CLAIMS

What is claimed is:

1. A method for continuously, non-invasively, and directly measuring blood pressure, the method comprising:

providing a calibrated measurement device having a frame with a first side and a second side, a blood-flow control balloon mounted to the second side, an optical system between the first side and the blood-flow control balloon, and a sensor array having a sensor surface;

placing the sensor array in a non-invasive manner over a skin surface connected to an artery by adjoining soft tissues, wherein the sensor array being interfaced between the blood-flow control balloon and the skin surface;

inflating the blood-flow control balloon with a controlled amount of pressure;

generating signals in response to the inflating of the blood-flow control balloon that causes changes in artery size and shape during a heartbeat cycle;

detecting the signals, via the optical system and the sensor array, associated with the changes in artery size and shape; and

measuring and processing, via a controller, the signals to determine blood-pressure parameters.

2. The method of claim 1, wherein the signals are based on visible deformations in the sensor surface, the visible deformations being caused by the changes in the artery size and shape during a heartbeat cycle.

3. The method of claim 2, wherein the sensor array further comprises capacitance-based tactile sensors, and wherein the signals are tactile deformations in the sensor surface, the tactile deformations in the sensor surface being caused by the visible deformations.

4. The method of claim 2, wherein the optical system further includes a camera capable of detecting the signals.

5. The method of claim 1, wherein the calibrated measurement device further includes a rigid support adjacent to the blood-flow control balloon and between the optical system and the sensor array; and wherein the rigid support is transparent and the blood-flow control balloon is transparent.

6. The method of claim 1, wherein the sensor surface further includes a reflective layer in contact with the skin surface and responsive to deformations in the skin surface.

7. The method of claim 2,

wherein inflating the blood-flow control balloon further includes a gradual increase and a gradual decrease of a pressure in the blood-flow control balloon;

wherein detecting signals further includes detecting at least one signal at a low value of pressure during the gradual increase of pressure until the at least one signal is attenuated;

wherein measuring further includes measuring a mean pressure in the blood-flow control balloon; and

wherein processing further includes mapping markers of the at least one signal to estimate systolic blood pressure, mean arterial pressure, and diastolic blood pressure.

8. The method of claim 1, further comprising determining the changes in the artery size and shape based on an ultrasound of the artery.

9. The method of claim 1, further comprising placing the sensor surface in direct contact with the skin surface.

10. The method of claim 9, further comprising:

coating the skin surface with a pigment prior to placing the sensor surface in direct contact with the skin surface.

11. A calibrated measurement device for continuously, non-invasively, and directly measuring blood pressure, the calibrated measurement device comprising:

a frame;

a strap;

a blood-flow control balloon coupled to an internal surface of the strap, the blood-flow control balloon having an inflated state in which a controlled amount of pressure isolates a signal from an artery without compromising venous and lymphatic circulation or flow in other arteries of a limb containing the artery; and

a sensor array mounted on a surface of the blood-flow control balloon to directly contact a skin surface and non-invasively monitor blood pressure;

an optical system mounted to the frame and spaced from the blood-flow control balloon for detecting deformations in the skin surface caused by changes in artery size and shape during a heartbeat cycle; the deformations in the skin surface corresponding to blood pressure.

12. The calibrated measurement device of claim 11, wherein the strap is removably attached.

13. The calibrated measurement device of claim 11, further comprising a transparent rigid support mounted to the strap, the blood-flow control balloon being mounted on the transparent rigid support; the transparent rigid support being positioned between the optical system and the blood-flow control balloon.

14. The calibrated measurement device of claim 11, further comprising a strap control balloon coupled to the internal surface of the strap in a different area than the blood-flow control balloon, the strap control balloon having an inflated state in which a force applied between the skin surface of the limb and the strap is fine tuned.

15. The calibrated measurement device of claim 12, further comprising a strap force sensor coupled to the internal surface of the strap in a different area than the blood-flow control balloon and the strap control balloon, the strap force sensor detecting the force applied between the skin surface of the limb and the strap when at least one of the blood-flow control balloon and the strap control balloon is in the respective inflated state.

16. The calibrated measurement device of claim 11, wherein the sensor array further includes an array of capacitance-based tactile sensors.

17. The calibrated measurement device of claim 11, wherein the sensor array further includes one or more resistive, piezoelectric, or capacitive elements.

18. The calibrated measurement device of claim 11, wherein the optical system further includes a camera capable of detecting the deformations in the skin surface caused by changes in artery size and shape during a heartbeat cycle.