ARISTOTLE UNIVERSITY OF THESSALONIKI

RESEARCH COMMITTEE

FABRICATION OF 3D PRINTED MICRONEEDLES FOR THE TRANSDERMAL DELIVERY OF ACTIVES FOR SPECIAL POPULATIONS

Transdermal Drug Delivery (TDD) has significant advantages over parenteral and oral routes of administration since it is associated with potentially higher bioavailability and it is painless. In this context our group is investigating the use of 3D printed microneedles for the transdermal delivery of low and large molecular weight drugs for special populations (e.g., pediatric, geriatric).[1-4]

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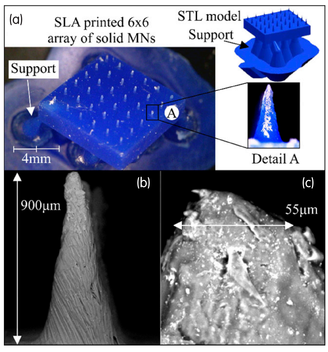

Figure 1: (a) 3D printed microneedle arrays and stl model in PreForm with support, (b) SEM of a representative microneedle of 900 μm height and (c) Microneedle tip radius of 55 μm.[1]

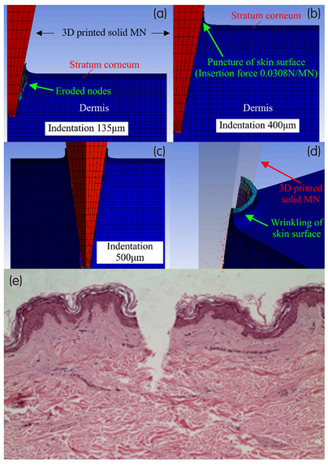

Figure 2: (a)-(d) Simulation of penetration process using FEA model and (e) hematoxylin-eosin staining of MN-treated skin.[1]

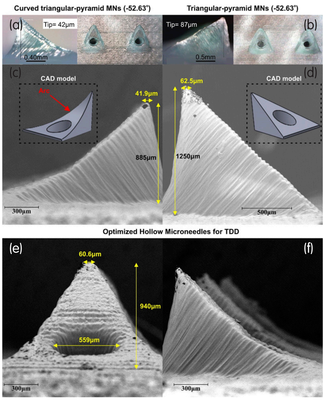

Figure 3: Optical microscopy and SEM micrographs of optimized curved HMNs (a), (c), (e), (f) compared with the initial configuration of triangular-pyramid HMNs (b), (d).[2]

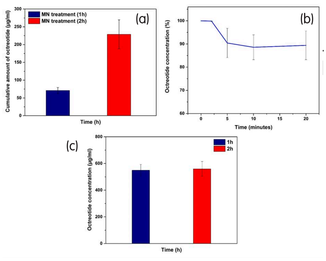

Figure 4: (a) Permeated octreotide concentration at 1h, 2h across human skin in vitro (n=3 ± S.D.), (b) Binding of octreotide with Pluronic F-127 coating in the first 20 min. and (c) Stability of octreotide concentration under experimental conditions.[2]

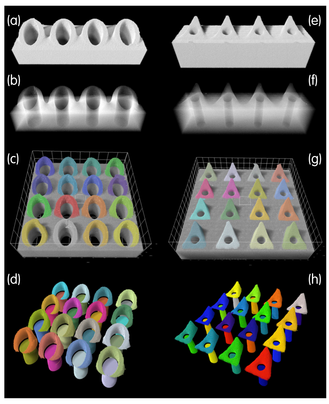

Figure 5: μCT images of syringe-like and pyramid-like microneedles.[3,4]

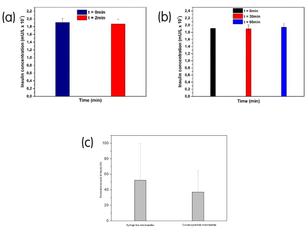

Figure 6: (a) Binding studies of insulin to surfactant coated microneedles (n=3), (b) Stability studies of insulin at 37ºC (n=3) (c) cumulative amount of permeated insulin across human skin in vitro.[4]

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References

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2. I.Xenikakis, K.Tsongas, M.Tzimtzimis, C.K.Zacharis, N.Theodoroula, E.P.Kalogianni, E.Demiri, I.S. Vizirianakis, D.Tzetzis, D.G.Fatouros.* Fabrication of hollow microneedles using liquid crystal display (LCD) vat polymerization 3D printing technology for transdermal macromolecular delivery. International Journal of Pharmaceutics, 2021, 597, 120303
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4. I.Xenikakis, K.Tsongas, M.Tzimtzimis, O.Katsamenis, E.Demiri, C.Zacharis, D.Tzetzis, D.G. Fatouros. Transdermal delivery of insulin across human skin in vitro with 3D printed hollow microneedles: the effect of shape, Submitted for publication