



CHIROPRACTIC
ECONOMICS



TREAT ARTHROGENIC MUSCULAR INHIBITION AND PATELLA BAJA WITH HIGH- ENERGY INDUCTIVE THERAPY AND EXTRACORPOREAL SHOCKWAVE THERAPY

Avoiding an above-knee amputation

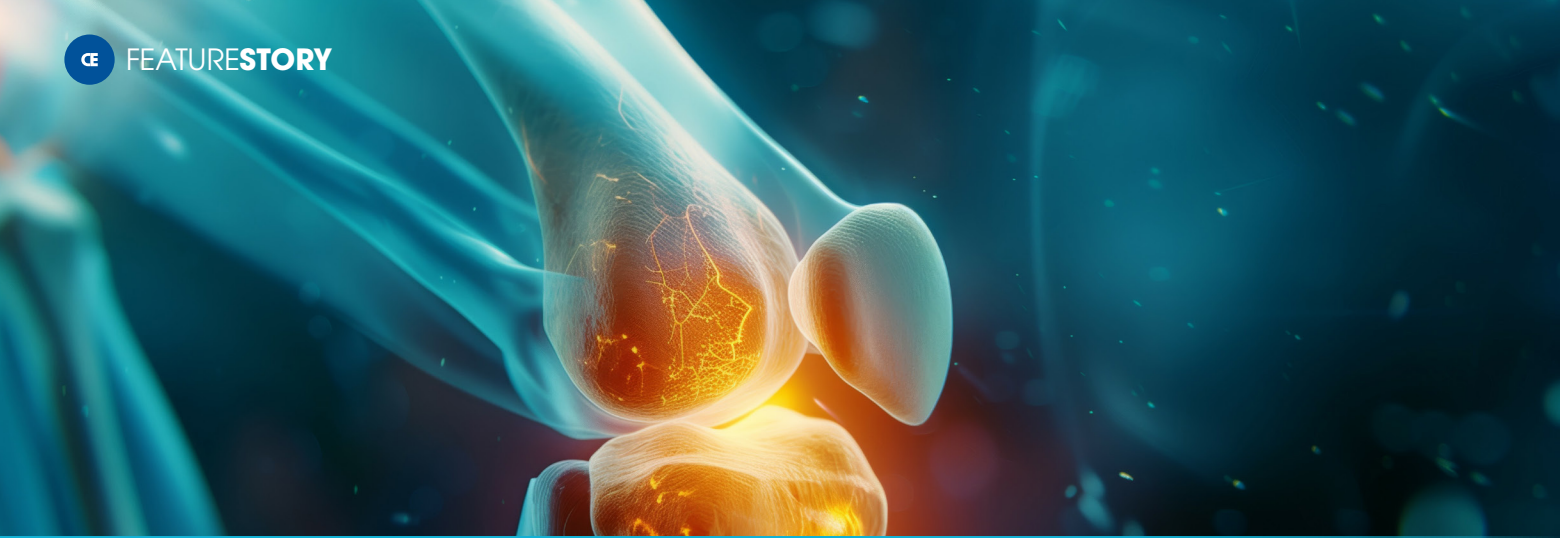
BY ROD TOMCZAK, MD, EDD

TIME TO READ: 11-12 MIN.

THE TAKEAWAY

Early identification and treatment with noninvasive modalities, such as HEIT and ESWT, can significantly improve outcomes and potentially help patients avoid more drastic measures.

IN SEPTEMBER 2020, A 72-YEAR-OLD MALE UNDERWENT A RIGHT TOTAL KNEE REPLACEMENT (TKA). A trial of Hylan G-F 20 had been unsuccessful, and the patient opted for a TKA. The patient tolerated the procedure well and progressed toward full weight bearing in physical therapy (PT). By Jan. 1, 2021, the patient's knee became infected with *Cutibacterium acnes*, which was treated with an extensive washout with an antibiotic solution and replacement of the acrylic portion of the implant.



Early recognition of the condition is crucial to avoid patellar tendon contracture and decrease the chances of progression to a stage requiring amputation.

This was followed by six weeks of intravenous rifampin via a peripherally inserted central catheter (PICC) line into the right atrium of the heart.

This regimen was unsuccessful, so the patient underwent removal of the implants, insertion of antibiotic spacers and another PICC line. When joint fluid was synovasure negative and other infection indicators had normalized, the patient was replanted with another permanent total knee. Rehabilitation was slow and the patient could no longer extend his knee or bear weight. During the gait cycle, the right leg collapsed during the left leg swing phase despite aggressive physical therapy.

In September 2023, the surgeon recommended scar tissue debridement and replacement of the tibial plateau acrylic implant. Subsequent to this fifth surgery, the patient returned to PT, strength training the right quadriceps and gastric-soleus complex, which had both severely atrophied. He also tried increasing body weight while supported by a sling from the ceiling.

By December 2023, the patient exhibited no discernable increase in ambulatory ability since his first surgery in September 2020. Over three years, the patient attended 258 PT appointments with little or no improvement. He lived and slept in a recliner, transferring to a chair side commode with a walker, and used a wheelchair to attend therapy sessions. This was the picture of an otherwise healthy 75-year-old who had not been out of dinner or church in more than three years. His time out of the chair was solely for trips to PT or to see the surgeon. The knee remained flexed at approximately 30 degrees. His surgeon recommended an above-knee amputation with a prosthesis if the patient wished to regain even a modicum of quality of life, noting the amputation

PATELLA BAJA VS. ALTA

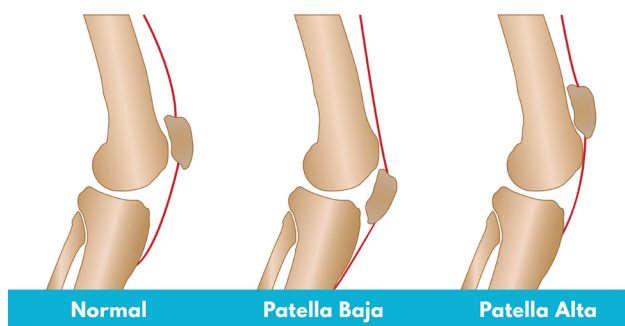


Image 1. Three stages of the patella

would result in a greatly decreased five-year survival rate similar to that of some cancers.

The patient then took a more aggressive role in his future, discovering arthrogenous muscular inhibition (AMI), a condition where quadriceps activation failure is caused by neural inhibition, common following knee injury or surgery. The patient had been a runner and weightlifter since his early 30s, so the language in an article by Freychet¹ was not foreign. The authors classified degrees of involvement from Grade 0 to Grade 3, including a video describing the physical exam used to classify each patient's deformity.

AMI involves inhibition of the vastus medialis obliquus (VMO) muscle, extension deficits due to hamstring contracture and chronic extension deficits leading to patella baja, a condition where the patella is below its normal position, resulting in a hard endpoint when extending the leg. See Image 1.

¹ Freychet B, et al. Arthrogenous muscle inhibition following knee injury or surgery. *Amer Orth Soc Sports Med*. June 23, 2022. Sage Journals. <https://doi.org/10.1177/26350254221086295>. Accessed June 10, 2024.



ESWT improves skin elasticity, increases collagen production and breaks up fibrous bands, releasing the tissue.

258

Over three years, the patient attended 258 physical therapy appointments with little or no improvement.



Grades 1 and 2 of the condition respond well to exercise, restoring normal extension and muscle strength. In Grade 2b, the VMO must be activated or gains in therapy will be lost once discontinued. Grade 2b patients require up to a year of therapy with emphasis on waking up the quadriceps muscles, specifically the VMO, with biofeedback and electrical stimulation. If Grade 2b does not respond to therapy, surgery may be necessary, including posterior arthrolysis of the knee joint capsule and patellar tendon lengthening. These procedures are fraught with risks, including complete rupture of the tendon and knee paralysis. Hence, noninvasive therapy modalities are preferable to invasive procedures where complications can easily arise.

This patient was treated with a high-energy inductive therapy (HEIT) electromagnetic device² to use on the quadriceps muscles, specifically on the VMO, four times per week for 20 minutes, increasing contraction intensity as tolerated. Hypertrophy was substantial, with the VMO gaining almost two inches in size. Freychet does not use circumference as a parameter for success but suggests comparison of the unaffected limb to the affected leg. That was not possible in this patient since he started therapy so late his non-affected quadriceps was also atrophied. The strength gain was approximately 50% in the four months the patient was treated with the HEIT device. At this point, the patient was treated with the device on the contralateral side, including bilateral gastric soleus muscles, anticipating a return to normal physical activity.

The patient was considered a stage 3 AMI when he began therapy and by April 2024 was still hitting a rigid endpoint approximately 20 degrees from full extension. He was also treated with an extracorporeal shockwave therapy (ESWT) device³ used on the patellar tendon, the posterior knee capsule and biceps femoris tendon, which remained contracted and partially responsible for maintaining the rigid endpoint. In one month, he made remarkable gains in the patella's position, but it was still engulfed in scar tissue and in a baja position. The biceps femoris tendon became significantly more flexible and released from its spastic condition. The patient was treated with ESWT three times per week alongside HEIT. ESWT is contraindicated for patients on anticoagulants, such as

² emFieldPro High Energy Inductive Therapy (HEIT) device manufactured by Zimmer MedizinSystems.

³ enPuls 2.0 Advanced Radial Shockwave Therapy device manufactured by Zimmer MedizinSystems.

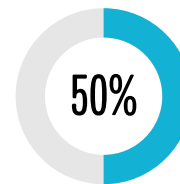
Coumadin®, Eliquis® or Xarelto.® This patient, on Eliquis® for chronic atrial fibrillation, experienced no bleeding in the ESWT area. Literature reveals anticoagulants require extra caution due to possible bleeding. Once an injury is incurred, however, there will be more bruising before hemostasis is achieved.

Five months of HEIT electromagnetic therapy and one month of ESWT resulted in significantly more gains in the treatment of AMI and patella baja than over three years of conventional PT, including electric nerve stimulation. Evaluation of the VMO muscles bilaterally revealed that the affected limb was only 15% smaller than the unaffected limb, and extension was measured to be 12 degrees. Extension of the right limb was still inadequate for weight-bearing, and the patient will be evaluated for a patellar tendon lengthening in the frontal plane. Early recognition of the condition is crucial to avoid patellar tendon contracture and decreasing the chances of progression to a stage requiring amputation and a prosthesis to restore ambulation.

High-energy inductive therapy

High-energy electromagnetic fields in the form of HEIT have been effectively used as noninvasive treatment for various musculoskeletal conditions. HEIT stimulates cellular signaling

50%
The strength gain was approximately 50% in the four months the patient was treated with the HEIT device.



pathways, translating electromagnetic signals into biological signals at the cellular level. This process stimulates nerves, muscle fibers and blood vessels through growth factors, such as fibroblast growth factor (FGF), vascular endothelial growth factor (VEGF) and bone morphogenetic proteins (BMP). HEIT also stimulates the release of endorphins, reducing pain perception and restoring the normal resting potential of cell membranes, which normalizes electrolyte exchange and supports cellular functions, including energy production by mitochondria.^{4,5} This therapy has shown impressive results for muscle stimulation

⁴ Stratton S. Role of Endorphins in Pain Modulation. *The Journal of Orthopaedic and Sports Physical Therapy*. 1982;3(4):200-205. <https://www.jospt.org/doi/abs/10.2519/jospt.1982.3.issue-4>. Accessed June 10, 2024.

⁵ Clement-Jones V, et al. Increased Beta-Endorphin but not Met-enkephalin Levels in Human Cerebrospinal Fluid After Acupuncture for Recurrent Pain. *Lancet*. 1980;2(8201):946-949. PubMed. <https://pubmed.ncbi.nlm.nih.gov/6107591/>. Accessed June 10, 2024.



HEIT stimulates cellular signaling pathways, translating electromagnetic signals into biological signals at the cellular level.

5 MONTHS

Five months of HEIT electromagnetic therapy and one month of ESWT resulted in significantly more gains in AMI and patella baja than over three years of conventional PT.



and strengthening in deep tissues due to its high frequency and magnetic energy levels, which conventional pulsed electromagnetic field (PEMF) therapy units cannot achieve.

Extracorporeal shockwave therapy

ESWT uses shockwaves to induce microtrauma, promoting neovascularization and healing through the recruitment of stem cells and the release of growth factors. ESWT improves skin elasticity, increases collagen production and breaks up fibrous bands, releasing the tissue. The mechanical energy from the shockwaves transforms into a biological response through mechanotransduction, activating cellular structures and stimulating proteins essential for the healing process.

ESWT has been shown to improve symptoms in conditions such as osteoarthritis by inhibiting cartilage degeneration and promoting subchondral bone rebuilding.⁶

Final thoughts

The importance of early recognition of AMI cannot be overstressed to avoid contracture of the patellar tendon and decrease the chances of the condition progressing to a stage where amputation is necessary. Early identification and treatment with noninvasive modalities, such as HEIT and ESWT, can significantly improve outcomes and potentially avert the need for more drastic measures. **CE**

ROD TOMCZAK, MD, EdD, is a board-certified foot and ankle surgeon. He assumed the positions of Chair of Surgical Care, the University Curriculum Committee and Surgical Residency Director at Des Moines University in 1986 after owning a successful private practice. He earned a Doctorate in Curriculum and Adult Education at Drake University. In 1995, he accepted the positions of Chair of the Problem-based Learning Curriculum and Co-chair of the medical school Curriculum Committee at The Ohio State University. Since retiring from surgery, he has been the founding dean of American University in Belize, Caribbean Medical University in Curaçao and Global University in Riyadh, Saudi Arabia. Tomczak's recent case study reports on the treatment of arthrogenic muscular inhibition accompanied by patella baja, highlighting the use of Zimmer MedizinSystems' emFieldPro High-Energy Inductive Therapy (HEIT) and the enPuls Advanced Radial Shockwave Therapy device to successfully help the patient avoid an above-knee amputation.

6 Auersperg V, Trieb K. Extracorporeal Shock Wave Therapy: An Update. *EFORT Open Rev*. 2020;5(10):584-592. PubMed. <https://pubmed.ncbi.nlm.nih.gov/33204500/>. Accessed June 10, 2024.