The Decompression Curve

by George Irvine

Decompression is a not linear event: twice the bottom time does not mean twice the deco, and half the bottom time does not mean half the deco. This is fairly intuitive, but for you Marines, the fact is that the fastest movement of gas occurs where there is the greatest differential. When you first go from one ATA to two for instance, there is a fast on gas rush, but as you stay there a while it slows down since the gradient factor powering the movement is lessening, like charging a battery.

On gassing is easy - you do not blow gas into the tissues in bubble form by on gassing. Off gassing is more tricky, as you want to prevent bubble formation in the tissues at all depths, and in the blood deep. Off gassing in bubble form into the blood is extremely efficient time wise and allows faster decompressions that avoid building in one tissue while eliminating in another, but this is for non shunt people only. Unfortunately for the shunts, the greatest incidence of bubbling into the venous blood occurs after you get out of the water.

It takes a certain amount of time to circulate the blood, maybe about two minutes, and it can take as much as five to get gas in solution to begin to come out of solution in bubble form in the tissues or into the blood in response to a reduction in pressure. Most of the short on/offs are handled well by the body in terms of outright pain or obvious symptoms, but they may cause the body's immune system to respond to the insult that is actually occurring, and uneven off gassing from sensitive tendon attachment points and live bone surfaces as well as certain dense muscle may not be able to accommodate the super short cycles. Tissues that are hard to on gas are not as much of an issue on minimum deco, only on longer exposures.

We have found that the short schedules under 30 minutes are inaccurate predictors. What we do is set a shape for the deco as if it were a longer dive, complete with starting the stops at 80% of the profile in ATA's, and merely go to a minimum reading for each stop. The minimum deep stop is 20 seconds at each ten feet, which is effectively 30 feet per minute plus the moving time. The max for these is five minutes for saturation (or anything within 85% of technical saturation, which I assume to occur at 150 minutes bottom time).The stops indicated by the shape of the deco curve higher up need to be done to a minimum number, like 1 minute for the deeper ones and then more when the gas switches come in. Give the gas a chance to work, then go back to the curve with the 1-2 or 3 minute stops. As you get higher up, the fact that you did the deeper part more meticulously will allow some abbreviation in the shallower steps.

In any of these decompressions, do your calculation and then discard the ten foot stop completely from the figures - throw it and its time out completely - that is total bullshit. Then ask yourself how much time do I need at 20. The answer is, enough to make it work if I did the deeper steps correctly. Two minutes on oxygen is not doing anything, ten is more like it. However, what you want to do is incorporate a slow ascent rate into the last 20 feet of the dive, so what was the 20 foot stop should be eased up from 20-6 in a steady motion after you have sat at 20 and allowed a full circulation of the blood and the effects of the pressure change and the gas to begin to work and a relative time based on you real bottom time where the total of the 20 plus ascent to surface is at least equal to your bottom time, again assuming you have done the other steps correctly. Do not waste a bunch of pyramided time at steps where there is little partial pressure advantage, use the gradient more in these cases, again assuming you have conscientiously done the lower steps.

Don't be in any big hurry to get up from the bottom, and do not be in any big hurry to get up from 30 feet to the surface. These two areas need careful attention.

I think that if you discard the 10 foot silliness in any program and the unnecessary time, then put some of that time back into the correct shape and strategy, you will not only prevent the out right DCS, you will prevent the sub clinical DCS and the immune responses.

If you execute deco correctly and are in good shape and have no preconditions, you should be clean and ready for anything 30 minutes after you get out of the water. You can tell if you have not done what I am saying here, you will not feel so good. It will be subtle, but if you want to test it, try going for a run. If you are immediately short of breath, you blew the deco. If you can rock, you did it right. If you get bent trying this, then tough luck, blame JJ. In reality, you will feel a little sluggish and heavy just putting your gear away if you did an inadequate deco.

Now, if there are questions that can help with the understanding, bring them on. If anyone wants to argue with me, save your breath and be ready to show me your logbook, and don't bother with the IANTD, TDI, PADI, DAN or any other form of nonsense that is floating around out there. Nobody understands this like I do, and nobody can execute it like I do, and nobody has done it this way for as long as I have, not even my own team. I know for a fact that this is not only correct, it is correct beyond a shadow of a doubt. I remember getting Exley to get out of the water with me at Wakulla one time on my schedule. That was easy to do with him because he responded very well to peer pressure - I could get him to do anything I dreamed up. He spent the next four hours in the lobby of the Lodge getting FSU to Doppler him over and over just waiting for the big bends hit - never happened. That was nine years ago. We have really perfected it now.