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NUS develops patch for painless drug delivery

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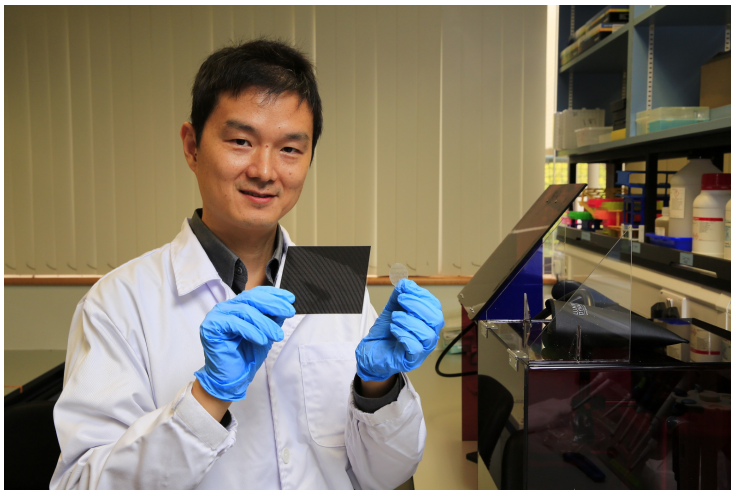

Singapore: Dr Kang Lifeng of the Department of Pharmacy at National University of Singapore (NUS) Faculty of Science has developed a small adhesive patch topped with minuscule needles to encapsulate lidocaine, a common painkiller.

When applied to the skin, the microneedles deliver the drug or collagen rapidly into the skin without any discomfort to the user.

The drug delivery technique could be used clinically to administer painkiller non-invasively to patients, or in home care settings for patients suffering from conditions such as diabetes and cancer. In addition, the novel transdermal delivery system could also be used for cosmetic and skincare purposes to deliver collagen to inner skin layers.

Faster delivery of painkillers is key to effective management of acute and chronic pain conditions. Currently, such drugs are mainly administered through invasive injections, or through the use of conventional transdermal patches, which may have limited efficiency due to variability of drug absorption among individuals.

To address the clinical gap, Dr Kang, together with Dr Jaspreet Singh Kochhar, who had recently graduated from NUS with a doctorate degree in Pharmacy, and their team members, used a photolithography based process to fabricate a novel transdermal patch with polymeric microneedles. The tiny needles are encapsulated with lidocaine, a common painkiller known for its pain-relief property.

Laboratory experiments showed that the novel microneedles patch can deliver lidocaine within five minutes of application while a commercial lidocaine patch takes 45 minutes for the drug to penetrate into the skin. The shorter time for drug delivery is made possible as the miniature needles on the patch create micrometre-sized porous channels in the skin to deliver the drug rapidly. As the needle shafts are about 600 micro-meters in length, they do not cause any perceivable pain on the skin.

The patch also comprises a reservoir system to act as channels for drugs to be encapsulated in backing layers, circumventing the premature closure of miniaturised pores created by the microneedles. This facilitates continued drug

permeation. In addition, the size of patch could be easily adjusted to encapsulate different drug dosages.

To expand their research on potential applications of the microneedles patch, the NUS team conducted a study to explore its effectiveness in delivering collagen into skin.

The researchers encapsulated collagen in the microneedles and tested the transdermal delivery of collagen using the novel technique. They found that collagen can be delivered up to the dermis layer of the skin, while current skincare products can only deliver to the outermost layer of skin.

As the novel technique for drug delivery is non-invasive and easy to use, the NUS team envisions that the microneedles patch has great potential for applications in clinical and home care settings for the management of perioperative pain and chronic pain in patients suffering from conditions like diabetes and cancer.

The innovative patch could also have paediatric applications. Dr Kang explained, "One prospective application is during vaccination for babies. The patch can be applied on the baby's arm five minutes before the jab, for the painkiller to set in. In this way, vaccination can potentially be painless for babies."

The research team intends to conduct clinical testing of the painkiller patch to further ascertain its effectiveness for clinical applications. They will also be conducting clinical studies to examine the efficacy of delivering collagen for cosmetic and skincare purposes.