Mechanical cardiopulmonary resuscitation in simulated microgravity and hypergravity conditions: a manikin study during parabolic flight

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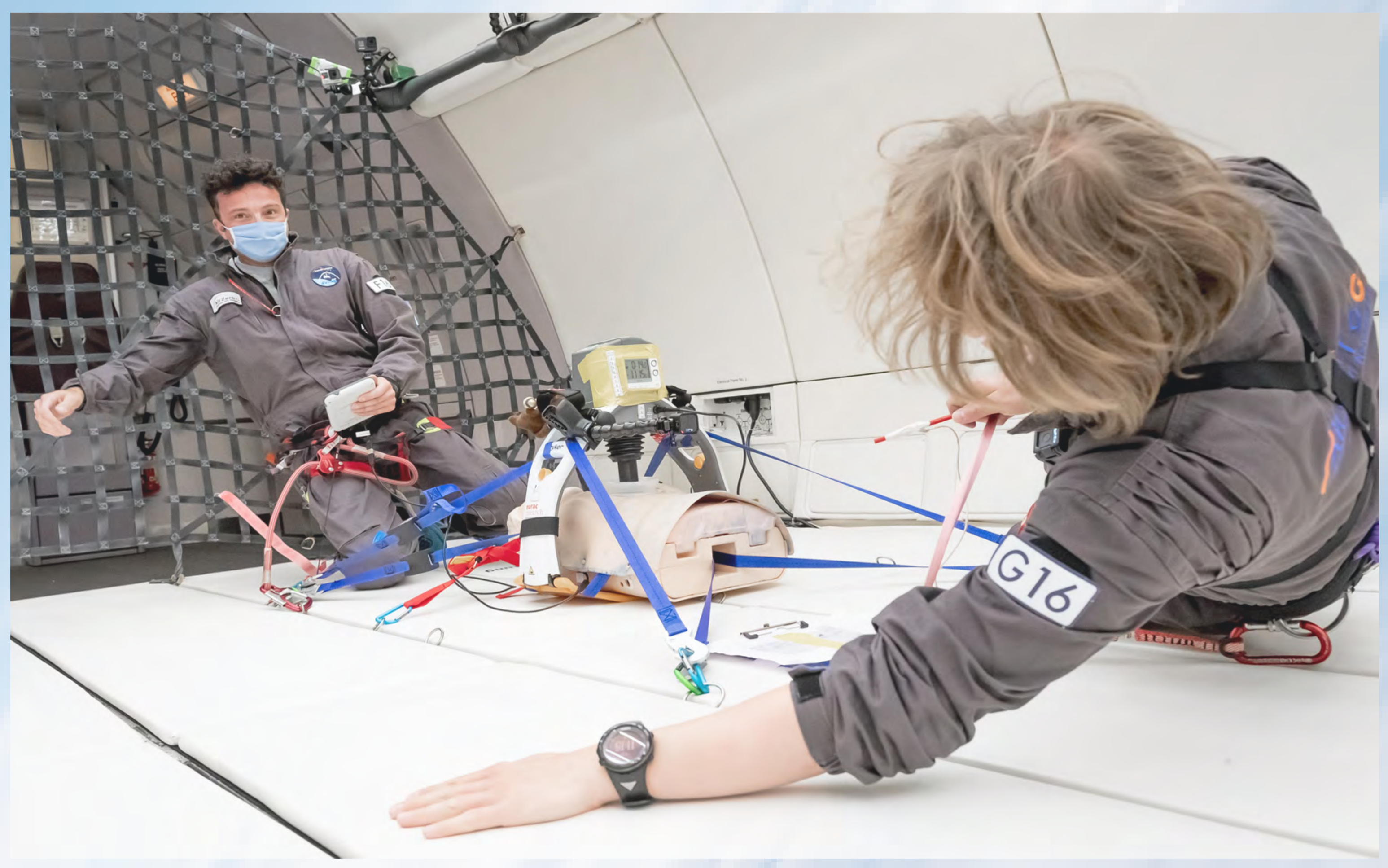

Introduction

Space travel is expected to grow in the near future, which could lead to a higher burden of sudden cardiac arrest in astronauts (SCA). These developments come with an increased risk of medical emergencies to be managed in challenging logistical conditions[1]. Space travel can affect the cardiovascular system during launch, orbit entry and re-entry extravehicular activity, physical and autonomic stress[2], as well as due to cardiovascular deconditioning in weightlessness[3]. Current methods to perform cardiopulmonary resuscitation in microgravity perform below earth-based standards in terms of depth achieved and the ability to sustain chest compressions (CC). We hypothesised that an automated chest compression device (ACCD) would deliver high-quality chest compressions during simulated hypergravity and microgravity conditions.

Methods

The study was performed during the 4th parabolic flight campaign in Dübendorf, Zürich (Switzerland) with Skylab and the Swiss Aerospace Agency on June 9-11, 2020. Data on CC depth, rate, release and position were collected continuously during a parabolic flight with alternating conditions of normogravity (1 G), hypergravity (1.8 G) and microgravity (0 G), performed on a training manikin fixed in place utilising an ACCD.

Results

8 consecutive parabolas were performed and analysed. Mechanical chest compression was performed continuously during the entire flight; no missed compressions or pauses were recorded. Mean depth of CC showed minimal but statistically significant variations in compression depth during the different phases of the parabolic flight (microgravity 49.9 ± 0.7, normogravity 49.9 ± 0.5 and hypergravity 50.1 ± 0.6 $p<0.001$).

Conclusion

The use of an ACCD allows continuous delivery of high-quality CC in microgravity as experienced in parabolic flight. The decision to bring extra load for a high impact and low likelihood event (SCA) should be based on specifics of its crew's mission and health status.

References

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