

## EFFECT OF A DEEP STOP ON VGE BUBBLES AFTER A 20 MSW DIVE

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### Background/Objective

On the basis of the varying gradient model, a classical theory of bubble dynamics (Yount and Hoffman 1986), deep stops (maximal diving depth, MDD) are assumed to reduce the amount of precordially detectable bubbles and thus may diminish the DCS risk. However, published effects of deep stops show inconsistency (Marroni et al. 2004, Blatteau et al. 2005). In these studies the deep stop was added to the stops of the control dive. To ascertain whether it is the deep stop or a prolonged decompression time that is responsible for this effect, the deep stop should not increase decompression time. We examined under this condition whether a deep-stop dive produces less bubbles.

### Materials and Method

Recreational divers (32) performed either a deep stop profile (DeSt) or a control dive (Contr). Both groups were matched biometrically. MDD was 20 msw, bottom time 40 min, total diving time 47 min. In DeSt, the "deep" stop (10 msw) replaced 4 min of the 7 min stop at 4 msw of Contr. Flex bubbles were recorded 40 and 100 min after surfacing.

### Results

Yates Cochran and paired t-tests yielded nearly significance more bubbles with DeSt than Contr. With combined data, Yates Cochran and mixed models gave significant and KISS nearly significant outcomes. %M-values (ZH-L16C) of DeSt shows lower %M-values from 10 msw to surface and higher afterward.

### Discussion

Strictly, on the basis of Haldanian theory, no benefit can be expected of any deep stop replacing a shallow stop under the prerequisites that M-values are not violated and MDD is at most moderate. However, by adding the deep stop to Contr, after surfacing the relevant %M-values (halftimes 12.5 and 27 min) are ~~also~~ lower than for Contr. This effect was found for extension of the ascent with any stop. The Doppler measurements can be understood when less bubble growth due to the lower %M-values during the DeSt ascent is cancelled or overwhelmed by higher bubble growth due to the higher %M-values after surfacing.

### Conclusion

As yet, with MDD until about 20 msw there seems to be no reason to abandon the classical practise of surfacing with shallow stops when prescribed.

### References

- Blatteau J-E, Hugon M, Gardette B, Sainty JM, Galland FM. Bubble incidence after staged decompression from 50 or 60 msw: effect of adding deep stops. *Aviat Space Environ Med* 2005;76:490-2.
- Marroni A, Bennett PB, Cronje FJ, Cali-Corleo R, Germonpre P, Pieri M, Bonuccelli C, Balestra C. A deep stop during decompression from 82 fsw (25 m) significantly reduces bubbles and fast tissue gas tensions. *Undersea Hyperb Med* 2004;31:233-243.
- Yount DE, Hoffman DC, 1986 On the use of a bubble formation model to calculate diving tables. *Aviat Space Environ Med* 1986;57:149-56.