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MOBILE MEDICAL MODULE PROJECT (PROJECT MMM): USING ATMED RESTRAINT SYSTEM (ARS) FOR TRANSPORTING PATIENTS DURING RESUSCITATION IN SIMULATED MICROGRAVITY - TESTS ON THE GROUND, IN NEUTRAL BUOYANCY AND AT ZERO-G IN HUMAN TRAINING CENTRIFUGE

Abstract

Background: Future planned missions to the Moon and Mars entail an increased risk of injuries and sudden illnesses among astronauts. One crucial element of medical assistance is swift evacuation and safe transport from the scene of the incident (injury or illness) or from the spacecraft airlock, where the injured astronaut is received, to the designated medical module for specialised care. During transport, a need for urgent assistance may likely arise, especially for cardiopulmonary resuscitation (CPR). The research team has sought to develop a new model for transporting injured or ill astronauts within the spacecraft which permits continuous provision of CPR or further advanced medical assistance. Aim: The research aimed to evaluate the adoption of the ARS for medical assistance and CPR during astronaut transport within the spacecraft in simulated microgravity. Material and method: The research consisted of initial ground-based tests in a space station's interior simulator, followed by specialised tests in a pool and in a human training centrifuge. These tests were conducted as part of the Mobile Medical Module Project (Project MMM). A prototype model of a transport resuscitation platform was prepared and equipped with the ARS for stabilising rescuers and the patient. Firstly, in the space station's interior simulator, the tests assessed the medical team management in the limited space around the patient and the effectiveness of CPR during transport of the patient simulator placed on the resuscitation MMM platform (control test). Secondly, during the pool test, conducted in neutral buoyancy at the depth of 4 meters (13 ft), the control test was reproduced. Finally, the ARS's functioning and effectiveness in facilitating CPR were assessed at zero-G in a human training centrifuge at the Military Institute of Aviation Medicine in Warsaw, Poland. Results: The research demonstrated the usefulness and effectiveness of the ARS in facilitating medical assistance, including CPR, during transport in simulated microgravity conditions. In the underwater tests, the ARS enabled constant contact between the rescuer and the patient throughout

the transport as well as uninterrupted provision of medical assistance, including CPR. Furthermore, the centrifuge test confirmed that the ARS effectively stabilised the rescuer on the MMM platform, ensuring medical assistance quality and CPR efficiency comparable to Earth-based transport. Conclusion: The ARS enables medical assistance during free-floating movements of the platform in simulated microgravity. The ultimate confirmation of these results requires final tests during parabolic flights and in operational conditions at the International Space Station.