Executive Summary: Effect of the AirSurfer® on Non-exercise Activity Thermogenesis (N.E.A.T.) and Cognitive Function

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Introduction: Sedentary lifestyle is increasingly linked to chronic disease and early mortality. "Sedentaryism" is promoted by the desk job that requires hours of sitting. Aside from other risk factors, sitting has been linked directly to chronic disease and death. Efforts to increase physical activity and non-exercise activity thermogenesis (NEAT) are ever more important in reversing this trend. The purpose of this study was to determine whether the AirSurfer designed to increase movement while seated, would elevate metabolic rate. Our specific aim was to compare metabolic rate during three types of desk job activity: sitting, sitting while using the AirSurfer, and standing. We hypothesized that the AirSurfer would raise metabolic rate more than sitting and not be different from the response to standing, which would be similar to a standing work station. **Methods**: Subjects (3 males, 13 females; age, 26.1 ±6.0 y; height 168.8 ±7.4 cm; weight, 70.5 ±13.1 kg; BMI, 24.7 ±4.3) participated after a session to be familiarized with procedures. They reported to the lab for measurement of metabolic rate during 15 min of each activity: sitting, sitting and using the AirSurfer, and standing, always done in that order. To simulate the desk job, subjects performed their choice of intellectual work during all three phases, and consistently brought 60 min of the same type of work to keep activities consistent. This included working on a computer; reading a book, science papers, document on a tablet; or grading papers. After 5 min of working at the desk activity to establish a steady state, subjects continued while wearing a mouthpiece and nose clips for 10 min of indirect calorimetry (TrueOne 2400, Parvomedics, Salt Lake City, UT). The first five min of data were discarded and the final five min were averaged for the metabolic data that represented that phase. Heart rate was also measured. At the end of each phase the Stroop word-color test was administered to determine whether cognitive function was alerted in any phase. Mean ±SD were calculated to summarize the data. One-way ANOVA was used to test the primary outcome (oxygen consumption, VO_2 in L/min) and secondary variables (METs, RER, and heart rate) with alpha set at 0.05 for statistical significance. The Bonferonni multiple comparison post-hoc test was used when the ANOVA was significant. **Results**: Mean ±SD are presented in the adjacent table for primary and secondary outcomes.

Phase	VO_2, L/min	METs	RER	HR	Stroop[ǂ]
Sitting	0.286 ±0.040[a]	1.19 ±0.16[a]	0.81 ±0.06	73.5 ±9.9	248.0 ±30.7
AirSurfer	0.337 ±0.064[b]	1.39 ±0.20[b]	0.79 ±0.06	78.4 ±17.0	257.3 ±39.1
Standing	0.315 ±0.054[a,b]	1.29 ±0.19 [a,b]	0.77 ±0.04	85.9 ±17.6	265.3 ±37.4

[ǂ]Mean for sum on Word, Color and Word Color portions of the test
Different superscripts indicate difference within an outcome variable.

The ANOVA for VO_2 and METs revealed differences between phases ($p<0.05$). Post hoc tests indicated VO_2 and METs were higher for the AirSurfer phase vs. sitting. For VO_2 and METs, standing was not different than either sitting or AirSurfer. Heart rate and RER were not different during the phases. Stroop scores were also not different suggesting that the AirSurfer was not a distraction from cognitive effort. The AirSurfer elevated metabolic rate by 17.6% compared to sitting and, though not statistically different, there was a tendency for an increase of 7.0% for AirSurfer compared to standing.