Physical activity, falls, injuries, and technology: Toward an accessible biomechanical data base?

In addressing the specific issues of physical activity, falls and injuries, as mentioned in the European Silver Paper[1], technologies currently exist for measuring the biomechanical performance of the muscles and joints of older adults. This is of value in informing the planning of their healthcare, rehabilitation, the design of the built environment, and services to optimise mobility and quality of life. However, the technologies for obtaining data from older adults currently entail screening to determine their fitness for trials participation, cumbersome and slow evaluation processes, large and expensive labs, and the data produced tend to remain in the style and domain of bioengineers, creating a barrier to exploiting their wider value. The data is also generalised and it is difficult to plan immediate and effective healthcare on an individual basis. The challenges here are: (i) to share this data in an accessible format amongst a broad range of key professions to enable more holistic planning, and (ii) to develop approaches and technologies that allow individualised diagnosis and planning.

Steps towards this goal have already been made[2] where a proof-of-concept trial has highlighted the value of visualisation of biomechanical data obtained from older adults. The method promotes communication between and amongst different disciplines as well as deepening professional understanding, particularly in physiotherapy applications. This has underlined the value of a coordinated multidisciplinary approach to enable biomechanical data to be shared more easily with further disciplines, such as physiotherapy, occupational therapy, and design, as well as allowing commentary from older people themselves. Further investment will assist in the development of not only technologies to the extent that they are portable, cost-effective, and easily usable, but also rethinking processes and protocols to be more inclusive, benefiting to a far greater extent from the valuable experiences and insights of older adults as well as a broad range of professionals. Application of such technology will assist in, for instance, healthcare team diagnosis, prevention, and in the rehabilitation of physical activities compromised by age-related conditions, disease, or falls, such as appropriate exercises to prevent or minimise foreseeable injuries, rebuilding or maintaining strength through rehabilitation in the event of injury, or planning for increased mobility in institutionalised settings.

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Physical activity, electronic assessment and coaching

The age-related decline of biological potential, as mentioned in the European Silver Paper[1], is clearly reflected in physical activity. Doubly labelled water studies show that physical activity induced energy expenditure decreases on average with more than 50% between the age of 20-30 and over 65[2]. Encouraging physical activity,

as part of a wider campaign on prevention of falls and maintenance of independence should indeed be popularized[1].

Ideally, recommendations are tailored to the individual subject, based on the personal activity pattern and activity preferences. The development of triaxial accelerometers for movement registration offers an excellent opportunity for subjects to get objective information on their activity, activity intensity and activity level throughout the day. We developed such an activity monitor, measuring triaxial body acceleration through body movement that can be converted to activity dimensions including activity intensity and total activity level. In a comparative analysis of the ability of different accelerometers to assess physical activity, it produced the best results, as compared with the doubly labeled water technique, which is considered the golden standard for measuring energy expenditure under free-living conditions[3]. The device has been miniaturized to a light-weight waterproof instrument (13 g; Philips Lifestyle Incubator, New Wellness Solutions, Eindhoven, The Netherlands) with stand alone flashlight read-out, and can be connected with the USB gate of a computer for read-out and connection with a life style coaching service.

Combined observations of the activity pattern with motion sensors and physical activity levels derived from total energy expenditure showed that it is not so much exercise, but rather the distribution of time spent in inactivity and moderate-intensity activity that determines our total activity level[4]. By stimulating moderate-intensity activities and decreasing inactivity at the same time, and not necessarily by promoting exercise programs, healthy physical activity levels can be obtained. This is especially important for older persons, where exercise programs might not be tolerated but moderate-intensity activity is a feasible option. They could be recommended to spend less time on low intensity activities, such as sitting and standing, and more time on moderate-intensity activities like walking[5]. The question then is how to inform the subject about the current activity level, options for a healthy change, and effects of the follow-up of any changes. Then, a small device as described above, with easy data entrance in a computer for read-out and connection with a life style coaching service opens an optimal technical option to encourage physical activity, and help to popularize a campaign on prevention of falls and maintenance of independence.

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