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Editorial

Commentary on "The Role of Alginate Hydrogels as a Potential Treatment Modality for Spinal Cord Injury: A Comprehensive Review of the Literature"

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See the article "The Role of Alginate Hydrogels as a Potential Treatment Modality for Spinal Cord Injury: A Comprehensive Review of the Literature" via https://doi.org/10.14245/ns.2244186.093.

In this paper,[1] the authors identified 555 preclinical studies that used alginate scaffolds. The authors have discussed the role of alginate hydrogels as substrate, drug delivery, neural regeneration, and cell-based therapy for spinal cord injury (SCI). In the current scenario, tissue engineering for repairing the damaged spinal cord is essential, and hydrogels seem promising for tissue engineering.[2] In central nervous system injuries, including SCI, the primary approach is to fix what we have (left after primary injury) by preventing further cell death,[3] restoring axon regrowth,[4] and removing blockades. The second approach is built around it; this could be accomplished by tissue engineering, biomaterial, and cell therapy.[5] Finally, the restoration of impulse conduction in demyelinated axons could be achieved by building a "bridge" around the injured area. Regenerative cell therapy using different types of stem cells, different inoculation techniques, and scaffolds has undergone many trials, highlighting cell efficacies and limitations.[6]

Alginates are polysaccharides extracted from brown algae; these include *Laminaria hyperborea*, *Laminaria digitata, Laminaria japonica, Ascophyllum nodosum,* and *Macrocystis pyrifera*. Alginate is composed of M-residues and G-residues arranged in diaxial links, and the ratio of 2 polymers depends on the algae of origin. Alginate hydrogels boost cell proliferation and differentiation before implantation. The use of alginate hydrogels is encouraging in the SCI therapy as it could be utilized as a substrate to make a bridge and could also be exploited in drug delivery and cell therapy.[7] Once integrated, their soft, porous, 3-dimensional structure can sustain injured spine tissue. Interestingly, alginates resemble hyaluronic acid, a brain and spinal cord extracellular matrix component, suggesting it could be a promising material for tissue engineering. Furthermore, a hydrogel can occupy the injured site and take shape for *in situ* gelations. The authors also summarised the studies suggesting that alginates are "antidegenerative" and "pro-regenerative," making them attractive candidates for SCI research.

The authors also discussed the studies where alginate-encapsulated brain-derived neurotrophic factor-producing fibroblast grafts restore spinal cord function without immune suppression,[8] and microvesicles with sodium alginate and naloxone improve functional recovery after SCI.[9] The advantages of using alginate hydrogels are that they are natural, biocompatible, biodegradable, and have multifunctional usage, and they are easily modifiable to suit the desired functionality. However, alginate hydrogel application has certain limitations; they can cause adverse cations leading to immunological reactions, they are not clinically characterized, and sometimes it is difficult to adjust the composition to meet specific applications. In addition, the molecular weights might fluctuate due to their easy chemical modification. The other issue is long-term term stability and degradation as byproducts are not entirely known.

In summary, alginate hydrogels have been shown to support neural stem cell development in several investigations as summarised by authors, and they could be promising for tissue engineering, medication delivery, axon regrowth, brain regeneration, and cell-based SCI treatments.

Conflict of Interest: The author has nothing to disclose.

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Title: Dove of Peace
Year: 1949
Artist: Pablo Picasso

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