Micropatch™ solid dose skin delivery system

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The Micropatch™ solid dose skin delivery device combines the use of a solid stainless steel microneedle and the insertion of a solid drug loaded pellet which is inserted into the skin to the desired depth. The device has been developed in conjunction with Nemaura Pharma Limited (Loughborough, UK). This administration technique allows a drug dosage form ranging from several hundred microns to several millimetres to be inserted into the skin in a rapid user-independent manner. The principle of the device is based upon the initial insertion of a super sharp stainless steel needle to breach the tough outer barrier of the skin, followed by a secondary drug carrier which contains the drug dosage form. The device allows the drug formulation to be inserted efficiently into the skin at any specified depth. The Micropatch™ device differs to conventional microneedle technology techniques such as the ‘poke and patch’, ‘coat and poke’ or biodegradable microneedles and can overcome the disadvantages and limitations associated with these techniques. This includes the ability of the Micropatch™ to deliver a defined drug loading into to the skin, eliminating the poor reproducibility of dosing associated with large array microneedle patches. The instantaneous administration of the drug minimises the residual time required for the needles to be inside the skin, and therefore can lead to less irritation and therefore reduced user discomfort.

The aim of this research is to evaluate the delivery of a model drug, Diclofenac Sodium, with a view to then evaluating Bio-Pharmaceuticals and vaccine delivery. Characterisation experiments have been conducted on full thickness Porcine skin to determine the drug penetration depth profile of the solid dose pellet and to illustrate various stages of pellet insertion. A USB microscope was used to capture the images. The time taken for the skin to reseal was also determined. This is illustrated in Figure 1. Dissolution of the pellet has also been conducted to determine the time taken for the diclofenac sodium drug to be released from the pellet. A 2.35 mm length conical pellet, 1.48 mm top diameter and 0.8 mm tip diameter pellet was used. The pellets were produced using a proprietary manufacturing technique developed by Nemaura Pharma, and yielded pellets weighing 23 mg.

The results show that the Micropatch™ was able to successfully insert the pellet to a penetration depth of 2 mm from the base of the Micropatch™. The porcine skin was shown to reseal after 30 minutes (as shown in Figure 1. Image H). The dissolution study showed that a total drug release of diclofenac sodium occurred after 10 minutes (Figure 2). The results indicated that the Micropatch™ can be used as a new delivery system for diclofenac sodium and other biotherapeutics. The delivery of various sized pellets can also be conducted by tailoring the Micropatch™ device.