Treatment for blindness-causing retinal detachment using viscous seaweed

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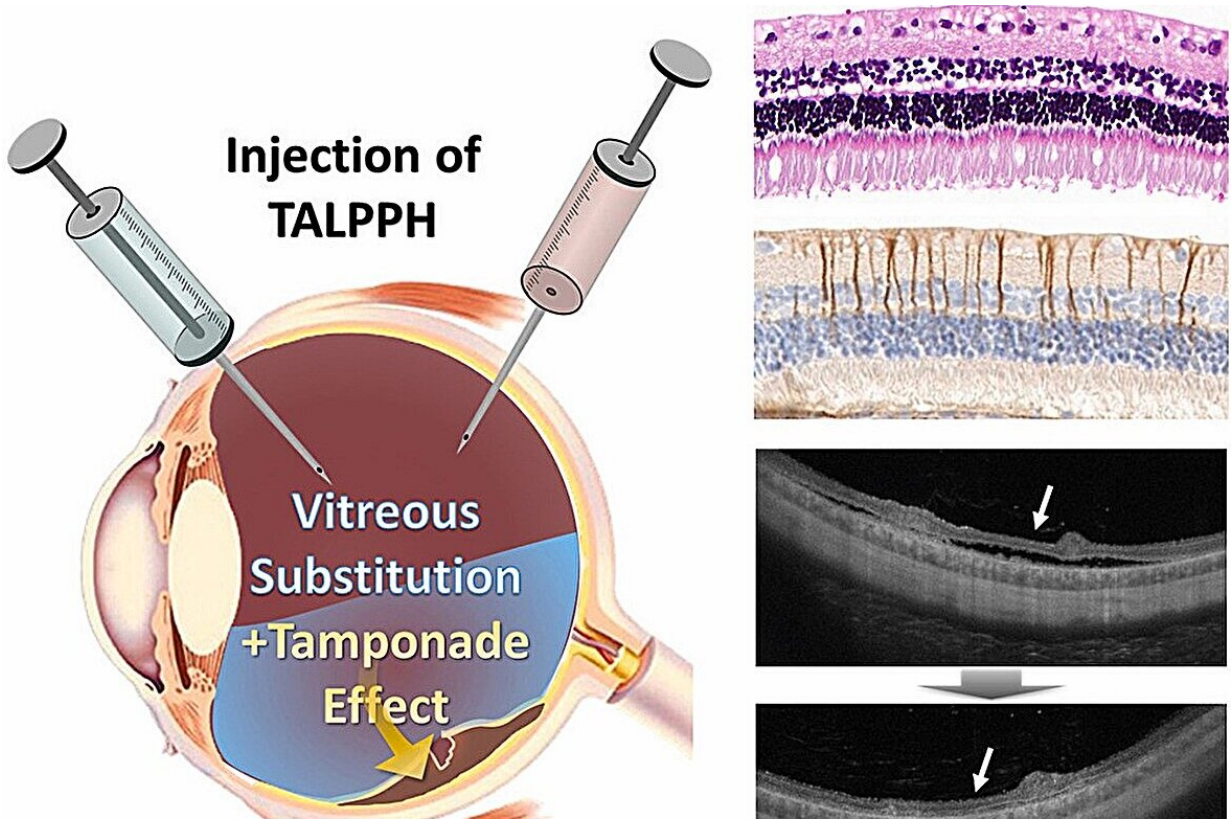

Hydrogels designed for treating retinal detachment, formulated from natural carbohydrate biomaterials obtained from algae. Credit: POSTECH

It's taboo to consume seaweed soup before exams in Korea since it can lead to failing the exam. The belief is rooted in the idea that the slippery nature of seaweed may cause people to slip and falter during the test. The slick surface of seaweeds such as seaweed and kelp is attributed to alginate, a mucilaginous substance, which may prove beneficial beyond the realm of superstition. A study exploring the use of alginate for the treatment of retinal detachment has been published in the journal *Biomaterials*.

The researchers' collaborative effort has resulted in the creation of an artificial vitreous body for treating retinal detachment. This solution is based on a natural carbohydrate derived from algae.

The vitreous body is a gel-like substance that occupies the space between the lens and retina, contributing to the eye's structural integrity. Retinal detachment occurs when the retina separates from the inner wall of the eye and moves into the vitreous cavity, leading to detachment and potentially resulting in blindness in severe cases.

While a common approach involves removing the vitreous body and substituting it with medical intraocular fillers like expandable gas or silicone oil, these fillers have been associated with various side effects.

To address these concerns, the research team employed a modified form of alginate, a natural carbohydrate sourced from algae. Alginate, also known as alginic acid, is widely utilized in various industries, including food and medicine, for its ability to create viscous products. In this research, the team crafted a medical composite hydrogel based on alginate, offering a potential alternative for vitreous replacement.

The hydrogel, possessing high biocompatibility and optical properties

akin to an authentic vitreous body, enables patients to preserve their vision post-surgery. Its distinctive viscoelasticity effectively regulates fluid dynamics within the eye, contributing to retinal stabilization and the elimination of air bubbles.

To validate the hydrogel's stability and effectiveness, the team conducted experiments using animal models, specifically rabbit eyes, which closely resemble human eyes in structure, size, and physiological response. Implanting the hydrogel into rabbit eyes demonstrated its success in preventing the recurrence of retinal detachment, maintaining stability, and functioning well over an extended period without any adverse effects.

The research team included Professor Hyung Joon Cha from the Department of Chemical Engineering and the School of Convergence Science and Technology and Dr. Geunho Choi from the Department of Chemical Engineering at Pohang University of Science and Technology (POSTECH), and Professor Woo Jin Jeong.

Professor Hyung Joon Cha from POSTECH, who led the study, said, "There is a correlation between retinal detachment and severe myopia and the prevalence of retinal detachment is increasing, particularly in young people. The incidence of retinal detachment cases in Korea rose by 50% in 2022 compared to 2017."

"Our team will enhance and progress the technology to make the hydrogel suitable for practical use in real-world eye care through ongoing research."

Professor Jin Jeong from the Dong-A University Hospital stated, "The worldwide market for intraocular fillers is expanding at a rate of 3% per year. We anticipate that the hydrogel we've created will prove beneficial in upcoming vitreoretinal surgeries."

More information: Geunho Choi et al, Injectable alginate-based in situ self-healable transparent hydrogel as a vitreous substitute with a tamponading function, *Biomaterials* (2024). DOI: 10.1016/j.biomaterials.2023.122459