**Investigation of the rheological and tissue adhesive properties of injectable chitosan and aldehyde pullulan hydrogels for deep and irregular wound healing.**

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In wound healing, it is essential for a hydrogel to adhere to the tissue to facilitate wound closure and tissue growth in a dynamic environment. However, most injectable hydrogels have poor adhesion to the tissue, limiting their ability to provide effective wound protection. Injectable hydrogels with adhesive properties can effectively fill deep and irregular wounds, especially those with movement, creating a sealed environment to protect wounds and reduce the risk of infection. Additionally, hydrogels with self-healing capacity can automatically repair themselves after mechanical damage, extending their service life and providing better wound protection, especially in critical situations.

This study investigated the impact of aldehyde pullulan concentrations (2, 3, 4, 5%) on the tissue adhesive, self-healing, and rheological properties of the injectable chitosan and aldehyde pullulan (CS/APUL) hydrogel. The chemical modification of the pullulan chain was confirmed by Fourier transform infrared spectroscopy. The adhesive strength, rheological test, thermal analysis, porosity and swelling studies of the hydrogels were investigated.

The results showed that the aldehyde concentration significantly influenced the physical, adhesion, and rheological properties of the CS/APUL hydrogel. The findings demonstrated that the hydrogels rapidly formed self-healing scaffolds and exhibited good adhesive strength ranging from 16 to 30 kPa. The adhesive properties of the gel were attributed to the presence of aldehydes and amino groups in the hydrogel. The hydrogels also self-repaired within 10–15 minutes without any external stimulus. Therefore, the synthesized hydrogels have the potential to be used as biomaterials for wound dressings, adhesives, and drug delivery devices.