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New Technologies can Improve Integration of Sedentarity Behavior in the Global Cardiovascular Risk

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Short Communication

Cardiovascular disease (CVD) remains the leading cause of death in the Western countries[1]. Several factors, such as smoking, hypertension and hypercholesterolemia are associated to the pathogenesis of coronary heart disease (CHD). Since 2005, a new field of cardiology emerged, called behavioral cardiology[2]. This new approach was particularly innovative as it provided a new dimension to our understanding of the health model, moving from a pure biomedical model to a model integrating other health dimensions as defined by the WHO organisation[3]. Based on several epidemiological studies, the behavioral risk is divided in different categories: physical health behaviors, negative emotions and mental mindsets, stress, social isolation and lack of sense of purpose. Among physical health behaviors, improvement of physical activity (PA) has demonstrated a significant positive impact on morbidity and mortality from CVD causes[4].

The potential detrimental effect of 'sedentarity behavior' (SB), as an independent risk factor from PA, has been debated since the turn of the century. In the meantime, epidemiological studies have been conducted to determine if there is a link between a sitting position and health outcomes. A new claim, *'Sitting is the new smoking'* has been largely disseminated to increase awareness in the population. Most of the messages go in the direction that SB is an independent factor of moderate to vigorous physical activity (MVPA). But the definition of SB is still in discussion and assessment methods to evaluate SB are emerging. Postural (sitting and reclining postures) and contextual components (awaking) on top of a purely physiological definition (<1.5 METS) have been recently integrated[5]. Evidence of sitting has been sometimes difficult to assess and for this reason has been sometimes replaced by evidence of television viewing or recreational screen time[6]. However, the correlation between sitting and TV viewing is relatively poor based on several studies. Two potential biological causes concern the fact that a prolonged sitting position might impair lipopratease activity and the second one that endothelial dysfunction might be responsible due to blood flow - induced shear stress[7].

On top of SB self, the question has been raised on the influence of length of sitting sessions and frequency of breaks as interruption of prolonged sitting episodes. *« Sit less, breaking sedentarity time »* has been included in the New Zealand guidelines on eating and activity guidelines for New Zealand Adults[8] and the importance of multiplying breaks has been underscored, even if the total sedentarity time is unchanged. However, if some benefit of these changes in behaviors has been suggested in terms of improvement of cardiometabolic outcomes (post-prandial glucose metabolism), the 2018

Physical Activity Guidelines Advisory Committee Scientific Report still consider that the evidence of the beneficial effect of sedentarity breaks on health outcomes is still lacking[9].

As the negative impact of sedentarity has been demonstrated, particularly on cardiovascular outcomes, accurate measurement of SB is key to increase health literacy of the concerned population at risk and to implement solutions to decrease the risk. One of the reasons of the poor evidence is related to the methodology used to measure physical inactivity and sedentarity. One of the common approach is to ask a single question to evaluate SB, usually time spend on viewing television. If this method is very easy to use particularly in the format of a medical consultation, the information collected is frequently underestimated and does not cover the full representation of SB. It appears also that self-reports are seriously underestimating SB compared to more objective techniques. The use of questionnaires has been the most used method in cross-sectional and longitudinal studies for a while. Several questionnaires have been developed and used, differing on characteristics of PA or SB such

as duration, frequency and calories. The International Physical Activity Questionnaire (IPAQ), European Physical Activity Questionnaire (EPAQ) and Workforce Sitting Questionnaire (WSQ) are among the most used. Main advantages are the low cost and translation in multiple languages that make them convenient for large epidemiological studies. However, their use makes difficult to estimate over-reporting of participants that might create an error level around 40 to 60% and the burden for participants is relatively heavy. So questionnaires are more appropriate for epidemiological investigations than for real life clinical practice.

The first technology introduced was recorded or on-site visual observations for evaluation at work. If there is some interest for assessing body posture, the methodology is costly and might induce observational bias. An informed consent is also certainly needed to cover the GDPR dimension and the technique is only applicable in a work setting. Two types of objective measures have been introduced afterwards : energy expenditure devices (accelerometers) and posture classification devices. Accelerometers are easy to use, they can collect a large amount of data in epidemiological studies. Accelerometers were initially constructed to measure PA, not SB. Movement is indeed driven by acceleration but not body posture, so differentiation between sitting and lying is difficult to obtain from these devices. Incorporation of inclinometers is thus necessary and has been done in the most recent devices. The Actigraph GT3X+®has been the most used technology in clinical studies. Two seven-days studies demonstrated moderate to good level of accuracy to measure SB[10,11]. However, machine learning algorithms in free-living conditions need to be used together with the Actigraph.

Posture classification devices such as the activPAL® deliver data on body posture based on decision criteria evaluating the body inclination, staying, sitting or lying.

Both types of devices have limitation in measuring SB in the context of PA. ActivPAL® for exemple is more accurate to measure the sedentarity dimension that the activity one. The devices have also a relatively high weight (around 400 gr), are most of the time worn on the thigh which might sometimes hinder patient activities.

New developments are represented by smartwatches, smartphones and pressure sensors. 82 validated technologies were available on the market in 2016.[12], including only 9 self- monitoring SB devices The conclusion of the review is that the effectiveness of these devices still need to be demonstrated in behavior changes interventions.

The recent advances in behavioral cardiology has not yet been fully implemented in clinical management of cardiovascular patients. The cardiovascular risk assessment is becoming more and more complex for cardiologists because of the need for integration of several new dimensions. Combining conventional factors and physical health factors including PA, SB, poor or inadequate sleep implies the development of novel cost-effective methods of evaluation.

In order to avoid the multiplication of consultations and a prolonged period of time for assessing the holistic CV risk of a patient, devices collecting several dimensions of diagnosis need to be developed as soon as possible. The ideal situation would be to have access to a wearable device able to identify in a non invasive way all dimensions of CV risks : lipids and glycemia, detection of sequences of atrial fibrillation, stress, sleep pattern, physical activity and sedentarity. Is this a twenty-first century utopia? The recent development and commercialisation by Abbott of the Freestyle Libre system, a small sensor automatically measuring and storing glucose readings day and night was a first demonstration that minimally invasive methods can replace classical biomarkers. The same could be done for sophisticated lipid analysis in the future. One further step has been reached with the very recent development of the Rooti RX®, a wireless, very light (14 gr) patch-type device. Combining wearable biosensing technology with deep learning capabilities, the technology allows registration of a one channel ECG for arrhythmia detection[13], blood pressure measures, heart rate variability, SB and PA and screening of obstructive sleep apnea in one single device and for periods up to 7 days. The system incorporates also a 3-Axis accelerometer worn on the chest. Not only global physical inactivity but number and length of inactive periods can be counted. Having all these informations and data collected within a single device is a good step for cardiologists to integrate in one analysis conventional and behavior risk factors and to accelerate the decision process for interventions needed by the patients. Additional evidence data need to be produced by the Rooti company, but this device is a significant progress for clinical cardiology practice

but also for further understanding and more precise definition of SB.

References

[1] European Heart Network. http://www.ehnheart.org/cdv-statistics.html (24 june 2010)

[2] Rozanski A. J of American College of Cardiology. 2010; Vol 64 [1] 100-10

[3] WHO, 1948

[4] Nocon N., et al. Association of physical activity with all-cause and cardiovascular mortality. Eur J Cardiovasc Prev Rehabil. 2008 ;15 : 239-46

[5] Network SBR. Standardized use of the terms 'sedentarity' and 'sedentarity behaviours'. Appl Physiol Nutr Metab 2012 ; 37 : 540-2

[6] Dunstan DW et al. Television viewing time and mortality. Circulation 2010 ; 121: 384-91

[7] Padilla J et al. Prolonged sitting leg vasculopathy. Am J Heart Circ Physiol 2017 ; 313 :H722-8

[8] New Zealand Ministry of Health. Eating and activity guidelines for NZ adults. Wellington, 2015

[9] Physical Activity Guidelines, Advisory Committee. U.S. Department of Health and Human Services, 2018

[10] Aguilar-Farias N, et a. ActiGraph GT3X+ cut-points for identifying sedentary behaviour in older adults in free-living environments. J Sci Med Sport .2014; 17: 293–9.

[11] Koster A, et al. Comparison of sedentary estimates between activPAL and hip- and wristworn ActiGraph Med Sci Sports Exerc. 48: 1514–22

[12] Sanders J.P. et al. Devices for self-monitoring sedentarity time or physical activity. J Med Internet Res. 2016 May; 18(5): e90.

[13] Karaoguz M.R. et al. The quality of ECG data acquisition, and diagnostic performance of a novel adhesive patch for ambulatory cardiac rhythm monitoring in arrhythmia detection. J. Electrocard. 2019 ; 54, 28-35

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