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IIT Madras develops a wound dressing material to treat diabetic wounds

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Researchers at Indian Institute of Technology Madras have developed novel reduced graphene oxide loaded nanocomposite scaffolds for treating normal and diabetic wounds.

Wounds in diabetic patients do not heal as rapidly as it would in a normal and healthy individual. This leads to chronic non-healing wounds that can result in serious complications like amputations. Treatment of such chronic non-healing wounds in diabetes is still a major clinical challenge. Although there are some wound dressings that are commercially available, they are very expensive. As the diabetic population in India keeps growing, treating these diabetic wounds is a major clinical and social challenge.

The work of Prof. Vignesh Muthuvijayan, Assistant Professor, Department of Biotechnology, Bhupat and Jyoti Mehta School of Biosciences, IIT Madras, focuses on developing low-cost wound dressings that are effective in treating diabetic wounds.

Dr. T Ponrasu, an Institute Postdoctoral Fellow, working under Prof. Vignesh Muthuvijayan's mentorship has developed a new and rapid technique for preparing reduced graphene oxide from graphite powder.

Speaking about his research, Prof. Vignesh Muthuvijayan, Assistant Professor, Department of Biotechnology, Bhupat and Jyoti Mehta School of Biosciences, IIT Madras, says, "We wanted to exploit graphene-based materials' property of improving blood vessel formation at certain concentrations to prepare an inexpensive wound dressing. The psyllium-reduced graphene oxide nanocomposite that we prepared has shown exciting results in animal studies. We hope this is the first step towards developing inexpensive wound dressings using graphene-based materials for clinical use."

Researchers at IIT Madras used a convex lens to focus sunlight on graphene oxide to obtain reduced graphene oxide. Then, they load these reduced graphene oxide dispersions into a plant carbohydrate polymer (psyllium) solution to obtain wound dressing scaffolds.

Fibroblast cells, responsible for wound healing are used to evaluate the toxicity and bioactivity of these scaffolds on the cell attachment, migration and proliferation. These newly developed scaffolds provide a suitable tissue-friendly environment for

the cells and subsequently improve cell proliferation and attachment.

The wound healing efficacy of these scaffolds was studied, and the results revealed that these scaffolds provided an ideal environment to wounds for the regrowth of damaged skin through proliferated fibroblast cells on the injured site. Histopathology and immunohistochemistry analyses showed that these scaffolds treatment enhanced new blood vessels formation, collagen synthesis and deposition in treated wounds.

Overall, the research shows that these wound dressings could significantly accelerate healing of normal and diabetic wounds. The normal wounds treated with the dressings healed in 16 days compared to 23 days in untreated normal wounds.

Similarly, the diabetic wounds treated with the dressings healed in 20 days compared to 26 days in untreated diabetic wounds. These scaffolds are easy to prepare, inexpensive, and show excellent healing properties. Thus, the material acts as a good wound dressing and helps in accelerated healing of normal and diabetic wounds.