

# Advanced Ultrasound-Guided Interventions for Tendinopathy



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## KEYWORDS

- High volume • Musculoskeletal • Percutaneous • Tendinosis • Tendon
- Sonography • Tenotomy • Ultrasound

## KEY POINTS

- Evolving research has shown that tendinopathy is primarily a degenerative condition within the tendon, termed angiofibroblastic hyperplasia, with a likely secondary neurogenic inflammatory component outside the tendon in the surrounding milieu, and this pathophysiologic understanding is reflected in novel percutaneous treatment approaches.
- Ultrasound is an important imaging tool for diagnosis of tendon disorders and for image-guided interventions.
- Percutaneous needle tenotomy, percutaneous ultrasonic tenotomy, high-volume injection, and percutaneous needle scraping are promising new treatments for tendinopathy, but further research is needed with larger, high-quality, randomized controlled trials to further define their efficacy and role.

## INTRODUCTION

Tendinopathy is an important cause of musculoskeletal pain and disability. Although traditionally thought to be an inflammatory condition and described as tendonitis, subsequent data showed it to be primarily a degenerative problem, more appropriately labeled tendinosis.<sup>1–3</sup> Tendinosis occurs with multiple microtrauma, leading to degeneration of tenocytes and the extracellular matrix, which fail to mature or remodel into

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normal tendon.<sup>4</sup> This process has been described as angiofibroblastic hyperplasia, consisting of fibroblasts, vascular hyperplasia, and disorganized collagen.<sup>3,4</sup> Risk factors for the development of tendinopathy include ballistic performance, repeated or high-force eccentric contractions, an adjacent convex surface or apex of a concavity, muscles that cross 2 joints, scant vascular supply, and repetitive tension.<sup>3,4</sup>

Although inflammatory cells are generally not seen within the tendon substance in tendinopathy, inflammatory mediators have been found in the tendon's surrounding milieu, suggesting that tendinopathy is not solely degenerative.<sup>5</sup> This condition has been described as neurogenic inflammation, consisting of inflammatory mediators that induce matrix metalloproteinase production, leading to degradation of the extracellular matrix of the tendon and promoting neoangiogenesis.<sup>5,6</sup> These abnormal neovessels are associated with neoneurons, theorized to contribute to the pain of tendinopathy.<sup>6</sup>

Tendinopathy has historically been treated with a wide range of interventions,<sup>7</sup> including rest; cryotherapy; therapeutic ultrasound (US); stretching; strengthening, including eccentric-biased strengthening; taping; bracing; oral and topical analgesics and nonsteroidal antiinflammatory drugs (NSAIDs); extracorporeal shock-wave therapy; topical vasodilators; and corticosteroid injections.<sup>8,9</sup> Few of these treatments have been shown to be effective, and corticosteroid injections, once a mainstay of tendinopathy treatment, have been found to be harmful to tendons.<sup>10</sup> Consequently, clinicians have sought safer and more effective interventions for the treatment of this condition.

With the emergence of diagnostic musculoskeletal US, clinicians are better able to evaluate tendinopathy at the point of care while using an easily portable, safe, cost-effective, and high-resolution imaging modality. US is able to characterize tendon disorders in detail by assessing the tendon's fibrillar architecture; identifying tears, enthesophytes, cortical irregularity, and intrasubstance calcifications; and quantifying hyperemia.<sup>7</sup> With the use of US, the specific location of a disorder within a tendon can be more accurately and completely delineated. As the diagnostic capability of musculoskeletal US has improved, clinicians have also developed more advanced interventional procedures facilitated by US guidance, with procedural mechanisms corresponding with the improved understanding of tendon disorders outlined earlier. These procedures include percutaneous needle tenotomy (PNT), percutaneous ultrasonic tenotomy (PUT), high-volume injection (HVI), percutaneous needle scraping (PNS), and orthobiologic interventions. This article reviews common percutaneous US-guided procedures for the treatment of tendinopathy using chiefly some form of mechanical debridement or similar intervention to stimulate regeneration. For a discussion of orthobiologic substances, such as platelet-rich plasma and mesenchymal stem cells, see [Malanga G, Abdelshahed D, Jayaram P: Orthobiologic Interventions Utilizing Ultrasound Guidance](#), in this issue.

## PERCUTANEOUS NEEDLE TENOTOMY

US-guided PNT has been used as an independent treatment strategy as well as being combined with orthobiologic products. PNT involves repeatedly passing a needle through a tendon with the goal of disrupting the chronic degenerative process, including scar tissue, and encouraging localized bleeding and fibroblast proliferation, which can lead to growth factor release, collagen formation, and ultimately healing.<sup>9,11</sup>

There is minimal research on the outcomes of US-guided PNT alone. Some of the first published studies that described PNT also involved the injection of local anesthetic and corticosteroid. In 2006, McShane and colleagues<sup>8</sup> reported the results of

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