

# ESWT for Pain and Function in Severe Knee Osteoarthritis

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Knee osteoarthritis is a common condition that causes significant morbidity in the global population. According to the CDC, 75 million Americans suffer from damaged cartilage, and 40 million develop knee osteoarthritis. These individuals endure excruciating pain, experience reduced mobility, become incapacitated, or may require invasive surgeries. And once all the articular cartilage in the knee has been lost, the most predictable solution remains a total knee replacement. However, this procedure often does not result in a high degree of satisfaction due to the frequent persistence of pain and the potential complications it entails. The majority of patients are elderly and have comorbidities that significantly increase the surgical risk. The number of patients who cannot undergo surgery and must live with functional disabilities and pain is high

Recently, non-surgical systems have been developed to improve pain and function in patients with severe knee osteoarthritis. These systems include biomechanical measures such as load control and physical therapy, pharmacological measures such as NSAIDs, opioids, and cannabinoids, as well as regenerative measures such as hyaluronate injection or orthobiologics. Shockwave treatments have demonstrated their effects on pain, inflammation, and tissue regeneration in various tissues such as subchondral bone, synovial tissue, ligaments, muscles, and tendons for over three decades. These effects have the potential to improve function and alleviate pain in patients with severe knee osteoarthritis. The use of electromagnetic pulse therapy (EMTT), high-intensity laser therapy (HILT), radiofrequency, focused shockwaves, vibrational systems in muscles, among others, has been reported with varying degrees of success.

With the aim of providing the best options for patients with severe knee osteoarthritis who are not candidates for total knee replacement, we designed a multimodal protocol consisting of electromagnetic pulse therapy, high-intensity laser therapy, focused high-energy shockwaves, vibrational waves, and hyaluronate injections. In 33 patients scheduled for total knee replacement (TKR) due to severe knee osteoarthritis, we implemented a non-invasive multimodal management approach. All patients had various comorbidities and were evaluated for the effect on the Visual Analog Scale (VAS) for pain, the Oxford functional scale, and the Likert satisfaction scale. Outcomes were assessed at 12 months, looking for early results or the need for early intervention or surgery. The protocol we employed consisted of three sessions. We administered 3000 EMTT impulses at level 8 on the anterior side of the knee, 3000 Laser HILT impulses at 8 W at the point of maximum pain, 1500 Focused

ESWT impulses at 0.1 MJ/mm<sup>2</sup> over the affected joint line area, and 6000 vibration impacts at level 2 on the quadriceps muscle. During the third and final session, we administered one intra-articular injection of hyaluronate (Hylan GF20) immediately after the multimodal ESWT session.

Our results were encouraging, with a 55% improvement in the VAS pain score after 2 months and a 26% improvement after 12 months. Function, as measured by the Oxford scale, showed a significant improvement of 18 points after 2 months and 7 points after 12 months. Overall treatment satisfaction was also very positive, as patients rated the treatment as good after one session, excellent after two sessions and maintained this rating after 12 months. During the follow-up period, we unfortunately experienced the loss of two patients. It is important to note that their deaths were a result of medical conditions unrelated to their knee pathology. In measuring our outcomes, we observed that out of the total patients, 19 (58%) did not require any interventions after 12 months. Among the remaining patients, 10 (33%) received steroid injections, 2 (9%) underwent PRP injections, and only 1 (3%) required a total knee replacement.

In the present study, we have reached the conclusion that our Multimodal ESWT + Hyaluronate injection protocol was both safe and effective in our case series. Significant reductions in pain, improvements in function, and decreased reliance on major interventions were observed. The results demonstrated better outcomes at 2 months, sustainability after 6 months, and a relative recurrence after one year. Therefore, we highly recommend repeating this protocol every 12 months. Patients have expressed a positive perception of the treatment, appreciating the availability of a non-surgical option. Furthermore, they demonstrate a strong sense of purpose and optimism towards their future goals in life.

With these encouraging results in pain improvement, function, and patient satisfaction, we are confident that we are offering a safe and effective system for patients with severe knee osteoarthritis who are not suitable for total replacement. Controlled and randomized studies are needed to compare the outcomes with patients who underwent surgery under similar circumstances and evaluate the final results. At the moment, we can recommend the multimodal protocol of shockwave therapy and hyaluronate as an excellent option for selected patients.