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NANOSCALE ANALYSIS OF TATTOO INK IN VITRO USING ATOMIC FORCE MICROSCOPY (AFM)

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Aims: Many appreciate the allure of intricate ink patterns drawn by skilful tattoo artists; however, clients are often not informed of the potential ramifications of having relatively untested pigment (nano)particles injected into their dermis. Here, using AFM we visualise ink particles in situ in normal human dermis, and after exposure to normal human dermal fibroblasts in vitro.

Methods: Tattooed arm skin was obtained with ethics approval from a 62y male, from which horizontal and vertical cryosections (5mm) were collected onto microscope slides. Tissue sections were transferred to a MFP-3D AFM (Asylum Research, USA) and imaged in air using Olympus AC160 silicon probes (tip radius ~10nm) in intermittent contact mode.

Results:

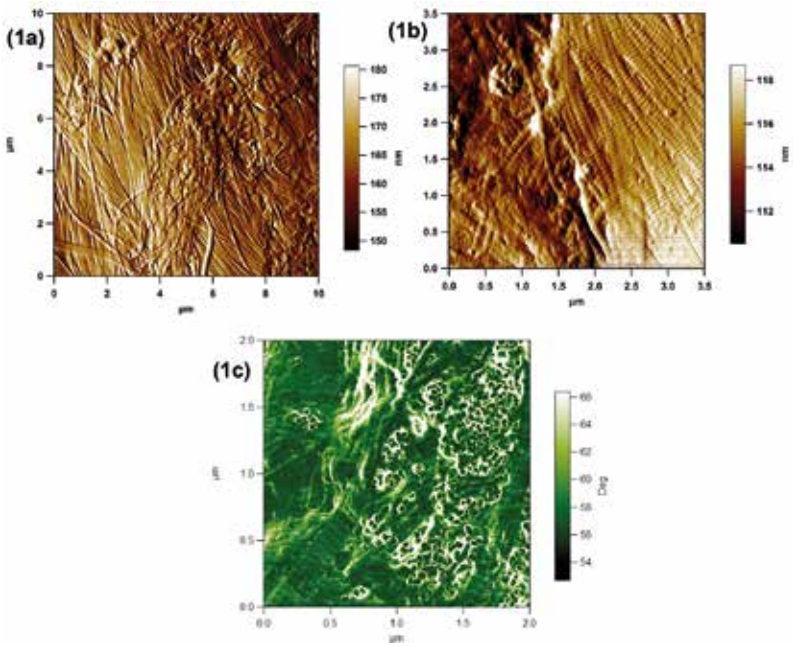

Figure 1a & b shows AFM amplitude images of disperse ink particles within the dermal collagen network. These figures demonstrate a strong orientation of the collagen fibrils, likely caused by the tattoo process.

Figure 1c shows a 2mm phase image, clearly resolving small ink particles.

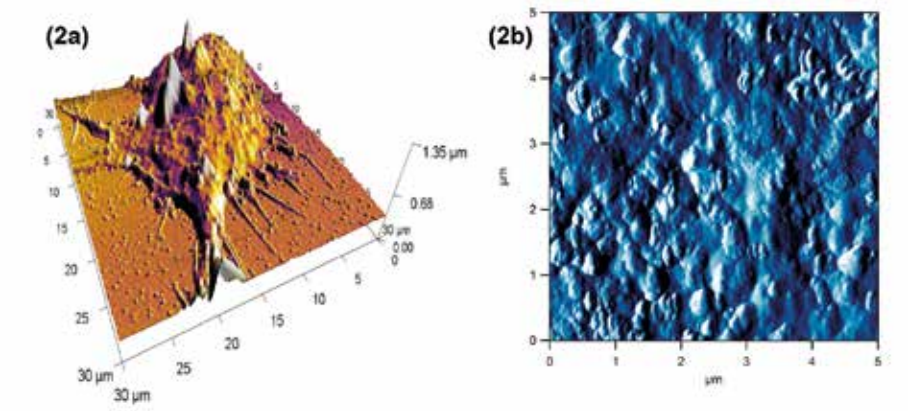

Figure 2a shows a 30mm scan of an individual fibroblast that has been incubated in dilute tattoo ink for 1 week. Figure 2b shows a close up of the fibroblast surface, showing ink particles on the surface.

Conclusions: AFM can resolve individual tattoo ink particles in skin tissue in situ and in association with individual fibroblasts in vitro and so may reveal potential interactions between ink (nano) particles and skin cells and tissues. Oriented collagen fibrils are also revealed from the tattooing process.