87+%

Table 3
Near-anhydrous Injection Parameters

CONCLUSION: Near-anhydrous arterial embalming is now possible. Injection procedures utilizing PLASMA Injection Factor along with moderate and normal amounts of arterial fluids and accompanying co-injectant, such as BETA Factor, allows an embalming with an extremely small amount of water present. Near-anhydrous injection redefines what "waterless" embalming is and eliminates the myths that were previously associated with it. Exposure impacts are minimal with no compromise of any safety issues during embalming. The procedure is flexible with as little or as much water elimination/replacement as the individual embalmer sees fit on a case-by-case basis. Water can now be completely controlled, added, reduced, or eliminated to near insignificance in all modem embalming situations. In embalming, think scientific and, as always, embalm smart, embalm safe.

REFERENCES: Consult my previous Champion Encyclopedia article concerning waterless embalming for a list of references that are valid and relevant. Additional references include my lab/technical notes and reports with the Champion Company and the MSDS/Product Data Sheet for PLASMA Injection Factor which is available through The Champion Company's website. A massive amount of references regarding the relative efficacy, embalming value, exposure hazards and environmental and health concerns of glutaraldehyde versus formaldehyde is contained in several of my previous Champion Encyclopedia articles and I encourage you to consult them for an indepth discussion and comparison of the true value of glutaraldehyde, the gold standard of disinfection/sanitation and, in stark contrast, the fools gold of formaldehyde. Sorry to burst your funerary bubble, but the research and facts are scientific and unassailable, and that's just the way it is.