

Regenerative medicine

Revolutionising osteoarthritis treatment

Osteoarthritis (OA) is the most common joint disease, affecting over 528 million people worldwide. OA results in chronic pain, stiffness, and reduced joint function. Conventional treatments focus on symptomatic relief rather than addressing underlying causes. Dr Torbjörn Ogéus from the Stockholms led- & smärtspecialist (SLS) clinic in Sweden is pioneering regenerative medicine approaches to treating OA using patients' stem cells. These treatments show significant improvements in pain and joint function, with possible cartilage regeneration, offering a potential cure and vast improvement in the quality of life for millions of people.

Osteoarthritis (OA) is a chronic, degenerative joint disease affecting over 528 million people worldwide, making it the most common disease in the world. It is characterised by the progressive degeneration of cartilage in the joints, the smooth, rubbery material that cushions the contacts between bones and allows for smooth, pain-free movement. Bone alterations and inflammation at the joint are also common observations, causing symptoms of pain, stiffness, and reduced function in affected joints.

Living with this condition can be incredibly debilitating; everyday activities such as walking, climbing stairs, and gripping objects can become painful and difficult. The impact on quality of life is substantial, often leading to reduced physical activity, social isolation, and psychological distress. The economic

burden is also considerable, with direct medical costs and indirect costs such as lost productivity adding up to billions of dollars annually. Additionally, with an ageing global population and rising obesity rates, the burden of OA on healthcare systems is only expected to increase.

Conventional treatments for OA, such as pain relievers, physical therapy, and joint replacement surgery, tend to focus on alleviating symptoms rather than addressing the root causes of the disease. Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly prescribed to manage pain and inflammation, but they can cause gastrointestinal issues, cardiovascular problems, and kidney damage with long-term use. Physical therapy can help maintain joint function and mobility, but this is often not sufficient for severe cases.

In more advanced stages of OA, joint replacement surgery becomes the primary treatment option. While effective in restoring function and reducing pain, these surgeries are very invasive and come with additional risks, including infection, blood clots, and the potential need for revision surgeries. Moreover, joint replacements have a limited lifespan, and younger patients are often advised to delay surgery until absolutely necessary, which can result in prolonged periods of pain and disability.

THE REGENERATION REVOLUTION

There is a clear need for new, innovative therapeutic options that not only alleviate symptoms of OA but also treat the underlying causes of the disease. One potential answer comes from the new field of regenerative medicine.



Ogéus' colleague Mattias Lejon is performing a liposuction to prepare the patient for SVF treatment.

similar reductions. Stiffness in both knees and hips dropped by 89%, and physical function scores improved by 81% for knees and 85% for hips over the same period. These changes indicate substantial improvements in patients' quality of life. Radiographic images also supported these findings, showing an increase in joint space of 2 mm on average for knees and 1.6 mm for hips (where normal knees have approximately 4 mm and hip joint approximately 3 mm cartilage). This increase suggests that the SVF+PRF treatment not only alleviates symptoms

Ogéus has been pioneering a groundbreaking regenerative medicine methodology for the treatment of osteoarthritis which has shown great promise in the clinic.



Ogéus performed the first stem cell/SVF injection in Sweden 6 years ago.

Regenerative medicine harnesses the body's innate healing mechanisms to repair, replace, or regenerate damaged tissues using methods including stem cell therapy, tissue engineering, and molecular biology. Dr Torbjörn Ogéus, a pain specialist with the SLS clinic in Stockholm, Sweden, has been pioneering a groundbreaking regenerative medicine methodology for the treatment of OA which has shown great promise in the clinic. This method uses a patient's own stem cells to treat the condition; specifically, a stromal vascular fraction (SVF) combined with platelet-rich fibrin (PRF). SVF is derived from a patient's adipose tissue (body fat) and contains a mixture of cells, including mesenchymal stem cells (MSCs) and endothelial progenitor cells, as well as various growth factors. PRF, on the other hand, is obtained from the patient's blood and is rich in growth factors like transforming growth factor-beta (TGF- β) and platelet-derived growth factor (PDGF). When used together, the growth factors in the PRF activate the stem cells in the SVF after they are injected into the osteoarthritic joint, promoting tissue regeneration and healing.

STEM CELLS IN THE CLINIC

Ogéus recently published a retrospective cohort study of 104 patients who underwent SVF+PRF therapy for knee and hip OA. The research focused on 2-year follow-up WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) scores and radiographic images. The WOMAC index is the gold standard tool that measures pain, stiffness, and physical function in patients with OA. WOMAC scores range from 0 to 4, with

lower scores indicating fewer symptoms and better physical function.

The results of the study are compelling. Statistically significant improvements in WOMAC scores were observed for both hip and knee OA patients at the 6-month check-up and at the end of the 2-year study. On average, knee patients saw their WOMAC scores drop 84.5% over the 2 years. Hip patients experienced a similar improvement, with scores falling 84.4% when followed up 2 years post-treatment. Knee pain decreased by 94% over the two years, while hip pain showed

but may also contribute to the regeneration of joint structures.

Interestingly, the WOMAC scores reported in this study closely match the outcome scores for replacement surgery for hips and knees with OA, but often took longer to achieve the same reductions in pain and improvements in function. The SVF+PRF therapy, however, is very minimally invasive compared to joint replacement surgery, and in cases where total replacement surgery was still required, this was delayed for multiple years, which is particularly advantageous for younger patients. Other advantages of this therapy include the ease of obtaining the relevant SVF and PRF material, and the extremely low risk of rejection due to using a patient's own (autologous) stem cells. Further research is still needed, including placebo-controlled trials and magnetic resonance imaging (MRI) before and after treatment to evaluate cartilage regeneration, but overall, SVF+PRF treatment offers a minimally invasive, low-risk treatment for OA as an alternative to invasive and risky total joint replacement surgery.

NANOSCALE MEDICINE

SVF+PRF therapy is not the only strategy based on regenerative medicine that Ogéus is developing. Another strategy involves harnessing





Ogéus presented his research at the Future Biosensors Conference in Barcelona, June 2024.

exosomes, which are nanosized vesicles – essentially tiny bubbles – enclosed by a lipid bilayer. They are produced naturally by many cells in the body and carry a cargo of proteins, lipids, and other bioactive molecules that reflect the characteristics of their cell of origin. Exosomes have many advantageous properties compared to stem cells, including enhanced stability, reduced immunogenicity, and the ability to cross biological barriers impassible to most cells. One of the most promising sources of exosomes is amniotic fluid. This is because amniotic stem cells have a pluripotency similar to that of embryonic stem cells, which gives them an exceptionally high regenerative potential. Amniotic exosomes have shown remarkable potential in regenerative medicine and tissue repair, and influence various cellular functions including cell proliferation, differentiation, and immunomodulation.

The potential and power of exosome-based therapy is exemplified in another recent paper published by Ogéus, summarising three case studies from real patients in the clinic. Case 1 was a 32-year-old professional basketball player who faced the end of his career due to chronic hip pain caused by osteoarthritis. After receiving a treatment of SVF+PRF and amniotic exosomes, his flexibility and pain levels improved significantly. Six months post-treatment, he was able to return to professional basketball, pain-free, and continues to play one year later. Case 2 was a 33-year-old former ice hockey player who had been living

with severe lower back pain for seven years, stemming from multiple disc hernias. After an intravenous exosome treatment, his back pain disappeared within three weeks. Six months later, he remained pain-free and could exercise and train without discomfort. Case 3 was a 54-year-old man suffering from chronic pain after a motocross accident 35 years ago. His injuries included a fractured vertebra in his spine, partial tears in his rotator cuff, and severe osteoarthritis in his knee. His knee woke him up 5–10 times every night, and if he walked more than 3km he had swelling and pain for about a week afterwards.

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Following treatment with SVF+PRF and exosomes, he reported being pain-free in his spine for the first time in 35 years. His knee pain also improved significantly, not waking him up for many months, and allowing him to walk long distances without swelling or pain.

All three of these cases were treatment-resistant conditions causing chronic pain due to bone or cartilage degeneration. Despite different injuries and slightly different treatments, in each case a single injection of amniotic fluid-derived exosomes showed remarkable short-

term symptomatic relief and reductions in chronic pain. While multiple other ongoing clinical studies have also reported safe and efficacious use of exosomes, more work is still needed. Exosomes face multiple challenges regarding clinical application, including heterogeneity of the harvested exosomes, unknown pharmacokinetics and pharmacodynamics, and questions about long-term effects and stability. There is also a need to standardise therapeutic doses and route of administration, and a need to collect data from larger patient groups over longer follow-up periods.

Despite these hurdles, the potential of exosomes in regenerative medicine is undeniably exciting, both in combination with stem cell treatments such as SVF+PRF and alone.

To underscore this, Ogéus and his team have performed over 120 exosome/PRF treatments on patients with OA since October 2023, and the initial results are extremely promising. Patients saw a similar recovery to the SVF+PRF treatment, however the exosome+PRF therapy is cheaper, faster, doesn't contain any cells, and patients generally showed faster recovery. A retrospective study is planned to be published on these treatments within the next year.

A LOOK TO THE FUTURE

Osteoarthritis remains a significant challenge, but advancements in regenerative medicine offer new hope. SVF, PRF, and exosome treatments have shown remarkable potential in treating hip and knee OA, providing significant symptomatic relief and improved joint function. In the face of a growing OA epidemic, these treatments could become a standard part of OA management, offering millions of patients a better quality of life and potentially delaying or negating the need for invasive surgeries.



Behind the Research

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Research Objectives

Dr Torbjörn Ogéus is pioneering regenerative medicine approaches to treating osteoarthritis.

Detail

Bio

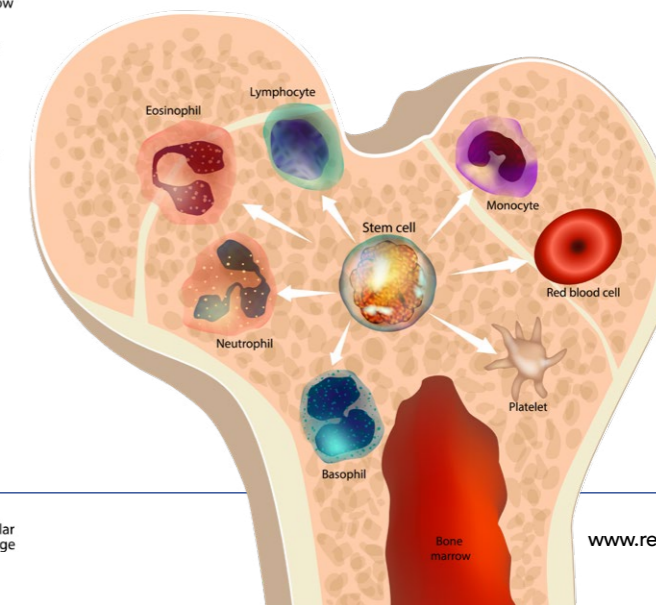
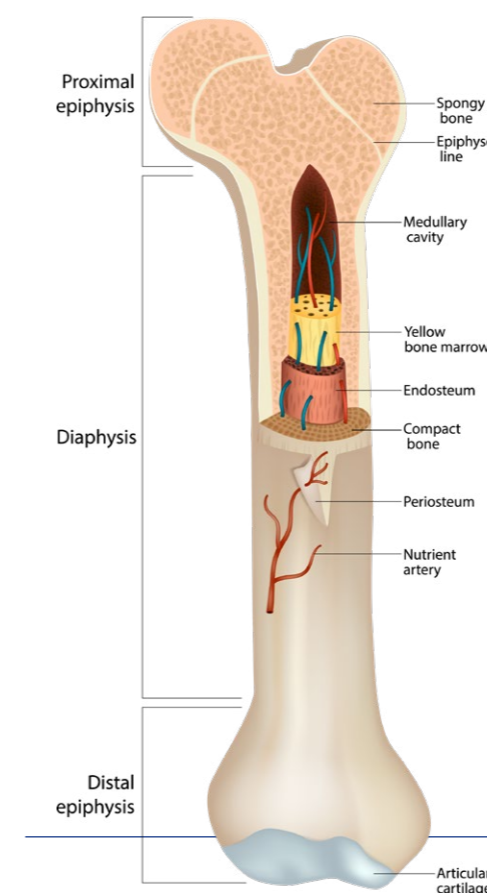
Dr Torbjörn Ogéus is a pain specialist with clinical experience in regenerative medicine. He has been treating tendons and osteoarthritis (OA) with growth factors for 15 years. 6 years ago, Ogéus did his first stem cell treatment for OA and recently published one of the first clinical studies in the world on exosomes and OA.

Competing interest statement

Ogéus is an expert advisor to numerous companies in the stem cell industry, helping them with clinical aspects such as developing clinical protocols and discussing practical challenges. He funded and paid for all his research to avoid external influence.

Collaborators

- Mattias Lejon, MD



References

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Personal Response

What inspired you to conduct these studies?

“ An unsuccessful routine surgery of my knee caused severe OA and my career as a professional athlete was ended at the age of 30. I was given the option of a total knee replacement but decided to dedicate my life to developing a regenerative treatment. Since then, I have been looking for a way to treat and eventually cure OA. Today I am 45 and still have my original knee and live a virtually pain-free life where I exercise and play sports without a problem. ”

Are these therapies applicable to all OA patients, and at what point in disease progression should they consider these treatments?

“ Yes, but the prognosis is better the milder the OA is. If the subchondral bone (the bone under the cartilage) is deteriorated or destroyed, a joint replacement surgery might still be a better option as most of the stem cell activity seems to work on rebuilding the destroyed bone first, before rebuilding cartilage. ”