

# Measurement Example: Hair

## Measurement of Human Hair

We measured hairs using the Hadatomo™ Z photoacoustic microscope. The measurement area was 9 mm square, and the scan step was 30 μm. Lasers of two wavelengths, 575 nm and 650 nm, were used for measurement.

We measured hairs from the side of the head. Fig. 1 (a) shows a photo of the measured area. Where hairs were long, there were gaps between the Hadatomo™ Z's measurement unit and the scalp, so we measured an area where hairs were shorter. Fig. 1 (b) shows an enlarged image of the measurement area, using a microscope. We can see that two or three hairs are growing from each pore. Fig. 1 (c) shows a measurement image obtained by the Hadatomo™ Z. The green colored lines show photoacoustic images using the 650 nm wavelength laser. Because the absorption coefficient of melanin is dominant in the wavelength, we can tell that the image is selectively visualizing the hair. The red color shows differentiated images obtained with wavelengths 575 nm and 650 nm, visualizing blood vessels within the dermis. From Fig. 1 (a) and (b), we cannot observe the blood vessels within the dermis. However, the photoacoustic image enables observation of the blood vessels within the dermis.

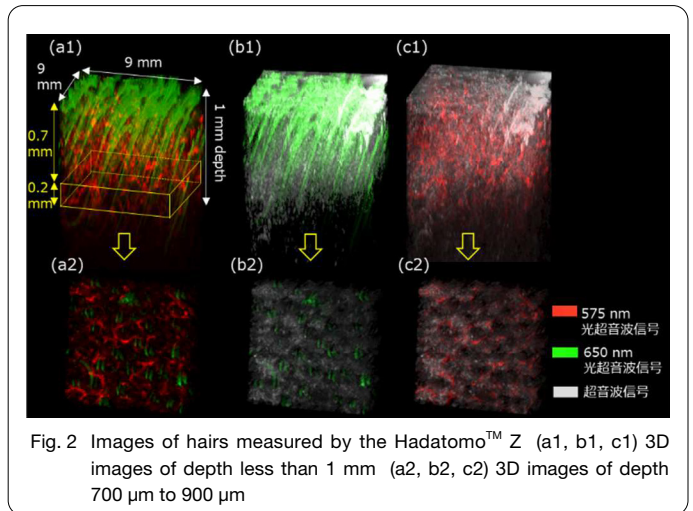


Fig. 2 Images of hairs measured by the Hadatomo™ Z (a1, b1, c1) 3D images of depth less than 1 mm (a2, b2, c2) 3D images of depth 700 μm to 900 μm

Fig. 2 (b2), we can observe pores and hairs growing from inside them. In Fig. 2 (c2), we can observe blood vessels running around the pores.

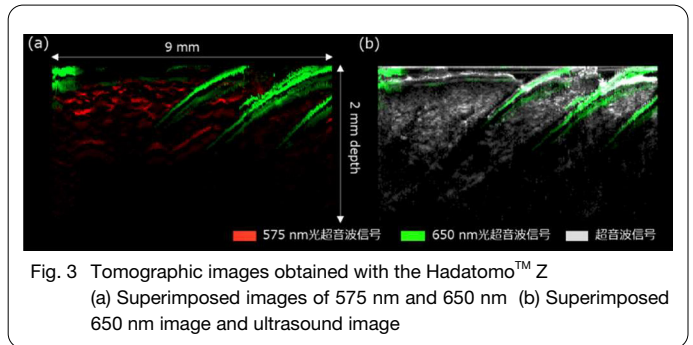
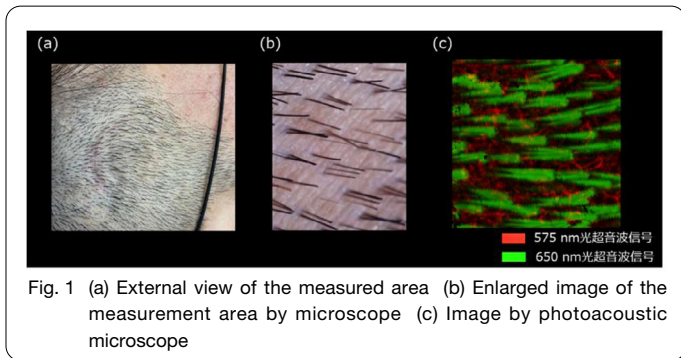


Fig. 3 Tomographic images obtained with the Hadatomo™ Z (a) Superimposed images of 575 nm and 650 nm (b) Superimposed 650 nm image and ultrasound image

Fig. 2 shows measured 3D images. Fig. 2 (a1) shows images obtained with photoacoustic signals of 575 nm and signals of 650 nm, superimposed, similar to Fig. 1 (c). Fig. 2 (b1) shows ultrasonic signals and an ultrasound image superimposed, both obtained with the 650 nm wavelength. Fig. 2 (c1) shows photoacoustic signals and an ultrasound image superimposed, both obtained with the 575 nm wavelength. Hairs penetrating inside dermis, as shown in Fig. 2 (a1), and blood vessels running around the hairs are visualized as 3D images. Fig. 2 (a2), (b2), (c2) are 3D images of depth 700 μm to 900 μm. In Fig. 2 (a2), we can observe blood vessels running around hairs within the dermis. In the ultrasound image in

Fig. 3 shows tomographic images of Fig. 2 (a), (b), respectively. Hairs, pores, and blood vessels inside the scalp are visualized with precise depth information.

As shown above, we were able to confirm that the Hadatomo™ Z photoacoustic microscope can noninvasively visualize hairs superimposed with blood vessels in the dermis and the dermis structure. The instrument may be used for measurement of alopecia or aging of hair.

