



Review of Type 1 Decompression Sickness Disposition Policies across 18 Organizations

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Disclaimer



- Due to the nature of altitude DCS, there are very limited studies involving humans and altitude DCS. Modern DCS literature and understanding consists almost entirely of case studies and expert knowledge.
 - There are no randomized double-blind studies
 - Current DCS return to duty practices are historical practices that are (clinically) opinion based rather than research based
- Cannot rely on Apollo experience as the 5.0 psia 100% O₂ environment during Apollo ops eliminated the risk of DCS during EVA



Bottom Line



There is no clear minimum success threshold or known physiological rationale that necessitates a minimum return to duties timeframe after successful DCS Type 1 treatment

- Return to duty timeframes across 18 organizations share similar language, timeframes, and checklists
- Clustering of timeframes exemplify the latency period between research and policy

NASA recognizes the potential for reducing return to duty timeframes with no change in risk posture



Alternative DCS Type I Disposition Policies



UHMS (Undersea and Hyperbaric Medical Society) – “There is **no compelling evidence at present to support any specific waiting period** for return to diving after treatment of DCS”. This is largely accepted as the current state of DCS disposition policies. There is no current physiological rationale that would necessitate a minimum timeframe after successful treatment.

- Why is there a return to duty timeframe? **“Its just what NASA (and others) have always done”**
- 18 different organizations were reviewed (US and International)
 - 3 organizations have a 24 hour policy,
 - 3 organizations have a 72 hour policy,
 - 2 organizations have a 7 day policy,
 - 9 organizations have no specific timeframe,
 - 1 organization does not have a disposition policy



Referenced Organizations

- 3 organizations have a 24 hour policy, one of which requires no medical clearance*:

Association of Diving
Contractors International
(ADCI)*

International Marine
Contractors Association
(IMCA)

Chilean Safety Association
(ACHS)

- 3 organizations have a 72 hour policy:

Aerospace Medical
Association (AsMA)

US Army

NASA

- 2 organizations have a 7 day policy:

US Navy

Diving Medical Advisory
Committee (DMAC)



Referenced Organizations

- 9 organizations have no specific timeframe, return to duty will be determined on an individual basis with clearance authorized by a medical professional:

North Atlantic Treaty Organization (NATO)	European Committee for Hyperbaric Medicine (ECHM)	National Oceanic and Atmospheric Administration (NOAA)
Federal Aviation Administration (FAA)	Diver's Alert Network (DAN)	Professional Association of Diving Instructors (PADI)
Health and Safety Executive of UK (HSE)	Canadian Undersea and Hyperbaric Medical Association (CUHMA)	International Civil Aviation Organization (ICAO)

- US Air Force does not have a documented disposition policy regarding Type I DCS events



“Evidence”



- 1) 2 Major Commercial Dive Orgs *practice* a 24-hour RTD
 - No reported increase in DCS recurrence
 - No reported impact on diver health

- 2) A literature search found no cases of unsuccessful treatment of Type I DCS
 - No report of long-term sequelae of *treated* Type I DCS

- 3) Plenty of cases where a *diver* had symptoms, treated with GLO, symptoms resolved
 - Dove the following day
 - No reported reoccurrence of DCS



Disposition Policy Review

NASA recognizes the potential for reducing return to duty timeframes with no change in risk posture

- Review/decrease of return to duty timeframes may:
 - Remove restrictively cautious timeframes based on legacy DCS data and understanding
 - Unlock mission capabilities located within legacy timeframes

At NASA: Will increase mission success probabilities after a DCS Type 1 event with no change in risk posture for Artemis Missions. ISS: No mission impact (low EVA frequency + alternate crew availability)

- Decrease of return to duty timeframes are driven by the research/medical community and data. Organization goals (financial, performance, efficiency, etc) **DO NOT** drive policy tailoring
- Policy shift is **strictly informed** by the body of available data. No changes are driven by mission considerations



Questions?



Altitude vs. Diving DCS



- Both involve bubble formation and propagation after a reduction in ambient pressure
 - Divers are able to rest when supersaturated (post dive)
 - Aviators and Astronauts must *work* when supersaturated (risk only)
- Both are treated with increased pressure and O₂
 - Both have a *new* decompression stress when they return to work



Appendix B



References



Alternative Dispositions



DCS Disposition Policy	Timeframe	Notes
NASA	Alternobaric duty: 72 hrs w/resolution upon repress, otherwise 7 days after treatment & resolution (excludes cutis marmorata)	This standard dates back to the 1990's and was created in conjunction with experts in and outside of NASA
UHMS (Undersea and Hyperbaric Medical Society)	"There is no compelling evidence at present to support any specific waiting period for return to diving after treatment of DCS" Decision to be made by clinical assessment. Cites USN: 7 days and ADCI: 24 hrs"	This rationale is largely accepted and viewed as the current state of DCS disposition policies. While there is no evidence to specify a timeframe, most orgs chose currently accepted timeframes from other groups
ADCI (Association of Diving Contractors International)	24-72 (simple pain only) Does not require medical officer eval for return to diving	This is a US organization that several petrochemical companies abide by
IMCA (Intl Marine Contractors Association)	24 hrs (uncomplicated recovery)	Requires medical clearance, guidelines used by Shell Oil
ACHS (Chilean Safety Association)	24 hrs (cutaneous/joint pain only)	Requires medical clearance



Alternative Dispositions

DCS Disposition Policy	Timeframe	Notes
AsMA (Aerospace Medical Association)	72 Hours	Based on US Military Policies
US Army	72 Hours	Requires medical clearance
US Navy	7 Days	Requires medical clearance
US Air Force	No current disposition documented regarding a Type I DCS Event	
DMAC (Diving Medical Advisory Committee)	7 days (any residual symptoms = unfit for duty). 28 days cutis marmorata (20% of skin issues involved neuro)	Requires medical clearance
NATO	Follow guidelines for UHMS and ECHIM	Policy based on a joint team of USA and EU experts
ECHM (European Committee for Hyperbaric Medicine)	Individual assessment basis with recognition of very few criteria available. Residua may inhibit return to duty	Requires medical clearance



Alternative Dispositions

DCS Disposition Policy	Timeframe	Notes
NOAA	Individual basis with medical provider clearance and NDC DMO approval	Requires medical clearance
FAA	Individual basis cleared by medical professional	Requires medical clearance
DAN (Diver's Alert Network)	Individual basis cleared by medical professional	Requires medical clearance. DAN researches recreational/professional divers, <u>not commercial divers</u>
PADI (Professional Association of Diving Instructors) Public Safety Diver	Individual basis cleared by medical professional	Requires medical clearance
HSE (Health and Safety Executive) UK	Individual basis and cardiologist assessment of PFO followed by return to duty window determination	Requires medical clearance
CUHMA (Canadian Undersea and Hyperbaric Medical Association)	Clinicians duty to determine safe window for each patient to return to normal activities	Requires medical clearance
ICAO (International Civil Aviation Organization) Manual of Civil Aviation Medicine	Points to UHMS and PADI for additional information and guidance regarding DCS	UHMS and PADI = individual basis cleared by a medical professional