Poster abstract: Novel dissolving microarray patches for intradermal delivery of finasteride

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Novel Dissolving Microarray Patches For Intradermal Delivery Of Finasteride

Presenter Biography:
Alejandro Javier Paredes graduated as a Pharmacist and Ph.D. at the National University of Córdoba, Argentina. During his doctoral studies, he developed a new albendazole nanocrystalline formulation with improved pharmacokinetic performance and therapeutic efficacy. As a postdoctoral researcher, he visited the University of the Basque Country, Spain and the University of Pavia, Italy where he worked in groups of reference in gene therapy and wound healing, respectively. Dr. Paredes currently works as a Research Fellow at Queen's University Belfast, UK, where he focuses on the formulation and characterization of microarray patches for long-acting intradermal drug delivery. Dr. Paredes also participated in the development of novel formulations aimed at improving food quality and optimizing the treatment of plant diseases. He has also been an Assistant Teacher of Pharmaceutical Technology for 7 years at his home University with a tenured position. Dr. Paredes has authored 13 peer-reviewed publications and participated as an inventor in two submitted patents.

Author Block: A. J. Paredes[1], F. Volpe Zanutto[1], A. D. Permana[1], A. Murphy[1], M. Guerini[2], J. A. Coulter[1], R. Donnelly[1];

[1]Queen's University Belfast, Belfast, UNITED KINGDOM, [2]University of Pavia, Pavia, ITALY.

Abstract:
Introduction: Although microarray patches (MAPs) have been extensively explored for the intradermal delivery of vaccines, their use for the systemic administration of small molecules remains an area of potential for development (1). Finasteride (FND) is a 5 alpha-reductase inhibitor approved for the treatment of androgenetic alopecia and benign prostatic hyperplasia. FND is considered to be a feasible candidate for the formulation of long-acting MAPs due to its low solubility (<2 mg/mL), high potency and low clinical dose (1 or 5 mg/day orally). In this work, we report for the first time the formulation of two-layered dissolving MAPs for intradermal delivery of FND.
Methods: Two-layered dissolving FND MAPs were prepared using three different silicone moulds with needle densities, shapes, and heights being: conical 14 x 14, 600 µm (F1); pyramidal 16 x 16, 850 µm (F2); and pyramidal 19 x 19, 500 µm (F3), respectively. The formulation protocol is illustrated in Figure 1. A Texture Analyzer was used to evaluate the height reduction of the MAPs needles after the

application of a vertical compression force (32 N, 30 s). The insertion capability of the MAPs was studied in a skin simulant Parafilm® model as previously reported (2). FND MAPs were also inserted in full-thickness neonatal porcine skin (n=4) and mounted on Franz-diffusion cells. After 24 h, the drug was extracted with methanol:water (1:1) using a TissueLyser® and quantified by HPLC-UV. Optical coherence tomography (OCT) was utilized to examine the insertion of MAPs in Parafilm® and skin.
Results: Three different FND loaded MAPs were produced from the aforementioned moulds. The needle reduction was less than 10 % in all cases, and the insertion test showed that F1 and F2 penetrated 378 µm, while F3 penetrated only 252 µm, data that was confirmed by OCT analysis. A high drug content was achieved in the MAPs, as the amount of FND corresponded to 60% of the needle tips in the dry state (F1: 1137.30 µg, F2: 2697.86 µg and F3: 1182.41 µg). Skin deposition assays revealed recovery values of 288.68 ± 42.24, 420.56 ± 156.18 and 316.78 ± 142.79 µg FND/array for F1, 2 and 3 respectively (Figure 2). Interestingly, these results are up to 21-fold higher than those observed in the literature (3).
Conclusion/Implications: The obtained MAPs hold significant potential for the sustained delivery of FND, allowing the drug to slowly dissolve within the skin interstitial fluid and be absorbed into the plasma.

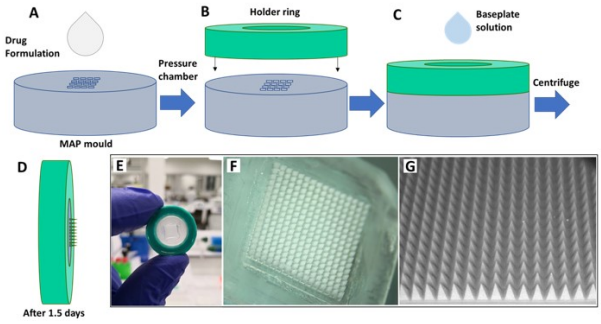

Figure 1. (A) The drug-loaded tips were casted from an aqueous blend of 40% w/w of (PVA 9-10 kDa: PVP K29-32, 1:1 w/w) that was mixed with 60% w/w of FND. (B) A holder ring was attached to the mould. (C) 850 µL of the second layer (PVP k-90 30 % w/w im water) were added into the ring and centrifuged at 3,500 rpm for 15 min. (D) After 1.5 days of drying, MAPs were separated from the ring and the excess of polymer removed. (E) Illustrative picture of MAP and holder ring after being removed from the mould. (F) Illustrative optical microscope image of a FND MAP. (G) Scanning electron microscopy image of F3.

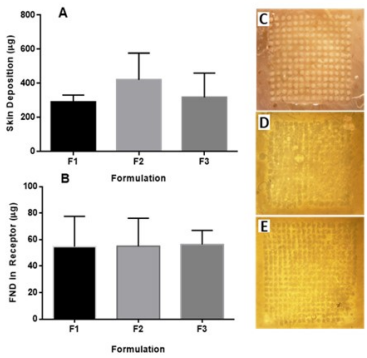

Figure 2. (A) FND ex vivo deposition results after insertion of F1-3 in full-thickness neonatal porcine skin. (B) FND quantification in Franz cells receptor compartments after insertion of F1-3 in full-thickness neonatal porcine. (C) Optical microscopy of porcine skin 24 h after the insertion of F1. (D) Optical microscopy of porcine skin 24 h after the insertion of F2. (E) Optical microscopy of porcine skin 24 h after the insertion of F3.

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Keyword (Complete):
Keyword 1: Research approaches/methods/tools - Formulation development
Keyword 2: Route/target of delivery - Transdermal/topical/mucosal
Keyword 3: Type of delivery agent - Poorly soluble
Keyword 4: Focus groups - Transdermal & Mucosal Drug Delivery (TMD)
Keyword 5: Type of delivery agent - Small molecule
Keyword 6: Research approaches/methods/tools - Novel methods

Abstract Additional (Complete):
References: : (1) Donnelly R and Larrañeta E. Drug Discovery Today. 2018; 23,5:1026-33 (2)

Larrañeta E et al. Int. J. Pharm. 2014; 472: 65–73. (3) Kim S, Eum J, Yang H, Jung H. J. Control. Release. 2019; 316: 1–11.

Learning Objective 1: : Describes a method to produce two-layered dissolving FND MAPs
Learning Objective 2: : Evaluate the mechanical properties of high dose loaded FND MAPs
Learning Objective 3: : Compares the ex vivo FND skin deposition of three different MAP designs
Area of Interest 1: Transdermal & Mucosal Drug Delivery (TMD)
Award Selection: Transdermal & Mucosal Drug Delivery (TMD)

Presentation Preference (Complete): Poster
Employment (Complete):
Are you professionally employed by academia or industry?: Academia
Are you currently looking or planning to look for a new job/position?: Yes, postdoc position
Job Title : Research Fellow
Experience Level: Mid
Job Fair Looking for Employment: No
Job Fair Hiring for Employment: No

Status: Complete

Feedback