Biofeedback based on mobile accelerometry to improve running in space – ideas and first results

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Background – actibelt technology – a 3D accelerometer in a belt buckle and a package of algorithms, mainly used in international multi centre clinical trials – has also been evaluated for various applications in space, moon and mars in a series of studies and projects since roughly 10 years (2 parabola flight campaigns by ESA, 1 parabola flight campaign by NASA, mars 500).

Aim – To develop a training feedback application which compares the similarity of running parameters under artificial gravity conditions with natural running on earth.

Methods - We use an actibelt BLU2, a version of the actibelt with bluetooth transmission capability, an android tablet with internet access and R packages to visualize and quantify acceleration patterns. Data, including video documentation in some cases, was collected from various runners (marathon, mountain runs, B2run) and various running styles. Written informed consent was obtained.

Results: We have developed an application running on an android tablet. It displays an overview of the projections of the accelerometry pattern of the individual steps in the sagittal plane as well as a summary measure for the mean area per step. There are clear differences between extremes of running style (heel strike overstriding vs. forefoot) both in the area and the shape of the curve.

Discussion/Conclusion: We speculate that online-biofeedback of the acceleration patterns and extracted parameters could advise astronauts during their treadmill training how to best adapt their running style as to optimally avoid loss of bone mineral density. As with running on earth also footwear – with or without heel cushioning, minimal footwear, barefoot – may play an important role.