Guest Editorial
What's New in Orthopaedic Rehabilitation

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Orthopaedic surgery and rehabilitation medicine continue to remain synergistic fields of medicine. Here we review articles published from March 2021 through February 2022. We considered articles from the *American Journal of Physical Medicine & Rehabilitation, The American Journal of Sports Medicine, Clinical Journal of Sports Medicine, Archives of Physical Medicine and Rehabilitation, The BMJ, The Journal of Bone & Joint Surgery, JAMA, Journal of Rehabilitation Medicine, Journal of Shoulder and Elbow Surgery, The New England Journal of Medicine, Pain Medicine, PM&R, Regional Anesthesia & Pain Medicine, Spine,* and *The Spine Journal.*

Shoulder

Gamification is an advancement in rehabilitation that has become increasingly popular. Marley et al. compared standard physical therapy with exergames using the principles of gamification with physical therapy support in patients following arthroscopic shoulder surgery for subacromial impingement syndrome, calcific tendinopathy, and/or rotator cuff tear[1]. They found no significant differences in range of motion, Oxford Shoulder Scores, Disabilities of the Arm, Shoulder and Hand (DASH) Questionnaire scores, or EuroQol Visual Analog Scale (EQ-VAS) scores, thus concluding that exergames can be an effective alternative in routine postoperative care, relieving some of the burden placed on physical therapy departments.

Little is known about the effects of blood flow restriction combined with low-intensity exercise on muscles proximal to the site of occlusion. In a controlled laboratory study, Lambert et al. looked at blood flow restriction in 32 healthy adults and found that those who utilized blood flow restriction along with a low-intensity exercise using common rotator cuff muscle exercises had increases in lean mass, strength, and muscular endurance in the shoulder and arm compared with low-intensity exercise alone[2].

As musculoskeletal ultrasound gains popularity, the value of its use for injection guidance remains under question. Deng et al. performed a systematic review and meta-analysis examining the effectiveness of ultrasound-guided compared with anatomic landmark-guided subacromial bursa corticosteroid injections for the treatment of subacromial impingement syndrome[3]. Twelve randomized controlled trials (RCTs) were included and pooled. The results included 454 ultrasound-guided injections and 437 anatomic landmark-guided injections. Ultrasound-guided injections were shown to be more beneficial for pain relief and functional improvement, but there was no significant difference in shoulder range of motion. Cho et al. examined ultrasound-guided compared with anatomic landmark-guided intra-articular glenohumeral corticosteroid injections for adhesive capsulitis and found that those undergoing ultrasound-guided injections had an increased likelihood of successful injection (100% compared with 71%), but there was no significant difference in clinical outcomes at 12 weeks between groups[4]. Balazs pointed out that this should be interpreted with caution[5]; although 13 of the 45 anatomic landmark-guided injections failed by the authors' criteria, 10 of the 13 had at least a portion of the injectate enter the glenohumeral joint, raising the question of exactly how failed these injections were. A more accurate takeaway may be that ultrasound guidance guarantees injection accuracy, but injections may still provide patients benefit even if the chosen technique is inaccurate.

Elbow

There is a paucity of strong evidence for a best second-line treatment of recalcitrant lateral elbow tendinopathy. Ang et al. studied ultrasound-guided percutaneous tenotomy of the brevis and common extensor tendons in 20 patients with lateral elbow tendinopathy[6]. At the median 90-month follow-up, satisfaction scores remained 100%, with no recurrences or secondary interventions. The Kruskal-Wallis test on median visual analog scale (VAS) for pain and DASH scores showed significant improvements. Ultrasound reevaluation demonstrated sustained tissue healing in all patients and reduced hypervascularity in 79% of cases.

Hand

First carpometacarpal (CMC) joint osteoarthritis is a common disease that can result in pain and functional limitations. In a

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJS/H245).

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cohort study consisting of 308 patients who underwent nonoperative treatment with exercise therapy, an orthosis, or both, Hoogendam et al. investigated how satisfaction with treatment outcome is associated with patient mindset and Michigan Hand Outcome Questionnaire (MHQ) scores at baseline and 3 months[7]. The authors found that more positive pre-treatment outcome expectations were associated with a higher probability of being satisfied with treatment outcomes at 3 months. They concluded that, although satisfaction after nonoperative treatment of first CMC osteoarthritis is not yet optimal, positive expectations of treatment outcomes are associated with higher satisfaction. Therefore, optimizing patient expectations may further improve treatment expectations and outcomes.

Carpal tunnel syndrome is the most common compression neuropathy affecting the upper limb. In a double-blinded, placebo-controlled trial, Hofer et al. randomized 111 patients into 3 groups receiving an injection of 80-mg methylprednisolone, 40-mg methylprednisolone, or saline solution[8]. Participants were followed over 5 years with co-primary outcomes of the symptom severity score and rate of subsequent carpal tunnel release surgery on the study hand at 5 years. From baseline to the 5-year follow-up, there was no significant difference in the mean change in the symptom severity score for the 80-mg methylprednisolone group or the 40-mg methylprednisolone group when compared with placebo. However, local methylprednisolone injection (both 80 mg and 40 mg) resulted in a significant reduction in surgery rates and delay in the need for a surgical procedure when compared with placebo.

Hip

Image-guided intra-articular hip injections play an important role in both the diagnosis and the treatment of hip pathologies. In an early study, Wang et al. raised concern about injections increasing the risk of infection after hip arthroscopy[9]; however, in a follow-up study, Byrd et al. found no infections among 500 patients undergoing ultrasound-guided hip injections in the 3 months before hip arthroscopy[10]. In 2021, Varady et al. published a retrospective cohort study of 17,987 patients further evaluating the infection risk of ultrasound and fluoroscopy-guided injections prior to hip arthroscopy[11]. A total of 12.7% of patients received an image-guided hip injection within the year preceding the surgical procedure. The infection rate was 0.47% for patients who received injections and 0.46% for patients who did not receive injections. This trend persisted in sensitivity analyses, and there was no evidence of differential risk between the groups.

Knee

Patellofemoral pain is common in adolescents. In recent studies, authors have pointed toward an important psychological component contributing to patellofemoral pain. In an RCT by Selhorst et al., adolescents with patellofemoral pain watched either a psychologically informed video addressing pain-related fear and catastrophizing (n = 34) or a video discussing basic anatomy and biomechanical factors implicated in patellofemoral pain (n = 32) prior to completing a course of physical therapy[12]. Adolescents who viewed the psychologically informed video experienced a significant reduction in maladaptive psychological beliefs. Pain improved in both groups, with no significant between-group differences.

There continues to be debate over appropriate activity levels with regard to both prevention and progression of knee osteoarthritis. In a prospective, multicenter, observational study, Master et al. enrolled 516 adults with or at high risk for knee osteoarthritis[13]. In these subjects, higher daily walking volume and intensity did not increase the incidence of knee replacement over 5 years and demonstrated some protective effects.

Extracorporeal shockwave therapy (ESWT) is being explored for the treatment of musculoskeletal conditions, including knee osteoarthritis. In an RCT by Ho et al., 36 subjects with knee osteoarthritis were randomized to 3 weeks of ESWT or sham ESWT[14]. The ESWT group demonstrated significant improvements in WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) pain, physical function, and total scores, as well as VAS scores, compared with the control group at 1 week following the last treatment. There was also evidence for improved physical performance in this time frame.

When conservative treatments fail, not all patients with knee osteoarthritis are ready and able to proceed with a knee replacement. Image-guided genicular nerve radiofrequency ablation (RFA) is a treatment option with the potential to improve both pain and function. In a prospective observational study by Chang et al., 13 patients underwent ultrasound-guided genicular nerve RFA and demonstrated significant improvements in the numeric rating scale score (worst pain and mean pain), 36-item Short Form Health Survey (SF-36) physical health domain score, and the WOMAC pain and stiffness scores at 3 months after treatment[15]. The step test time significantly improved, and there were no significant changes in the other physical performance tests, including quadriceps strength and proprioception measures.

Blood flow restriction (BFR) training may be an effective means for strengthening muscle with low loads. A meta-analysis conducted by Li et al. consisted of 179 subjects who underwent low-load resistance training with BFR (L-BFR), 96 who underwent high-load resistance training, and 94 who underwent low-load resistance training[16]. Muscle strength increased in both the L-BFR and high-load resistance training groups, and pain scores significantly decreased only in the L-BFR group.

Foot and Ankle

Running-related injuries are prevalent in runners. In their study, Suda et al. sought to evaluate the protective effect of a therapeutic foot-core training intervention easily done at home. In a 12-month RCT, healthy recreational runners underwent an 8-week foot-core training program (n = 57) or a

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static stretching program (n = 61)[17]. The foot-core program was demonstrated to be a protective factor for running-related injuries.

Eccentric strengthening exercise is commonly utilized to treat insertional Achilles tendinopathy, with mixed results. ESWT use is rising as a modality for the treatment of tendinopathy; however, in an RCT, Mansur et al. did not show a difference in the treatment of Achilles insertional tendinopathy when comparing eccentric exercises alone with eccentric exercises combined with ESWT[18].

Botulinum toxin is being explored in the treatment of some musculoskeletal conditions such as plantar fasciitis. In a meta-analysis of RCTs, Acosta-Olivo et al. showed that botulinum toxin treatment of plantar fasciitis provides significant improvements in pain and functional outcomes[19].

Spine

Growing literature has identified the vertebral end plate as a likely source of chronic axial low back pain. Vertebral end-plate degeneration is correlated with Modic changes on imaging, and the vertebral end plates are innervated by the basivertebral nerve. In a prospective, open-label, multicenter RCT (n = 140), Smuck et al. compared basivertebral nerve ablation with standard care at up to 12 months[20]. The primary end point was the between-arm comparison of the mean Oswestry Disability Index change from baseline; the secondary end points were VAS scores, SF-36 scores, EuroQol 5-Dimension 5-Level (EQ-5D-5L) Quality-of-Life scores, responder rates, and the rates of continued opioid use. The authors concluded that basivertebral nerve ablation demonstrates significant improvements in pain and function over standard care, with treatment results sustained through 12 months in patients with chronic axial low back pain of vertebrogenic origin. Conger et al. further performed a systematic review to determine the effectiveness of intraosseous basivertebral nerve ablation for the treatment of chronic axial low back pain associated with Modic changes[21]. Findings indicated moderate-quality evidence suggesting that this procedure is effective in reducing pain and disability in patients with chronic low back pain who are selected on the basis of Modic changes (type 1 or 2).

Arthroplasty

The optimal approach to rehabilitation after reverse total shoulder arthroplasty (TSA) is unclear. Lee et al. compared accelerated rehabilitation with immediate activity following reverse TSA (no immobilization at all) with more conservative rehabilitation with immobilization for 3 and 6 weeks after reverse TSA[22]. There were 357 reverse TSAs, split evenly between the 3 groups. At the 1-year follow-up, there were no significant differences in the outcome measures between the groups, but there were significantly fewer postoperative complications in the accelerated rehabilitation group. These findings support an accelerated rehabilitation construct as safe, sound, and noninferior to conservative protocols. Additionally, a psychological benefit is implied as a secondary outcome of earlier mobilization.

In January 2021, shoulder arthroplasty was removed from the Medicare inpatient-only list, despite a lack of clarity on whether more medically complex Medicare populations may experience higher complication rates relative to privately insured patients. Goltz et al. examined unplanned 90-day readmission rates in patients discharged on postoperative day 1 and those who were not and compared the readmission rates between the 2 insurance cohorts; 4,723 shoulder arthroplasties (2,459 anatomic and 2,264 reverse) were reviewed[23]. The data showed that Medicare patients who were stable for discharge on day 1 were not more likely to experience readmission than privately insured patients, advocating for the safety of outpatient or short-stay shoulder arthroplasty. Notably, in comparison with TSA, across both insurance cohorts, reverse TSA had a significantly higher rate of unplanned readmission.

In a retrospective cohort study, Neoh et al. investigated 467 total knee arthroplasties (TKAs) postoperatively to determine the short-term outcomes at discharge of patients who were taught postoperative rehabilitative exercises by peer volunteers, in addition to standard physical therapy (combination education), and of patients who underwent only physical therapy[24]. There were 309 patients who received the combination education and 167 patients who received the control treatment (physical therapy only). No between-group significance was demonstrated with regard to pain, passive extension range of motion, unassisted straight leg raises of the involved leg, ambulation distance, use of ambulatory aids, ability to walk independently, discharge destination, or adverse events. However, the combination education group had an increased discharge passive range of motion that was significant (by 8°).

Pain Management

Massie et al. conducted a retrospective case-control study evaluating the relationship between the initial opioid prescription size and the likelihood of refilling after spine surgery[25]. The authors reviewed 25,329 opioid-naïve patients between the ages of 18 and 64 years who were undergoing elective spinal procedures (anterior cervical discectomy and fusion, posterior cervical fusion, lumbar decompression, and lumbar fusion) and filled an initial perioperative prescription between 2010 and 2015. The primary outcome measure was the occurrence of an opioid refill within 30 postoperative days. Patient factors associated with an increased likelihood of refills included age of 30 to 39 years, female gender, anxiety disorder, mood disorder, and history of alcohol and/or substance abuse. The authors concluded that, for opioid-naïve patients, surgeons can prescribe lower amounts of opioids after elective surgery for degenerative spinal disease without concern of an increased need for refills.

In an RCT of 62 patients, Moutzouros et al. compared postoperative pain control in patients undergoing anterior cruciate ligament (ACL) reconstruction[26]. Participants received

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either a multimodal nonopioid analgesic protocol (acetaminophen, ketorolac, diazepam, gabapentin, and meloxicam) or a standard opioid regimen (hydrocodone-acetaminophen). The primary outcome was postoperative VAS pain scores for 10 days. Patients receiving the multimodal nonopioid pain regimen demonstrated significantly lower VAS scores compared with patients who received opioid pain medications. The authors concluded that a multimodal nonopioid pain protocol provided at least equivalent pain control compared with traditional opioid analgesics in patients undergoing ACL reconstruction.

In a multicenter, randomized, double-blinded, placebo-controlled trial, Berkowitz et al. evaluated the effect of perioperative intravenous 30-mg meloxicam on opioid consumption in primary TKA[27]. The primary outcome parameter was total opioid use from the end of the surgical procedure through 24 hours; there were 181 patients in the study. Subjects who received intravenous meloxicam had significantly reduced opioid consumption after the surgical procedure compared with subjects who received placebo. Perioperative intravenous meloxicam was also associated with a lower incidence of adverse events typically associated with opioid use. In another study, Aoyagi et al. evaluated patients undergoing TKA and the associations of physical therapy before or after the surgical procedure with long-term opioid use[28]. This cohort study of 67,322 individuals found that undergoing any physical therapy before and after TKA, undergoing ≥6 physical therapy sessions after TKA, and the initiation of physical therapy care within 30 days after TKA were associated with a lower risk of long-term opioid use.

Orthobiologics

Platelet-rich plasma (PRP) for lateral epicondylosis has been well studied. Kim et al. completed a meta-analysis of outcomes in lateral epicondylosis treated with PRP compared with operative treatment[29]. This meta-analysis included 5 studies and pooled 340 patients (154 in the PRP group and 186 in the operative treatment group); analysis showed no significant differences, positive or negative, in VAS pain scales at 2, 6, and 12 months or in Patient-Related Tennis Elbow Evaluation scores at 12, 24, and 52 weeks. These data portray equivalency in pain and function between both modalities and support PRP as a reasonable alternative to a surgical procedure, especially in patients who are apprehensive or would be poor surgical candidates.

PRP and hyaluronic acid have been studied and compared with one another as monotherapies for knee osteoarthritis. A systematic review of 8 articles was completed to evaluate the efficacy of PRP and hyaluronic acid as a combination therapy[30]. At a mean follow-up of 9 months, combination therapy resulted in improved patient-reported outcomes in all studies. There was evidence to suggest that combination therapy was superior to hyaluronic acid alone; however, no data supported combination therapy as more effective than PRP alone.

For patellar tendinopathy, a randomized, controlled, prospective, double-blinded trial compared the efficacy of leukocyte-poor PRP (LP-PRP) and autologous expanded bone marrow mesenchymal stem cells (BM-MSCs) in proximal patellar tendinopathy recalcitrant to conservative treatment[31]. Two cohorts of 20 patients (10 in the LP-PRP group and 10 in the BM-MSC group) underwent ultrasound-guided intratendinous and peritendinous injections. Outcomes of pain, function, pathognomonic neovascularity, and tissue characterization were followed for 6 months. Both treatments proved safe and showed improvement in pain and functional status, without a significant difference. Notably, both orthobiologics showed structural tendon improvement, but BM-MSCs were significantly more restorative.

The effect of PRP for moderate-to-severe bilateral carpal tunnel syndrome was studied in a 1-year prospective, randomized, double-blinded trial of 24 patients; outcomes were assessed at 1, 3, 6, and 12 months[32]. Each patient had 1 wrist assigned to either the PRP group or the control group (saline solution), in a random fashion, and had an injection via ultrasound guidance. The Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) was the primary outcome, and secondary outcomes included cross-sectional area of the median nerve and an electrophysiological study. The PRP group exhibited significant improvements, compared with baseline, in BCTQ severity scores at all time points, BCTQ functional scores at 6 months, and cross-sectional area at 12 months.

Sports

Performance measures for ACL reconstruction rehabilitation are used to determine return to play. Problematically, these criteria do not identify the risk of rerupture. A study was designed to examine return-to-play criteria in order to predict injury[33]. From 9 months through 2 years after ACL reconstruction, differences in strength, jump, and change-of-direction time were measured in 1,045 level-1, male athletes, stratifying reinjured compared with not reinjured. No performance measures showed the statistical ability to predict reinjury. Double-leg jump and change of direction were identified as biomechanical differences and could be considered focuses of rehabilitation after ACL reconstruction, but neither was significantly able to predict reinjury.

A prospective study was conducted on 12 National Collegiate Athletic Association (NCAA) Division-I soccer programs, male and female (256 athletes), with the goal to characterize workload, sleep, and contextual factors as significant in injury risk or not[34]. Data have suggested that schedule-specific contextual factors, combined with characteristics of workload and weekly sleep behavior, are significantly related to injury. Maintaining higher chronic workloads, lowering training monotony, minimizing acute spikes or lulls in workloads, managing workloads during the preseason, and, for athletes with a previous injury, integrating more rest and

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recovery during congested periods and optimizing sleep quality are all practical considerations for reducing injury risk in collegiate soccer.

Aiming to better understand if a patient navigator can help to mitigate the barriers to individuals with disability achieving recommended physical activity recommendations, surveys and focus groups were conducted to adults with disability or parents of a child with disability[35]. There were 198 adults and 146 parents who completed surveys and 16 adults and 18 parents who participated in focus groups. Lack of knowledge of available adaptive sport and recreational resources, expense, limited number of trained volunteers, and necessity of instruction were noted barriers. Data showed that stakeholders believed that a patient navigator could increase participation in adaptive sport and recreational and physical activity within a community context.

Ultrasound

With the development of more portable and affordable ultrasound machines, point-of-care ultrasound is being used more in clinical settings. The technology provides real-time diagnostic information and can enhance the safety of standard ultrasound-guided procedures. Its true effect on patient outcomes and the required training to become competent at point-of-care ultrasound remain in question; nevertheless, point-of-care ultrasound may become a standard tool of the frontline clinician, given its advances in technology and popularity[36].

Wu et al. recently published a novel use of diagnostic ultrasound with adhesive capsulitis[37]. They evaluated the coracohumeral ligament thickness under ultrasound in 65 patients with clinically diagnosed adhesive capsulitis and found that coracohumeral ligament thickness had significant inverse correlations with shoulder range of motion in external rotation and internal rotation but not in abduction or flexion. Additionally, coracohumeral ligament thickness showed significant correlations with disease duration. Utilizing diagnostic ultrasound in this manner can help to confirm diagnoses such as adhesive capsulitis, leading to early intervention and treatment.

Orthotics

First CMC osteoarthritis can produce disabling pain and function. In a systematic review and meta-analysis narrowed to 11 RCTs, Marotta et al. compared the effectiveness of 4 different orthoses (short thermoplastic CMC splint, long thermoplastic CMC-metacarpophalangeal [MCP] splint, short neoprene CMC splint, and long neoprene CMC-MCP splint) with that of no splinting for first CMC osteoarthritis[38]. All splints were superior to no splinting at reducing pain. Based on outcomes measured at 3 to 6 months following the index treatment, the long thermoplastic CMC-MCP splint was the first choice for reducing pain, and the short thermoplastic CMC splint was the first choice for improving function; both effects were significant compared with no splinting.

Foot orthoses have been shown to reduce heel pain associated with plantar fasciitis. Seligman et al. performed the first prospective RCT comparing the effectiveness of hard orthotics with that of modified soft orthotics for plantar fasciitis[39]. At the 6-week follow-up, both groups showed a significant reduction in pain intensity and pain interference, but no improvement in function over time. There were no differences between groups in pain intensity, pain interference, or function. However, there was a significant improvement in function in the younger participants using hard orthotics and older participants using modified soft orthotics. The authors noted a cost difference in favor of modified soft orthotics.

Physiatry Societies and Upcoming Events

There are 3 medical societies in the United States for physical medicine and rehabilitation (PM&R): the Association of Academic Physiatrists (AAP), the American Academy of Physical Medicine and Rehabilitation (AAPM&R), and the American Congress of Rehabilitation Medicine (ACRM). The 2023 AAP Annual Meeting will be in Anaheim, California, from February 21 to 24, 2023. The 2023 AAPM&R Annual Assembly will be in New Orleans, Louisiana, from November 16 to 19, 2023. The 2023 ACRM Annual Conference will be held in Atlanta, Georgia, from October 30 to November 2, 2023.

Evidence-Based Orthopaedics

The editorial staff of *JBJS* reviewed a large number of recently published studies related to the musculoskeletal system that received a higher Level of Evidence grade. In addition to articles cited already in this update, 4 other articles relevant to orthopaedic rehabilitation are appended to this review after the standard bibliography, with a brief commentary about each article to help guide further evidence-based reading in this subspecialty area.

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References

1. Marley WD, Barratt A, Pigott T, Granat M, Wilson JD, Roy B. A multicenter randomized controlled trial comparing gamification with remote monitoring against standard rehabilitation for patients after arthroscopic shoulder surgery. J Shoulder Elbow Surg. 2022 Jan;31(1):8-16.

2. Lambert B, Hedt C, Daum J, Taft C, Chaliki K, Epner E, McCulloch P. Blood flow restriction training for the shoulder: a case for proximal benefit. Am J Sports Med. 2021 Aug;49(10):2716-28.

3. Deng X, Zhu S, Li D, Luo Y, Zhang X, Tan Y, Li J, He X. Effectiveness of ultrasound-guided versus anatomic landmark-guided corticosteroid injection on pain, physical function and safety in patients with subacromial impingement syndrome: a systematic review and meta-analysis. Am J Phys Med Rehabil. 2021 Dec 23.

4. Cho CH, Min BW, Bae KC, Lee KJ, Kim DH. A prospective double-blind randomized trial on ultrasound-guided versus blind intra-articular corticosteroid injections for primary frozen shoulder. Bone Joint J. 2021 Feb;103-B(2):353-9.

5. Balazs GC. In frozen shoulder, US-guided versus blind administration of intra-articular corticosteroid injections increased accuracy of injections but did not improve clinical outcomes at 12 weeks. J Bone Joint Surg Am. 2021 Nov 17; 103(22):2144.

6. Ang BFH, Mohan PC, Png MA, Allen JC Jr, Howe TS, Koh JSB, Lee BP, Morrey BF. Ultrasonic percutaneous tenotomy for recalcitrant lateral elbow tendinopathy: clinical and sonographic results at 90 months. Am J Sports Med. 2021 Jun;49(7): 1854-60.

7. Hoogendam L, van der Oest MJW, Wouters RM, Andrinopoulou ER, Vermeulen GM, Slijper HP, Porsius JT, Selles RW; Hand-Wrist Study Group. Patients with higher treatment outcome expectations are more satisfied with the results of nonoperative treatment for thumb base osteoarthritis: a cohort study. Arch Phys Med Rehabil. 2021 Aug;102(8):1533-40.

8. Hofer M, Ranstam J, Atroshi I. Extended follow-up of local steroid injection for carpal tunnel syndrome: a randomized clinical trial. JAMA Netw Open. 2021 Oct 1; 4(10):e2130753.

9. Wang D, Camp CL, Ranawat AS, Coleman SH, Kelly BT, Werner BC. The timing of hip arthroscopy after intra-articular hip injection affects postoperative infection risk. Arthroscopy. 2017 Nov;33(11):1988-94.e1.

10. Byrd JWT, Bardowski EA, Civils AN, Parker SE. The safety of hip arthroscopy within 3 months of an intra-articular injection. J Bone Joint Surg Am. 2019 Aug 21; 101(16):1467-9.

11. Varady NH, Amen TB, Abraham PF, Chopra A, Freccero DM, Smith EL, Martin SD. Image-guided intra-articular hip injections and risk of infection after hip arthroscopy. Am J Sports Med. 2021 Jul;49(9):2482-8.

12. Selhorst M, Fernandez-Fernandez A, Schmitt L, Hoehn J. Effect of a psychologically informed intervention to treat adolescents with patellofemoral pain: a randomized controlled trial. Arch Phys Med Rehabil. 2021 Jul;102(7):1267-73.

13. Master H, Thoma LM, Neogi T, Dunlop DD, LaValley M, Christiansen MB, Voinier D, White DK. Daily walking and the risk of knee replacement over 5 years among adults with advanced knee osteoarthritis in the United States. Arch Phys Med Rehabil. 2021 Oct;102(10):1888-94.

14. Ho KD, Yang CL, Lo HY, Yeh HJ. Extracorporeal shockwave therapy with a modified technique on tendon and ligament for knee osteoarthritis: a randomized controlled trial. Am J Phys Med Rehabil. 2022 Jan 1;101(1):11-7.

15. Chang YW, Tzeng IS, Lee KC, Kao MC. Functional outcomes and physical performance of knee osteoarthritis patients after ultrasound-guided genicular nerve radiofrequency ablation. Pain Med. 2022 Feb 1;23(2):352-61.

16. Li S, Shaharudin S, Abdul Kadir MR. Effects of blood flow restriction training on muscle strength and pain in patients with knee injuries: a meta-analysis. Am J Phys Med Rehabil. 2021 Apr 1;100(4):337-44.

17. Suda EY, Watari R, Matias AB, Taddei UT, Sacco ICN. Predictive effect of well-known risk factors and foot-core training in lower limb running-related injuries in recreational runners: a secondary analysis of a randomized controlled trial. Am J Sports Med. 2022 Jan;50(1):248-54.

18. Mansur NSB, Matsunaga FT, Carrazzone OL, Schiefer Dos Santos B, Nunes CG, Aoyama BT, Dias Dos Santos PR, Faloppa F, Tamaoki MJS. Shockwave therapy plus eccentric exercises versus isolated eccentric exercises for Achilles insertional tendinopathy: a double-blinded randomized clinical trial. J Bone Joint Surg Am. 2021 Jul 21;103(14):1295-302.

19. Acosta-Olivo C, Simental-Mendía LE, Vilchez-Cavazos F, Peña-Martínez VM, Elizondo-Rodíguez J, Simental-Mendía M. Clinical efficacy of botulinum toxin in the treatment of plantar fasciitis: a systematic review and meta-analysis of randomized controlled trials. Arch Phys Med Rehabil. 2022 Feb;103(2):364-371.e2.

20. Smuck M, Khalil J, Barrette K, Hirsch JA, Kreiner S, Koreckij T, Garfin S, Mekhail N; INTRACEPT Trial Investigators. Prospective, randomized, multicenter study of intraosseous basivertebral nerve ablation for the treatment of chronic low back pain: 12-month results. Reg Anesth Pain Med. 2021 Aug;46(8):683-93.

21. Conger A, Schuster NM, Cheng DS, Sperry BP, Joshi AB, Haring RS, Duszynski B, McCormick ZL. The effectiveness of intraosseous basivertebral nerve radiofrequency neurotomy for the treatment of chronic low back pain in patients with Modic changes: a systematic review. Pain Med. 2021 May 21; 22(5):1039-54.

22. Lee J, Consigliere P, Fawzy E, Mariani L, Witney-Lagen C, Natera L, Buch B, Atoun E, Sforza G, Amar E, Levy O. Accelerated rehabilitation following reverse total shoulder arthroplasty. J Shoulder Elbow Surg. 2021 Sep;30(9):e545-57.

23. Goltz DE, Burnett RA, Wickman JR, Levin JM, Howell CB, Nicholson GP, Verma NN, Anakwenze OA, Lassiter TE Jr, Garrigues GE, Klifto CS. Short stay after shoulder arthroplasty does not increase 90-day readmissions in Medicare patients compared with privately insured patients. J Shoulder Elbow Surg. 2022 Jan;31(1):35-42.

24. Neoh EC, Jie Tay MR, Tan J, Tan J, Lim YT, Sanchalika A, Chong LF, Guoping Tan K. Short-term effect of peer volunteers in providing inpatient rehabilitative exercises for patients after total knee arthroplasty. Arch Phys Med Rehabil. 2021 Jul;102(7): 1361-7.

25. Massie L, Gunaseelan V, Waljee J, Brummett C, Schwalb JM. Relationship between initial opioid prescription size and likelihood of refill after spine surgery. Spine J. 2021 May;21(5):772-8.

26. Moutzouros V, Jildeh TR, Tramer JS, Meta F, Kuhlmann N, Cross A, Okoroha KR. Can we eliminate opioids after anterior cruciate ligament reconstruction? A prospective, randomized controlled trial. Am J Sports Med. 2021 Dec;49(14): 3794-801.

27. Berkowitz RD, Steinfeld R, Sah AP, Mack RJ, McCallum SW, Du W, Black LK, Freyer A, Coyle E. Safety and efficacy of perioperative intravenous meloxicam for moderate-to-severe pain management in total knee arthroplasty: a randomized clinical trial. Pain Med. 2021 Jun 4;22(6):1261-71.

28. Aoyagi K, Neogi T, Peloquin C, Dubreuil M, Marinko L, Camarinos J, Felson DT, Kumar D. Association of physical therapy interventions with long-term opioid use after total knee replacement. JAMA Netw Open. 2021 Oct 1;4(10):e2131271.

29. Kim CH, Park YB, Lee JS, Jung HS. Platelet-rich plasma injection vs. operative treatment for lateral elbow tendinosis: a systematic review and meta-analysis. J Shoulder Elbow Surg. 2022 Feb;31(2):428-36.

30. Baria MR, Vasileff WK, Borchers J, DiBartola A, Flanigan DC, Plunkett E, Magnussen RA. Treating knee osteoarthritis with platelet-rich plasma and hyaluronic acid combination therapy: a systematic review. Am J Sports Med. 2022 Jan;50(1): 273-81.

31. Rodas G, Soler-Rich R, Rius-Tarruella J, Alomar X, Balius R, Orozco L, Masci L, Maffulli N. Effect of autologous expanded bone marrow mesenchymal stem cells or leukocyte-poor platelet-rich plasma in chronic patellar tendinopathy (with gap >3 mm): preliminary outcomes after 6 months of a double-blind, randomized, prospective study. Am J Sports Med. 2021 May;49(6):1492-504.

32. Chen SR, Shen YP, Ho TY, Li TY, Su YC, Chou YC, Chen LC, Wu YT. One-year efficacy of platelet-rich plasma for moderate-to-severe carpal tunnel syndrome: a prospective, randomized, double-blind, controlled trial. Arch Phys Med Rehabil. 2021 May;102(5):951-8.

33. King E, Richter C, Daniels KAJ, Franklyn-Miller A, Falvey E, Myer GD, Jackson M, Moran R, Strike S. Biomechanical but not strength or performance measures differentiate male athletes who experience ACL reinjury on return to level 1 sports. Am J Sports Med. 2021 Mar;49(4):918-27.

34. Curtis RM, Huggins RA, Benjamin CL, Sekiguchi Y, Lepley LK, Huedo-Medina TB, Casa DJ. Factors associated with noncontact injury in collegiate soccer: a 12-team prospective study of NCAA Division I men's and women's soccer. Am J Sports Med. 2021 Sep;49(11):3076-87.

35. Iverson M, Ng AV, Yan AF, Zvara K, Bonk M, Falk-Palec D, Sylla C, Strickland M, Preston R, Braza DW. Navigator role for promoting adaptive sports and recreation participation in individuals with disabilities. Am J Phys Med Rehabil. 2021 Jun 1; 100(6):592-8.

36. Díaz-Gómez JL, Mayo PH, Koenig SJ. Point-of-care ultrasonography. N Engl J Med. 2021 Oct 21;385(17):1593-602.

37. Wu PY, Hsu PC, Chen TN, Huang JR, Chou CL, Wang JC. Evaluating correlations of coracohumeral ligament thickness with restricted shoulder range of motion and clinical duration of adhesive capsulitis with ultrasound measurements. PM R. 2021 May;13(5):461-9.

38. Marotta N, Demeco A, Marinaro C, Moggio L, Pino I, Barletta M, Petraroli A, Ammendolia A. Comparative effectiveness of orthoses for thumb osteoarthritis: a systematic review and network meta-analysis. Arch Phys Med Rehabil. 2021 Mar; 102(3):502-9.

39. Seligman DAR, Dawson D, Streiner DL, Seligman DJ, Davis A. Treating heel pain in adults: a randomized controlled trial of hard vs modified soft custom orthotics and heel pads. Arch Phys Med Rehabil. 2021 Mar;102(3):363-70.

What's New in Orthopaedic Rehabilitation

Evidence-Based Orthopaedics

Corso M, Cancelliere C, Mior S, Salmi LR, Cedraschi C, Nordin M, Sci DM, Taylor-Vaisey A, Côté P. Are nonpharmacologic interventions delivered through synchronous telehealth as effective and safe as in-person interventions for the management of patients with nonacute musculoskeletal conditions? A systematic rapid review. *Arch Phys Med Rehabil.* 2022 Jan;103(1):145-54.e11.

The COVID-19 pandemic restricted the delivery of health care and rehabilitation and forced practitioners to deliver services by telehealth. In a positive way, it did highlight telehealth as a useful tool in situations including emergencies, disasters, bridging geographical barriers, and increasing healthcare services to rural or underserved communities. This systematic review examined whether telehealth is an effective and safe method to deliver care for nonacute musculoskeletal conditions. Eight RCTs were found, and the evidence suggested that synchronous telehealth alone or combined with in-person care is as effective and safe as in-person care alone for the nonpharmacologic management of chronic headaches; nonspecific low back pain; and knee, hip, and generalized osteoarthritis in adults. However, the authors pointed out that more high-quality research is needed to determine if this holds true in individuals with different socioeconomic status, locations of residence, levels of health literacy, or access to information and communication technologies. This study demonstrates that telehealth can be a safe and convenient option within orthopaedic clinics for certain types of visits, such as imaging review.

Johnson SE, Finnoff JT, Amrami KK, Jelsing EJ. Radiological prevalence of popliteal artery entrapment in individuals with anterior leg compartment chronic exertional compartment syndrome. *Clin J Sport Med.* 2022 Mar 1; 32(2):e160-4.

In this retrospective review, the radiographic prevalence of popliteal artery entrapment in subjects with anterior leg chronic exertional compartment syndrome was investigated, as these 2 conditions are common causes of exertional leg pain in athletes and often overlap in presentation. This specific tertiary center utilizes an in-scanner, exercise-based, magnetic resonance imaging (MRI) examination to evaluate for chronic exertional compartment syndrome; this examination is 96% sensitive and 87% specific for anterior leg chronic exertional compartment syndrome. There were 71 individuals who had a positive MRI for anterior leg chronic exertional compartment syndrome; 64 of these individuals underwent a Fast Imaging Employing Steady-State Acquisition (FIESTA) to evaluate for popliteal artery entrapment, and 33 (51.6%) tested positive. Of these 33 patients, 30 underwent vascular evaluation, which included ≥1 of the following tests: the ankle-brachial index (ABI) before and after exercise, ABI with popliteal artery entrapment maneuvers, lower-extremity arterial ultrasound, lower-extremity computed tomographic angiogram, or lower-extremity magnetic resonance angiogram. All of these individuals had ≥1 tests confirming the radiographic diagnosis of popliteal artery entrapment. These findings suggest that, when evaluating for popliteal artery entrapment in individuals with anterior leg compartment chronic exertional compartment syndrome, the initial vascular evaluation, apart from a FIESTA (which is not available in all centers and requires an experienced radiologist for interpretation), should include ABIs with popliteal artery entrapment maneuvers and ABIs before and after exercise. If these are normal, or more proximal vascular pathology is suspected, a lower-extremity arterial duplex ultrasound should be performed. Evaluation for a concomitant vascular cause of exertional leg pain in patients with anterior leg chronic exertional compartment syndrome is important as incomplete evaluation for both conditions can result in treatment failure. This review provides a comprehensive workup algorithm to rule out popliteal artery entrapment syndrome in those with anterior leg chronic exertional compartment syndrome.

Lavallee M, Bush C. Ultrasound-guided percutaneous tenotomy and its associated pain reduction and functionality outcomes in nonelite active adults. *Am J Phys Med Rehabil.* 2021 Apr 1;100(4):349-53.

Ultrasound-guided percutaneous tenotomy (USGPT) offers an attractive alternative to the more invasive open tenotomy procedure for subjects who have undergone failed conservative treatment modalities. This prospective cohort study evaluated 92 non-elite, active adults (11 of whom underwent bilateral procedures) who underwent a total of 103 USGPTs using Tenex (guanfacine; Promius Pharma) in 1 of the following tendons or ligaments: plantar fascia, Achilles, flexor carpi ulnaris, patellar, extensor carpi radialis brevis, or supraspinatus. At 1 week after the procedure, the mean VAS score decreased from 7.3 to 3.8 ($p < 0.0001$), with a mean decrease of 5.8 at 1 year ($p < 0.0001$). At 1 year postoperatively, the DASH scores improved from 41.5 to 10.4 ($p < 0.001$) and the Lower Extremity Functional Scale scores improved from 42.5 to 65.6 ($p < 0.001$). Of the 92 subjects, only 9 ultimately sought surgical intervention. Of the 9 patients who underwent surgical intervention, 8 underwent surgical intervention for the lower limb, and 7 of those patients were obese or morbidly obese. The authors determined that USGPTs using Tenex provide an attractive, noninvasive alternative to a surgical procedure without sacrificing improvement in pain and functional outcomes as they eliminate the need for general anesthesia, can be performed in an outpatient office setting, and have relatively low complication rates with shorter recovery times. Although further studies are needed, this study demonstrates a promising nonoperative treatment option for various tendinopathies and plantar fasciitis.

Ouellet P, Lafrance S, Pizzi A, Roy JS, Lewis J, Christiansen DH, Dubois B, Langevin P, Desmeules F. Region-specific exercises vs general exercises in the management of spinal and peripheral musculoskeletal disorders: a systematic review with meta-analyses of randomized controlled trials. *Arch Phys Med Rehabil.* 2021 Nov;102(11):2201-18.

Region-specific therapeutic exercises are commonly prescribed after clinical assessment and according to physical impairments and disabilities, but more general approaches have also been shown to be beneficial for musculoskeletal disorders. Ouellet et al. performed a systematic review and meta-analysis that included 18 RCTs comparing region-specific exercises with general exercise approaches for chronic neck pain, low back disorders, and knee osteoarthritis. Region-specific interventions included strengthening and stretching involving the symptomatic region, motor control exercises, proprioceptive exercises, and directional preference exercise. General exercise interventions included yoga, walking programs, stationary cycling, tai chi, general global strengthening, Pilates, and qigong. Based on very low to moderate-quality evidence, there were no clinically important differences between the 2 groups with regard to pain, disability, or health-related quality of life in the short, intermediate, or long-term follow-ups for adults with chronic low back or neck disorders, and evidence was lacking with regard to region-specific exercises compared with general exercises for peripheral disorders. This is of particular interest because general exercise approaches may be more accessible, may be more affordable, or may not require specific equipment when compared with region-specific exercises. This study emphasizes that exercise, in any shape or fashion, is medicine for our patients.