An Ice-inspired Lubricant Improves Osteoarthritis Symptoms in Rats

2022-01-16

Inspired by a super-lubricating surface, researchers have developed a treatment for osteoarthritis that enhances lubrication and reduces friction and inflammation in a rat model of the disease.

With the Winter Olympics approaching, many people will soon be tuning in to watch events that take place on ice, such as figure skating, speed skating and ice hockey. An ultrathin, super-lubricating layer of water on the ice's surface is essential for skaters' graceful glides.

Inspired by this surface, researchers reporting in ACS Nano have developed a treatment for osteoarthritis that enhances lubrication and reduces friction and inflammation in a rat model of the disease.

Osteoarthritis, a chronic disease common in middle-aged and older people, is characterized by persistent inflammation and degeneration of cartilage in the joints.

Anti-inflammatory drugs can help relieve pain and inflammation, but long-term use can reduce their effectiveness or cause gastrointestinal problems. Corticosteroids injected directly into the joint provide temporary relief, but frequent treatments can sometimes damage the cartilage.

Yuanjin Zhao and colleagues wanted to develop drug delivery particles that, when injected into a joint, could safely enhance lubrication and decrease inflammation.

The researchers based their particles on hyaluronic acid (HA), a natural polysaccharide already used as a lubricant to treat osteoarthritis, but this molecule degrades rapidly inside the body. So the researchers used a microfluidic device to make tiny methacrylate

anhydride-HA gel particles, which they reasoned might be stronger and persist longer in the body than an HA solution.

To enhance the lubrication of the particles, the team coated them with 2-methylacryloyloxyethyl phosphorylcholine (MPC), which has positively and negatively charged chemical groups that attract a thin layer of water, similar to ice.

In addition, the particles' pores were loaded with an anti-inflammatory drug, which could be slowly and continuously released. The researchers then injected drug-loaded HA-MPC particles into the knee joints of rats with early-stage osteoarthritis. The joints of treated rats were more lubricated and had less cartilage destruction, joint friction and inflammation compared with a control group.

The treated rats also expressed higher levels of collagen II and aggrecan, two markers of healthy cartilage. The particles have great potential for clinical applications, but first they must undergo additional animal and biosafety tests, the researchers say.

Read the original article on American Chemical Society (ACS).