

# The Effectiveness of Transcutaneous Nerve Stimulation on Patients with Knee Osteoarthritis: A Systematic Review

Austin Bedke, Department of Health Sciences  
Carroll College, Helena, Montana

## Introduction

-OA is due to the loss of cushioning between bones in joints. This is usually caused from the wear and tear associated with age. The bones begin to rub because of the lack of cushioning therefore causing stiffness, pain, loss of mobility, swelling, and bone spurs.<sup>2</sup>

-OA is the most common form of arthritis and the risk rises after the age of 45.<sup>1</sup>

-More than 27 million Americans have OA with it most commonly being found in the knee joint.<sup>2</sup>

-Factors for increasing chances of OA include joint injury/overuse, old age, being female, being obese, and relatives with OA.<sup>3</sup>

-During a lifetime males have a 40% risk of developing symptomatic osteoarthritis of the knee while females are at a 47% risk.<sup>5</sup>

-Surgery has been proven as the most effective treatment for people with knee osteoarthritis.

-It is estimated that over 600,000 knee arthroplasties took place in 2010. It is also estimated that by the year 2030 that 3 million knee arthroplasties a year will take place.<sup>6</sup> A knee arthroplasty is a total knee replacement.

-Common pain management therapies include acupuncture, nerve blocks, exercise, meditation, corticosteroid injections, and opioids.<sup>7</sup>

-A possible alternative to these treatments is transcutaneous electrical nerve stimulation (TENS) that works by stimulating opioid pathways in humans that produce analgesia (the inability to feel pain).<sup>8</sup>

-Research suggest that TENS can be an effective pain treatment strategy and is also effective at improving quadriceps muscles strength that will decrease pressure on the knee while also allowing more strength and increased range of motion.<sup>9</sup>

-The purpose of this study is to review literature on the effectiveness of TENS to treat pain in patients with knee osteoarthritis.

## Methods

-Primary sources relevant to this systematic review were retrieved January and February of 2022. Sources were retrieved from PubMed and CINAHL

-Search terms: [transcutaneous electrical nerve stimulation AND knee osteoarthritis AND pain management].

-Additional sources were obtained through articles that had relevant articles linked below them.

-A total of 357 total articles were identified through CINAHL and PubMed.

-28 articles were removed because of duplicates.

-329 articles were then screened for full text, correct study type, in English, and key words in abstract or title.

-309 articles were then excluded

-20 articles to be reviewed for eligibility.

-8 fit criteria, while 12 were excluded due to poor evidence of TENS use, other osteoarthritis besides knee, or were systematic reviews themselves.

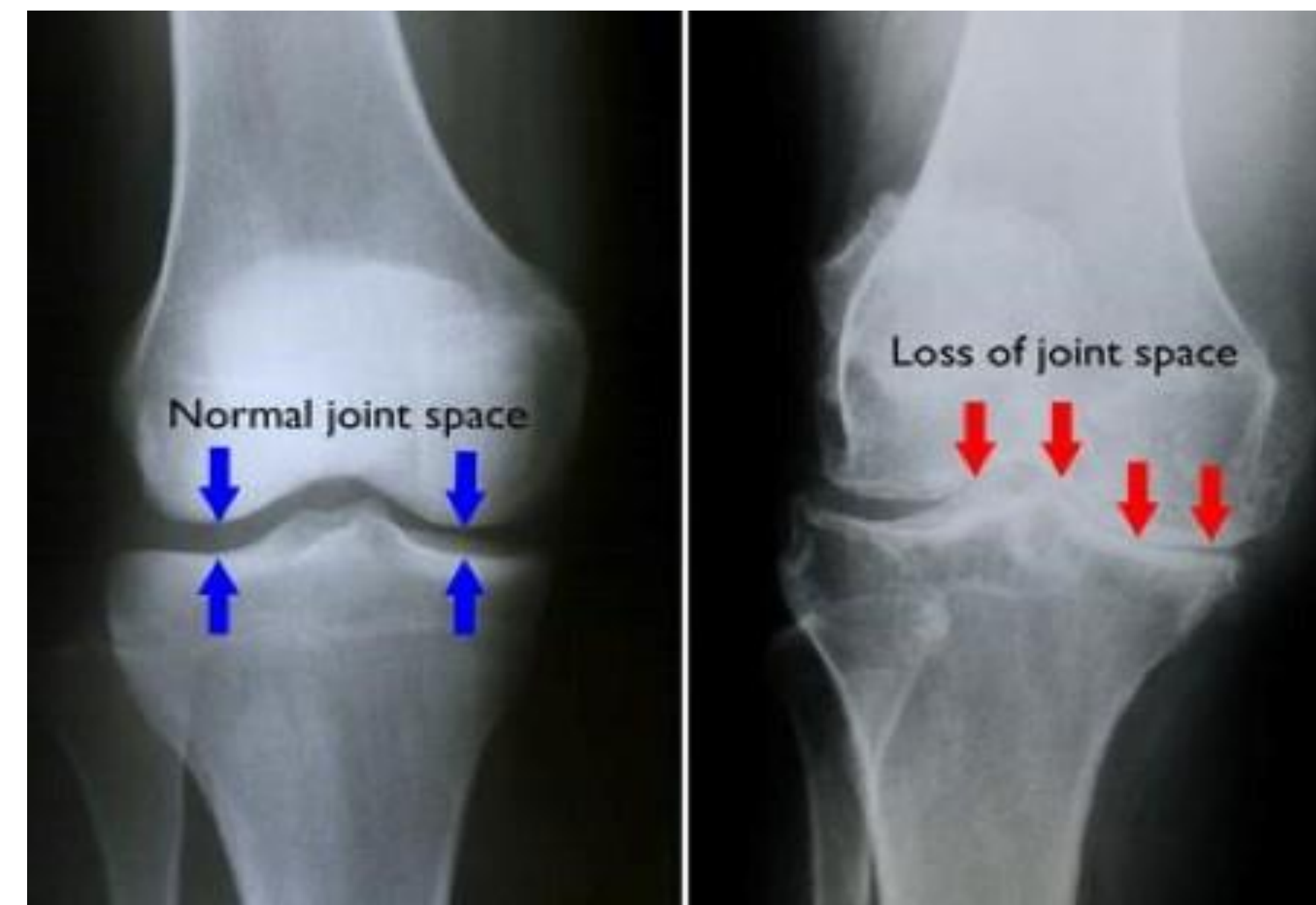


Figure 1. Showing the loss in knee joint space associated with knee osteoarthritis.<sup>14</sup>

## Results

-All studies included human patients with knee osteoarthritis.

-Overall, the use of TENS for knee OA proved to be a successful treatment in most of the studies.

-Several studies showed a decrease in pain with knee OA either post operation or as a treatment for pain management.<sup>1,8,11,12</sup>

-Three trials showed that with the addition of TENS, patients' timed up and go (TUG) tests improved.<sup>4,8,10</sup>

-When TENS was added to ultrasound or ultrasound was added to TENS, both treatments were found to be an effective strategy alone. Meaning TENS and ultrasound are both effective without the other.<sup>11,13</sup>

-Physical test scores improved with the use of TENS, such as stair climbing, range of motion, gait speed, and six-minute walk test.<sup>4,8-10,12,13</sup>

-One study found that TENS was just as effective as intra-articular corticosteroid injections.<sup>1</sup>

-One study suggested that a single treatment of TENS has minimal effect on pain and function associated with knee OA.<sup>8</sup>

-One study showed the use of TENS to treat knee pain associated with osteoarthritis showed inconsistent results.<sup>10</sup>

-One of these studies showed that TENS therapy was just as effective as intraarticular corticosteroid injections (hylan G-F 20).<sup>1</sup>

-Another study showed that using TENS on patients that have just received a total knee arthroplasty significantly reduced movement pain.<sup>12</sup>

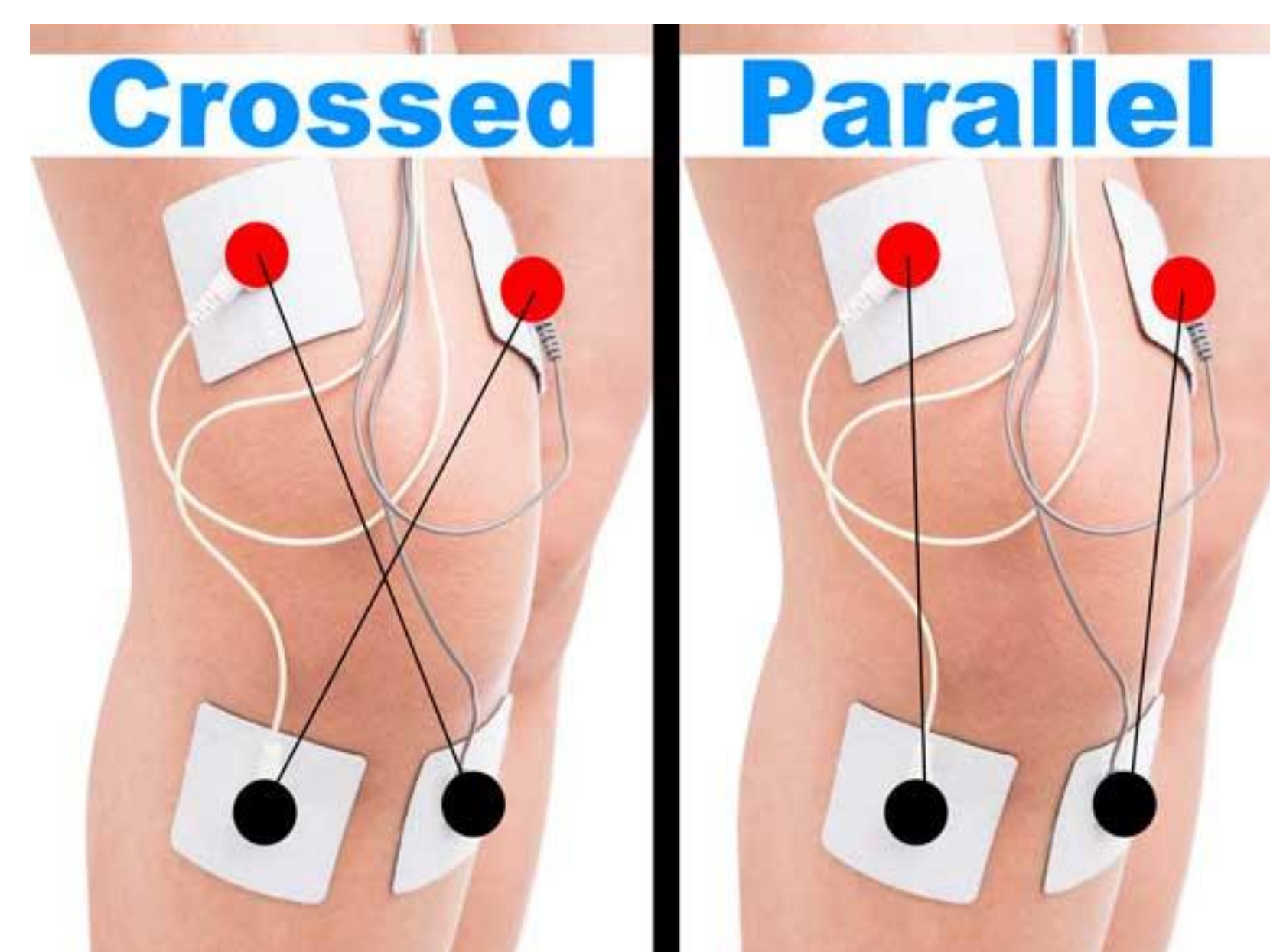


Figure 2. Showing the different applications of TENS.<sup>15</sup>

## Discussion

The goal of this paper was to assess academic literature that studied the effect of TENS on the treatment of knee osteoarthritis. It is shown throughout these studies that the use of TENS can have beneficial impacts on people suffering from knee osteoarthritis. The studies researched showed that TENS treatment helped with pain,<sup>12</sup> walk distance,<sup>4</sup> stair climbing capacity,<sup>9</sup> and an improved the VAS score of many different tests.<sup>4</sup> Some of the same tests were used across several different studies, all showing improvement with the use of TENS. Such as the TUG test,<sup>4,8,10</sup> and stair climbing capacity.<sup>4,9,10</sup> One major strength of this study included that all eight papers used in this review are randomized controlled trial.<sup>1,4,8-13</sup> Another strength included that most studies included both male and female participants.<sup>1,4,8,10-12</sup> This study was limited by sample size of studied populations as well as that diversity among patients was not reported. The findings of this systematic review can help guide of clinical practice in the relief of knee osteoarthritis symptoms. The results reported from the studies above indicate that TENS can be an effective treatment for knee osteoarthritis.

## Acknowledgments

I would like to thank Dr. Schafer and the Department of Health Sciences for their continued support of my education and career goals.

## References

1. Paker N, Tekdös D, Kesiktas N, Soy D. Comparison of the therapeutic efficacy of TENS versus intra-articular hyaluronic acid injection in patients with knee osteoarthritis: a prospective randomized study. *Adv Ther.* 2006;23(2):342-353. doi:10.1007/BF02850139
2. Osteoarthritis of the Knee (Degenerative Arthritis of the Knee). WebMD. Accessed February 16, 2022. <https://www.webmd.com/osteoarthritis/osteoarthritis-of-the-knee-degenerative-arthritis-of-the-knee>
3. Osteoarthritis (OA) | Arthritis | CDC. Published August 4, 2020. Accessed February 16, 2022. <https://www.cdc.gov/arthritis/basics/osteoarthritis.htm>
4. Shimoura K, Iijima H, Suzuki Y, Aoyama T. Immediate Effects of Transcutaneous Electrical Nerve Stimulation on Pain and Physical Performance in Individuals With Preradiographic Knee Osteoarthritis: A Randomized Controlled Trial. *Arch Phys Med Rehabil.* 2019;100(2):300-306.e1. doi:10.1016/j.apmr.2018.08.189
5. Neogi T, Zhang Y. Epidemiology of osteoarthritis. *Rheum Dis Clin North Am.* 2013;39(1):1-19. doi:10.1016/j.rdc.2012.10.004
6. Ruiz D, Koenig L, Dall TM, et al. The direct and indirect costs to society of treatment for end-stage knee osteoarthritis. *J Bone Joint Surg Am.* 2013;95(16):1473-1480. doi:10.2106/JBJS.L.01488
7. Goldenberg DL, MD. Evolving Management Strategies for Osteoarthritic Pain. Practical Pain Management. Accessed April 2, 2022. <https://www.practicalpainmanagement.com/pain/myofascial/osteoarthritis/evolving-management-strategies-osteoarthritic-pain>
8. Vance CGT, Rakel BA, Blodgett NP, et al. Effects of Transcutaneous Electrical Nerve Stimulation on Pain, Pain Sensitivity, and Function in People With Knee Osteoarthritis: A Randomized Controlled Trial. *Phys Ther.* 2012;92(7):898-910. doi:10.2522/ptj.20110183
9. Iijima H, Eguchi R, Shimoura K, Yamada K, Aoyama T, Takahashi M. Transcutaneous Electrical Nerve Stimulation Improves Stair Climbing Capacity in People with Knee Osteoarthritis. *Sci Rep.* 2020;10:7294. doi:10.1038/s41598-020-64176-0
10. Cherian JJ, Kapadia BH, Bhav A, et al. Use of Transcutaneous Electrical Nerve Stimulation Device in Early Osteoarthritis of the Knee. *J Knee Surg.* 2015;28(4):321-327. doi:10.1055/s-0034-1389160
11. Kim ED, Won YH, Park SH, et al. Efficacy and Safety of a Stimulator Using Low-Intensity Pulsed Ultrasound Combined with Transcutaneous Electrical Nerve Stimulation in Patients with Painful Knee Osteoarthritis. *Pain Res Manag.* 2019;2019:7964897. doi:10.1155/2019/7964897
12. Rakel BA, Zimmerman BM, Geasland K, et al. Transcutaneous electrical nerve stimulation for the control of pain during rehabilitation after total knee arthroplasty: A randomized, blinded, placebo-controlled trial. *Pain.* 2014;155(12):2599-2611. doi:10.1016/j.pain.2014.09.025
13. Sangtong K, Chupinijrobk C, Putthakumner W, Kuptniratsaikul V. Does adding transcutaneous electrical nerve stimulation to therapeutic ultrasound affect pain or function in people with osteoarthritis of the knee? A randomized controlled trial. *Clin Rehabil.* 2019;33(7):1197-1205. doi:10.1177/0269215519838017
14. a00212f02\_resized.jpg (450x336). Accessed April 6, 2022. [https://orthoinfo.aaos.org/globalassets/figures/a00212f02\\_resized.jpg](https://orthoinfo.aaos.org/globalassets/figures/a00212f02_resized.jpg)
15. TENS-Electrode-Placement-for-Knee-Pain.jpg (600x428). Accessed April 6, 2022. <https://totaltherapysolutions.com/wp-content/uploads/2021/01/TENS-Electrode-Placement-for-Knee-Pain.jpg>