Microneedle patch for fast and sustained pain relief

The occurrence of pain is very common in routine life and during invasive clinical procedures, such as injections, surgeries etc. which is the usually treated using painkiller and local anesthetics in form of oral dosage forms, creams, gels, patches, injections etc. Although injections are fast and highly efficacious but it cause inconvenience because of pain while oral dosing pose a problem for geriatric and pediatric patient because of difficulties in swallowing. The creams, gels and patches take long time for pain relief due to slow penetration of drugs into skin as a cause of protective epithelial barrier.

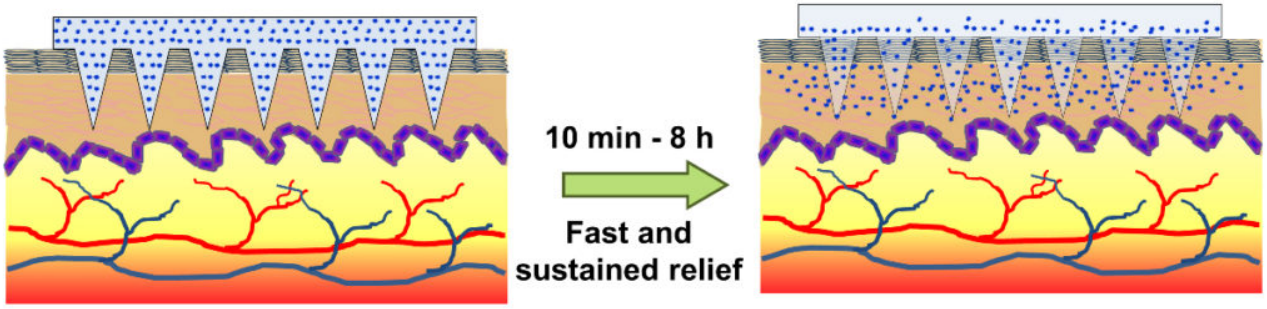

Fig. 1. Schematic of microneedle patch for drug delivery into skin.

The microneedle (MN) patch is patch with minuscule needles loaded with pain alleviating substance lidocaine (LD) which penetrate deeper enough into the skin to release LD (Fig. 1) which provides fast, more effective and painless solution to pain management.

The patch was made with biocompatible polymer loaded with LD and stduied in porcine model. The MN patch showed > 90% of the MN penetrated on the skin at thumb force. The depth of penetration of the MN were in the range of 210-380 µm. The skin permeation study in a porcine model showed that LD administrated by the MN patch achieved the desired therapeutic level locally within 10 min and sustained for 8 h atleast. The 11 fold and 9 fold higher permeation of LD for MN-patches at 10 min was evident of the fast onset of MN patches. The fast permeation can be attributed to the absorption of drug via micro-pores created after application of the MN patch while the later sustained release would have been an outcome of persistent absorption. The lateral drug diffsuion study showed that most of the drug diffuses perpendicularly against skin, with little lateral diffusion (Fig. 2) and unquantifiable amount of LD in the plasma of the pigs. This findings suggest that the MN patch can avoid systemic side effects.

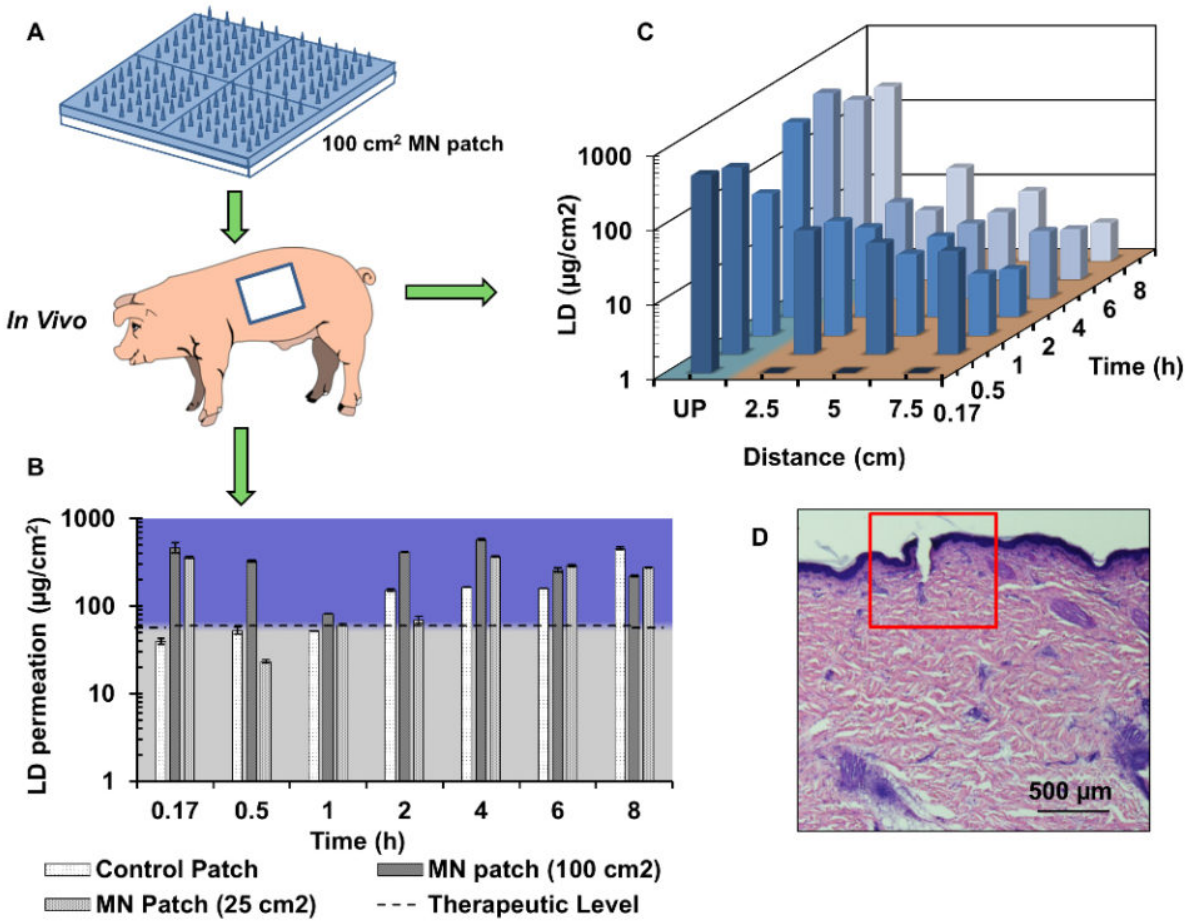

Fig. 2. A) Schematic of patch for study in pigs. B) Skin permeation of lidocaine. C) Lateral diffusion of lidocaine. D) H & E stained microneedle treated skin.

Overall, the MN patches provided fast and sustained delivery of LD through skin with majority of LD diffuses perpendicularly against skin, with little lateral diffusion. This MN patch will potentially be useful to increase the application scope of topical pain management. Particularly, it will be useful to geriatric and paediatrics patient for pain management as an alternative to injections with effectiveness and convenience.

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Publication

Large Size Microneedle Patch to Deliver Lidocaine through Skin.

Kathuria H, Li H, Pan J, Lim SH, Kochhar JS, Wu C, Kang L
Pharm Res. 2016 Nov