

Graphene oxide containing dressings for treating chronic wounds

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Chronic wounds negatively impact quality of life for millions of people globally, are costly to treat, and result in significant patient, clinician and healthcare system burden. Current wound care dressings provide suboptimal wound healing support for these high-risk patients who also have co-morbidities (e.g. diabetes, cancer). Limited options exist for these patients who are among the 30% of wounds which do not heal after one year of treatment. Prolonged wounds receiving ineffective repeat treatments can extend hospital stays, can lead to infections, amputations and, in severe cases, death.

Our solution is to create a bioactive wound care dressing containing durable and biocompatible graphene-oxide (GO) which self-assembles with an animal-free tissue repairing biomolecule, elastin-like peptide (ELP).

The GO in our dressings aims to provide enhanced mechanical strength to be used in combination or in place of conventional dressings which provide basic barrier protection and moisture retention, typically requiring changing 2-3 times per week due to limitations in durability. GO has the potential to pro-long the lifespan of dressings which could save weekly dressing costs and free up healthcare professional time per year globally (accounts for up to 71% of wound care management costs).

GO also offers the opportunity to design GO-protein interactions, which our proof-of-concept data shows has promising capabilities for promoting faster wound healing rates [1]. When ELP interacts with GO, we have shown improved wound healing by promoting dermal repair pathways for faster re-epithelialization, re-vascularisation and angiogenesis [2]. Our GO-ELP dressings could be used as a primary dressing to provide better wound bed support by delivering bioactive wound healing factors to be used in combination with secondary conventional dressings which provide an absorbent layer for exudate wound management.

To fully realise the clinical and commercial potential of this technology and further advance this study, we are currently converting our pre-prototype technology into a scalable, patient-relevant prototype dressing with Nottingham-based manufacturer, Brightwake to create an initial prototype featuring clinical-grade materials used and sold by their sister company Advancis Medical, a current supplier to the NHS and global market. This will enable us to conduct stability, safety and efficacy tests from pre-clinical to clinical stages and determine a viable route to the commercial market where we hope this technology can be used in the clinic to improve patient quality of life.

References

- [1] Yuanhao Wu, Babatunde O. Okesola, Jing Xu, Ivan Korotkin, Alice Berardo, Ilaria Corridori, Francesco Luigi Pellerej di Brocchetti, Janos Kanczler, Jingyu Feng, Weiqi Li, Yeijiao Shi, Vladimir Farafonov, Yiqiang Wang, Rebecca F. Thompson, Maria-Magdalena Titirici, Dmitry Nerukh, Sergey Karabasov, Richard O. C. Oreffo, Jose Carlos Rodriguez-Cabello, Giovanni Vozzi, Helena S. Azevedo, Nicola M. Pugno, Wen Wang & Alvaro Mata, Nat Commun. **11**, (2020), 1182.
- [2] Yuanhao Wu, Junyao Yang, Alexander van Teijlingen, Alice Berardo, Ilaria Corridori, Jingyu Feng, Jing Xu, Maria-Magdalena Titirici, Jose Carlos Rodriguez-Cabello, Nicola M Pugno, Jiaming Sun, Wen Wang, Tell Tuttle, Alvaro Mata. Adv. Funct. Mater., 38 (2022) 2205802.

