

## Research Article

# Lipogems in Osteoarthritis: Fact or Fiction?

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## Introduction

Osteoarthritis and chondral defects are medically challenging conditions in need of drastic improvement. Millions of patients are prescribed treatments with no supporting evidence for their use or therapies without curative intent. With the recent advances of the use of adipose tissue in the field of regenerative medicine; is it now finally possible to create a new evidence based care pathway to restore function, reduce pain and increase quality of life of these patients?

## Key words:

Lipogems; Osteoarthritis; m-Fat; Stem cells; MSCs; Medicinal Signalling Cells

## What makes ‘Lipogems’ therapy different?

Osteoarthritis is becoming increasingly common due to the aging population. The current long term treatment is surgery – either a total joint replacement or arthroscopy. Total joint replacements are major surgeries requiring long term rehabilitation. It is also important to mention the risks of surgery such as infection, bleeding and post-operative pain. For many elderly patients, the risks of this surgery are too great and are often a point of contention between surgeons and anaesthetists. Arthroscopy is the other surgical option and is a lower risk procedure but is by no means an alternative to joint replacements and is generally used for chondral defects in lower severity disease. Interestingly, arthroscopy has been proven in a systematic review by the BMJ to be ineffective and not worth the harm to the patients [1]. Therefore the question is raised as to whether arthroscopy does more harm than good.

There are several new techniques that have been developed recently, including microfracture, biomaterial, and adipose tissue. The therapy that shows the most promise by far is the use of microfragmented non-enzymatically digested adipose tissue, otherwise known as Lipogems. [2] There is an increasing level of evidence for this therapy; for example, a case study by Francheschini et al in 2016 [3] showed how a 33 year old semi-professional snowboarder with knee trauma (chondral lesion) was unable to achieve satisfactory pain relief from existing medical treatments. Additionally, surgery was not considered a viable option as the patient believed that the risk to his career was too high, as well as being put off by the high chance of requiring multiple revision surgeries. The surgeon decided to try Lipogems as monotherapy, and both the surgeon and the patient were satisfied with the level of pain relief this patient had achieved. When his pain was scored using the Oxford knee score, an improvement from 36 to 46 was seen; furthermore, Magnetic Resonance Imaging of his knee joint showed evidence of chondral

regeneration at 12 months. From this objective evidence, it is clear that Lipogems are of benefit to patients with osteoarthritis or chondral defects.

## Method

The therapy begins by using local anaesthetic to extract adipose tissue from the patient’s abdomen or thigh, and this tissue is inserted into the Lipogem container. The container uses filters to separate waste products such as blood, and also microfragments the tissue. The microfragmentation process uses ball-bearing as opposed to enzymes. By maintaining the natural constitution of the tissue, the efficacy of the process is increased as the vasculature remains preserved and the cells are protected from inflammatory damage. The intraoperative time is not significantly prolonged as preparation of the Lipogem material only takes around 15-20 minutes. Finally, the adipose tissue is injected into the joint preferentially with a saline washout beforehand, and patients are expected to weight bear and mobilise immediately without the need of rehabilitation [4,5] (Figure 1).



Figure 1: Lipogems – m-Fat.

## Mechanism of Action

The mechanism of action is currently unknown, but the latest theory is that it is by a combination of mechanical and chemical factors. The mechanical effect of inserting fatty tissue creates space in the articular joint space, therefore reducing the bone on bone friction. This achieves immediate pain relief in the patient, hence why they are able to mobilise after the procedure.

The second mechanism of action is from the paracrine release of tissue factors from Medicinal Signalling Cells (MSCs) (6,7). MSCs are derived from pericytes and are commonly used synonymously with stem cells in papers. However this is a misconception as these pericytes are not able to ‘de-differentiate’ into a multipotent cells

and then later differentiate into chondrocytes. This has been highlighted many times in the literature, most notably in a paper by Caplan (7) in 2017 where he called for the change in the name from mesenchymal stem cells to medicinal signalling cells. Although MSCs do cause regeneration of collagen, they achieve this by the release of anti-scarring, anti-apoptotic, angiogenic, and trophic cytokines. In comparison to the mechanical mechanism of action, the chemical release sustains the pain relief over longer periods of time and achieves regeneration of damaged tissue.

### Evidence

The use of autologous MSCs have consistently been seen to reduce pain, increase mobility and show improvements on surgical scoring systems such as the Tegner and Lysholm scores. Some studies such as Vega et al (5) have proven evidence of regeneration on MRI with one year follow up, and one study (8) showed improvement even with up to 3 years of follow up. Moreover, a case study by MSK Doctors (9) demonstrated how a patient that was medically unfit for a total knee replacement received Lipogem therapy and was later able to walk without pain.

### Limitation & Safety

A common cause of concern for new procedures is patient safety. Till date, after 30,000 report procedures, there have been no reported side effects in relation to the use of MSCs. There are theoretical risks such as infection and bleeding, but these risks are no different to that of IM injections. This is in vast contrast to arthroscopy and joint replacement where there are risks associated with anaesthesia, regardless of the patient demographic, as well as specific surgical complications. In fact, the use of Lipogem is safe even compared to medical treatments. For example, the chronic use of NSAIDs or opioids have been proven to have serious and sometimes life threatening side effects.

### Discussion

Lipogems is a therapy that has potential to treat joints pain. With current evidence, the population that would benefit the most are patients with earlier stages of osteoarthritis or with focal areas of chondral damage as they are often not recommended to undergo knee replacement surgery due to the high likelihood of requiring multiple revision surgeries in the future. The therapy could also be beneficial to patients who are unsuitable for surgery due to co-morbidities.

There is currently a peak of interest in MSCs but also a lot of scepticism. Clinicians and patients alike would benefit from further studies into this therapy especially from a safety perspective and ideally in comparison to the current standard practice.

### Conclusion

Further research is warranted, ideally with a blind comparison to arthroscopy or other injection therapy due to the ethical equipoise. Although the majority of the studies focus on the knee joint, this approach has possibilities of being expanded to other joints such as the shoulder, hip and elbow. (10) From the current evidence, this is a promising technology and would benefit from further exploration.

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