3-D Photonic scanning for health research and practice

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Abstract

Simple measurements of body shape (eg waist, hip, upper arm and mid-thigh girths) have been widely used in medical research and clinical practice for decades. However, the data are typically obtained through manual measurements which quickly become time-consuming, may be considered intrusive, and are prone to inter-observer variability in measurement style and hence accuracy. Whole-body 3-D photonic scanning offer a new approach to this field, capable on the one hand of collecting large datasets offering evidence of the association between body shape and health, and on the other hand of being applied in routine monitoring. Here, we describe our research on both of these issues.

We have used 3-D scanners in several large national sizing surveys, embracing a range of age, ethnicity and nutritional status in each sex. These surveys demonstrate significant variability in body shape between the genders, across the adult life course (though differently in men versus women), and between ethnic groups. We have further demonstrated significant associations between the pattern of child-bearing and body shape in women. Many conventional studies have likewise demonstrated associations between body shape and cardiovascular risk. Given the potential for 3-D scanners to be located in retail outlets and fitness centres, our work therefore offers the possibility of linking information on lifestyle, detailed body shape, and disease risk.

Whilst much of this work has been conducted on simple measurements of body girths, we have also developed software automatically to extract 2- or 3-D shape parameters. For example, Figure 1 illustrates our software for extracting cross-sectional areas or diameters (front to back, or side to side), which provide more sensitive information about body shape. In other studies, we are demonstrating links between external body surface topography and internal adiposity measured through magnetic resonance imaging, and further investigating ethnic variability in these associations.

To complement such research, linking body shape with health outcomes, we are also developing 3D scanning as a new tool for clinical monitoring, creating new body shape software and associated infrastructure to allow longitudinal monitoring of body shape in routine clinical practice. This research aims to explore associations between shape and indices of metabolic risk such as blood pressure.

We believe that 3-D represents a new non-invasive digital technology, capable of occupying the middle-ground between simple manual anthropometry and expensive imaging techniques such as dual-energy X-ray absorptiometry, CT scanning (both of which require radiation exposure) and magnetic resonance imaging.

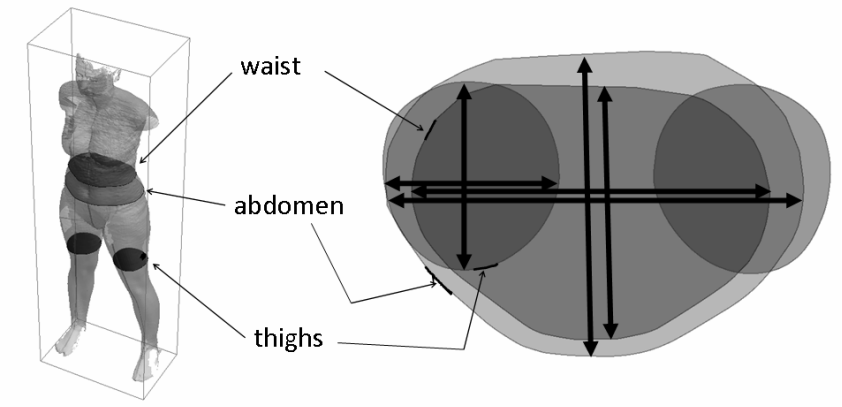

Figure 1