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# Study on Persistent Symptomatic and Functional Improvement of Hands Osteoarthritis Post Expanded Mesenchymal Stem Cell Therapy: A Clinical Approach

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## ABSTRACT

This study aims to find out if any potential cellular biological therapy could provide patients who suffer from hand osteoarthritis (OA) help with symptoms control and restore hand function to improve activities of daily living and make work more comfortable. OA of the hands is a challenging condition and difficult to treat. We usually treat OA with Analgesics, anti-inflammatory medications, and hand exercises. In severe cases, we proceed for surgery, either reconstruction, replacement, or fusion of the joint (s) depending on the affected area. We report a case of a sixty-six-year-old female who was bothered by symptomatic hand OA for six years that affected her activities of daily living and job; she works as an aromatherapist. She responded well to adipose-derived autologous expanded mesenchymal stem cell (MSC) therapy, which we accomplished under ultrasound guidance after digital nerve block for bilateral second through fifth distal interphalangeal joints. The improvement began one month after the stem cell implants, with the most significant benefit occurring ten months after the therapy, which lasted after that. A fourteen-month follow-up x-ray revealed no radiological progression of OA in the treated joints compared to the baseline x-ray. She continued to enjoy relaxing activities of daily livings and work. Despite the persistent response, she chose a booster dose of MSC therapy to maintain her function and prevent the progression of OA. This case demonstrated good symptomatic and functional outcomes, with no further OA joint deterioration on x-rays; this indicates a promising therapy for hand OA where no other available medical treatment can achieve so far.

*Keywords: Hand osteoarthritis; OA; mesenchymal stem cell; MSC; radiologic progression; ultrasound.*

## 1. INTRODUCTION

Osteoarthritis (OA) is a common condition described by pain, stiffness, reduced hand strength and function, and joint deformities. Particularly first carpometacarpal (CMC) joint, proximal interphalangeal (PIP), and distal phalangeal (DIP) joints [1,2]. As OA progresses, it affects routine daily activities and quality of life [3,4]. More specifically, hand OA is exceptionally challenging because of the joint complexity involved and the small surface region of the joints [5]. Dissimilar to the general belief that it is a disorder of older individuals, hand OA can occur reasonably early in life, especially in middle-aged people, and impair individuals' work capacity [6]. Statistics expect that the expense burden of OA is high-ranking around the world, as 2.5% of the gross domestic result in the United States [7].

The standard treatment for hand OA is a combination of non-medical and medical interventions, but the benefits are limited and temporary. We usually use local and systemic, nonsteroidal anti-inflammatory drugs (NSAIDs) in medical treatment. The latter may cause gastrointestinal irritation, bleeding, and renal damage, especially if the patient has diabetes, hypertension, or takes medications that interact with NSAIDs. Studies tried acetaminophen, glucosamine and chondroitin, intra-articular steroid, and hyaluronic acid injections [8-11]. The surgical option is the last resort with trapeziotomy for the first CMC joints, arthroplasties for PIP joints and arthrodesis in DIP joints [12].

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Our case demonstrates a remarkable lasting response to the implantation of autologous fat-derived expanded MSCs into multiple bilateral hands DIP joints; her follow-up x-ray revealed stability with no progression of the treated DIP joints.

## 2. CASE REPORT

A sixty-six-year-old female aromatherapist is usually fit and healthy who works thirty hours a week. She presented with six years history of increasing bilateral hand pain in second-fifth DIP joints, particularly in cold weather. She had significant stiffness with impairment in activities of daily living, notably gardening, cutting things, and opening jars. She struggled to do her job in aromatherapy. In January 2020, she had an x-ray of her hands which revealed severe OA of the right third DIP joint with narrowing and osteophyte formation. Moderate OA at the bilateral fourth and fifth DIPs (Fig. 1). She elected experimental mesenchymal stem cell (MSC) therapy; in June 2020, she had the abdominal fat harvesting then was sent to a specialized lab for cell expansion. In August 2020, she underwent MSC implantations. We did the procedures using multiple bilateral trans-theal digital nerve blocks (Fig. 2). We implanted 10 million MSCs without platelet-rich plasma in each of the eight DIP joints using a 0.4MLS solution under ultrasound guidance using a hockey stick probe with a Sonosite ultrasound transverse approach (Fig. 3). One-month post-MSC injections, she felt some improvement in pain and stiffness that peaked after ten months of the therapy. That encouraging effect has continued; she reported good daily and work functional abilities. A repeat x-ray in October 2021 revealed no progression of OA, as in (Fig. 4). We compared the current x-ray to her baseline x-ray, twenty-one months prior. In October 2021, she decided on a second MSC injection to further protect her joints, and we adapted the same practice as the first one.



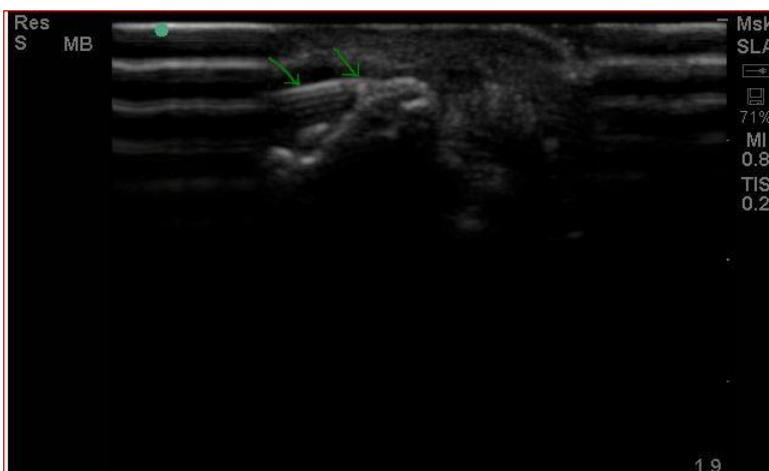
**Fig. 1. Pre-treatment X-ray hands demonstrating established osteoarthritis in multiple joints**

## 3. DISCUSSION

There is no proven therapy for hand OA, particularly for DIP joints, with arthrodesis the only choice while PIP joints can be replaced [12]. In comparison, various pharmacologic and non-pharmacologic therapy does not seem to alter the outcome of the hand's function in addition to the renal and gastrointestinal complications of the long-term use of NSAIDs. Fusion of DIP joints means a significant limitation of fine finger movements, which leads to impairment of daily living activities. It could also lead to job loss, like our patient, who could continue her adored work following MSC therapy.



**Fig. 2. Long axis ultrasound-guided needle for trans-thecal digital nerve block**



**Fig. 3. Short axis ultrasound-guided needle in distal interphalangeal joint**



**Fig. 4. Post-treatment X-ray hands demonstrating No progression of osteoarthritis**

MSC therapy is a promising science and is rapidly growing. However, it does not cure finger OA or reverse the severely damaged cartilage. A pilot study of Fifteen patients with first CMC joint OA got

treated with microfracture, and the bone marrow Stem cells were applied directly. The outcome revealed good symptomatic and functional results one year after the treatment indicating an alternative to trapeziotomy or other major plastic surgery [13].

Still, we believe it is the best available experimental effective and safe therapy, as shown in clinical trials [14]. While MSC therapy in OA had more encouraging studies than in rheumatoid arthritis (RA), some literature suggests it has a promise in both OA and RA with reduced pain, enhanced joint function, and heightened overall satisfaction in the patient life [15].

Our therapy, in this case, suggests a possible good potential and safe alternative medicine in patients who elect to try it. Expanded MSC therapy has the advantage of repeating the procedure whenever it is needed as we can cryo-preserve the cells in liquid nitrogen at -190 degrees to keep the cells alive for 15 years or longer. We then do not repeat the fat harvesting process, and the cells remain at a younger age, and it is less costly for the patients.

#### **4. CONCLUSION**

We hypothesize that autologous expanded MSC therapy has enhanced daily functional activities and returned to work with no further radiologic advancement. Given that we use the expanded MSC therapy, thus we can repeat the cells implantations quickly and safely to help maintain the hand function and slow or stop the OA progression. However, we need to confirm those findings are consistent in broad randomized controlled trials.

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#### **COMPETING INTERESTS**

The author has declared that no competing interests exist.

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**Biography of the author(s)**



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Department of Rheumatology, Auckland Regenerative Clinic, Ormiston Specialist Centre, New Zealand.

**Research and Academic Experience:** He has extensive experience in Expanded Autologous Mesenchymal Stem Cell Therapy for Musculoskeletal and Orthopaedic Conditions.

**Research Area:** His research area includes Interventional Regenerative Medicine, including plasma (PRP), Hyaluronic Acid, Mesenchymal Stem Cell Therapy, Exosome treatment and Various Scaffold Techniques for Stem Cells.

**The number of Published Papers:** He has six research articles.

**Special Award:** He has Certificates of Appreciation (Best Award) video Talk and two Certificate of Recognition in Stem Cell Therapy at SciTech Genomics, Proteomics and Bioinformatics 2021, Certificate of recognition in World Congress on "Pain Research & Management" held during November 17-18, 2021.

**Any Other Remarkable Point:** Ultrasound-Guided Procedures in musculoskeletal conditions.

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