

Chondromalacia: Etiology, Management Challenges, and Alternative Treatment

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In this study, a patient received two local injections of TELOXOME, a novel stem cell-derived agent developed by ContiNew Medical. The injections were administered to the patient's left knee, with the injections separated by 3 weeks. The patient underwent magnetic resonance imaging (MRI) of the knee before and at 6 months after the TELOXOME injections. The MRI scans revealed a significant improvement in chondromalacia following the two TELOXOME injections. This finding indicates that TELOXOME may be an effective treatment option for chondromalacia, especially in cases where traditional treatments have failed.

Key words: exosome, chondromalacia, patellae, TELOXOME

Introduction

Knee pain results from a common inflammation of the patellofemoral and tibiofemoral joints in young and older adults (9, 11). Osteoarthritis, a degenerative disease affecting more than 300 million people worldwide (1), is characterized by joint inflammation and pathologic destruction of articular cartilage (3). Chondromalacia is a condition wherein the transparent cartilage on the surface of a bone joint softens and subsequently tears, splits, and becomes eroded (5). Chondromalacia typically involves the extensor mechanism of the knee joint and is therefore often referred to as patellar chondromalacia, patellofemoral pain syndrome, or runner's knee. The undersurface of the patella, which is covered with transparent cartilage, is connected to the trochlea (groove) of the femur, which is also covered with transparent cartilage. Traumatic injury, overuse injury, and iat-

rogenic drug injection can lead to the development of chondromalacia. Chondromalacia can occur in any joint but is particularly common in joints with trauma and deformity.

The symptoms of chondromalacia include swelling around the knee joint or pain in the front of the knee, increased pain during activity—particularly when an individual is bending the knee or going up and down stairs—and a feeling of weakness or fatigue. Direct pressure on the patella can also cause pain that is likely to result in impaired function during activity. Chondromalacia has complex and numerous etiologies, including trauma, increased cartilage vulnerability, patellofemoral instability, bony anatomic variations, abnormal patellar kinematics, and occupation hazards (6, 11).

No universally accepted standard treatment for chondromalacia has been developed. On the basis of the results of physical examination, a doctor can prescribe medical interventions, such as patellar stabilization braces, physical therapy to strengthen the quadriceps muscles, orthotics to reduce pronation, and nonsteroidal anti-inflammatory drugs. Platelet-rich plasma therapy is occasionally recommended but is not currently a standard of care because it does not consistently lead to improved patient outcomes (2). For the same reason, the less frequently recommended regenerative therapy is not a standard of care for chondromalacia in Taiwan. When conservative medical interventions for chondromalacia do not elicit a response, surgical treatment may be required. The typical first-line surgical treatments are arthroscopic evaluation and subsequent debridement (removal of damaged cartilage), plica release, and lateral

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retinacular release. Open realignment procedures are occasionally used to improve patellofemoral joint movement. Patellofemoral joint replacement is an option that is rarely selected.

The diagnosis and management of patellar chondromalacia is complex and ideally should be completed by a multidisciplinary team (7). Furthermore, intervention for the condition is difficult because no single treatment is effective for all patients. Nonsurgical treatment is usually prioritized, with regenerative stem cells or alternative therapy being potential options if conservative measures fail. Surgery may ultimately be necessary if all treatment options have been exhausted; however, surgery does not always lead to satisfactory results, and some patients continue to complain of pain postsurgery. In the current case study, a patient received a diagnosis of chondromalacia after undergoing magnetic resonance imaging (MRI). He was treated with a knee injection of TELOXOME twice in 3 weeks.

Materials and methods

The patient's left knee was locally injected with 1 mL of TELOXOME (a novel stem cell-derived agent developed by ContiNew Medical, Taipei, Taiwan) (10). The second shot was administered 3 weeks after the first injection. MRI scans were obtained before and at 6 months after the TELOXOME injections.

Results

Our patient, a 46-year-old male athlete, had received a diagnosis of Stage IV chondromalacia 9 years previously. He had received two local injections of platelet-rich plasma and two of hyaluronic acid. However, his symptoms had persisted. After receiving two local injections of TELOXOME, his chondromalacia significantly improved, as indicated by his MRI scans.

Discussion

Chondromalacia is a common disorder that affects the cartilage on the surface of the knee joint. It can be caused by various factors, including overuse, injury, or degeneration due to aging. Chondromalacia can lead to pain, swelling, and difficulty performing normal activities, such as walking or climbing stairs (11). Traditional treatments for chondromalacia include physical therapy, anti-inflammatory medication, and injections of platelet-rich plasma or hyaluronic acid. However, these treatments may not be effective for all patients, and surgical treatment may be necessary in some cases. TELOXOME is a novel stem cell-derived agent containing highly purified exosomes. A

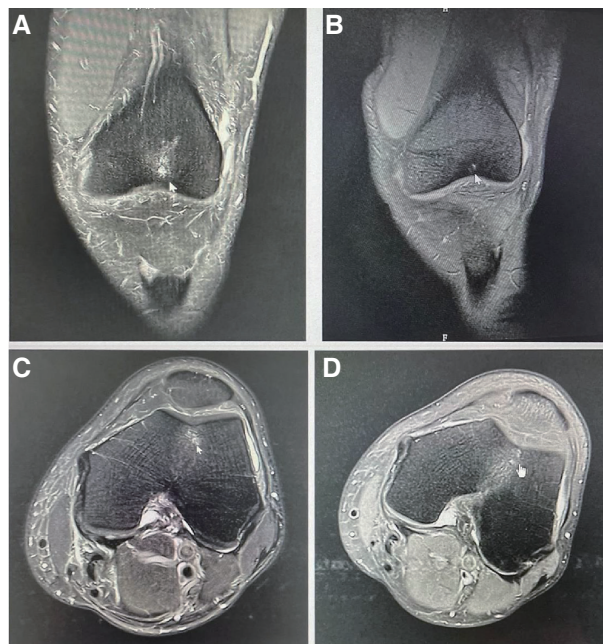


Fig. 1. MRI images depicting the condition of a patient with chondromalacia before and after TELOXOME injection. Coronal (A) and sagittal (C) sections illustrate the patient's condition before TELOXOME treatment, revealing Grade 4 chondromalacia in the left femoral trochlear groove. (B) Coronal and (D) sagittal sections after 3 weeks of TELOXOME injection. T2-weighted MRI was used to assess cartilage damage beneath the kneecap. The yellow lines in (C) and (D) form an angle known as the lateral patella tilt angle (LPTA). According to Damgacı et al., the LPTA decreases in patients with chondromalacia (1). The MRI scans after 3 weeks of TELOXOME injection reveal better morphology outcomes and an increased LPTA.

proteomic analysis of TELOXOME revealed a wide range of proteins and growth factors, some of which may be involved in the alleviation of chondromalacia. These include fetuin-B, which is known for its antiosteogenic properties; α -1-microglobulin/bikunin precursor protein, which acts as an antioxidant and facilitates tissue repair; α -2-macroglobulin, which serves as a carrier for various growth factors and cytokines; serotransferrin, which is known to stimulate cell proliferation; fibronectin, which is crucial for wound healing and embryonic development; and complement factors, which contribute to anti-inflammatory responses and injury repair. However, the precise role and importance of each of these proteins in the alleviation of chondromalacia must be further investigated. Furthermore, small interfering RNA sequencing of TELOXOME unveiled an abundance of various micro RNA (miRNA) species, including hsa-let-7a-5p, hsa-let-7f-5p, hsa-let-7i-5p, and hsa-miR-103a-3p. Research has extensively documented

the role of miRNAs in the pathogenesis of arthritis as well as their potential in therapeutic interventions (4, 8). The abundance of the aforementioned miRNAs in TELOXOME requires further confirmation. Huang et al. reported promising results regarding osteoarthritis treatment after using a similar therapeutic approach in both in vitro and in vivo systems (2). TELOXOME promotes regeneration of damaged cartilage and reduces inflammation in the knee joint. Although further studies are required to verify its effectiveness, early results indicate that TELOXOME is a safe and effective treatment option for patients with chondromalacia who have not responded to traditional treatments. The diagnosis and management of chondromalacia should be completed by a multidisciplinary team including orthopedic surgeons and physical therapists to ensure that patients receive the most appropriate and effective treatment regimens. This is the first human case study to report substantial improvement of chondromalacia after TELOXOME injection, as evidenced by the patient's MRI scans (Figure 1).

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