

Age Group Comparisons of TENS Response Among Individuals With Chronic Axial Low Back Pain

Corey B. Simon,^{*,†} Joseph L. Riley, III,[†] Roger B. Fillingim,[†] Mark D. Bishop,^{*,†} and Steven Z. George^{*,†}

^{*}Department of Physical Therapy, College of Public Health and Health Professions, University of Florida, Gainesville, Florida.

[†]Pain Research & Intervention Center of Excellence, University of Florida, Gainesville, Florida.

Abstract: Chronic low back pain (CLBP) is a highly prevalent and disabling musculoskeletal pain condition among older adults. Transcutaneous electrical nerve stimulation (TENS) is commonly used to treat CLBP, however response to TENS in older adults compared with younger adults is untested. In a dose-response study stratified by age, 60 participants with axial CLBP (20 young, 20 middle-aged, 20 older) received four 20-minute sessions of high-frequency high-intensity TENS over a 2- to 3-week period in a laboratory-controlled setting. Experimental measures of pain sensitivity (mechanical pressure pain detection threshold) and central pain excitability (phasic heat temporal summation and heat aftersensations) were assessed before and after TENS. Episodic or immediate axial CLBP relief was assessed after TENS via measures of resting pain, movement-evoked-pain, and self-reported disability. Cumulative or prolonged axial CLBP relief was assessed by comparing daily pain reports across sessions. Independent of age, individuals experienced episodic increase in the pressure pain detection threshold and reduction in aftersensation after TENS application. Similarly, all groups, on average, experienced episodic axial CLBP relief via improved resting pain, movement-evoked pain, and disability report. Under this design, no cumulative effect was observed as daily pain did not improve for any age group across the 4 sessions. However, older adults received higher TENS amplitude across all sessions to achieve TENS responses similar to those in younger adults. These findings suggest that older adults experience similar episodic axial CLBP relief to that of younger individuals after high-frequency, high-intensity TENS when higher dose parameters are used.

Perspective: This study examined age group differences in experimental and axial CLBP response to TENS, delivered under the current recommended parameters of strong, but tolerable amplitude. Older adults had comparable TENS response although at higher TENS amplitude than younger adults, which may have important mechanistic and clinical implications.

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Key words: Age, axial, low back pain, transcutaneous electrical nerve stimulation.

Chronic low back pain (CLBP) is a prevalent condition among older adults and a major contributor to the exponential increase in the use of pain management.^{10,36,37,66} Pharmacologic treatment is commonly prescribed for CLBP, however, such methods are controversial among older adults due to the potential for higher health risks.³ Alternatively, transcutaneous

electrical nerve stimulation (TENS) may be more suitable for older adults because it is a conservative, nonpharmacologic treatment for CLBP. TENS has been studied extensively and quantification of past studies has given mixed results.^{27,30,40,64} However, recent clinical research has advanced our understanding of TENS efficacy in important ways. Specifically, TENS appears to be more

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Address reprint requests to Corey B. Simon, DPT, PhD, Pain Research & Intervention Center of Excellence, Clinical & Translational Science Institute, PO Box 100242, 2004 Mowry Road, Gainesville, FL 32610. E-mail: coreysimon@php.ufl.edu
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effective for movement-evoked versus resting pain and requires a high-intensity stimulus (ie, strong, yet tolerable).^{39,47,52,62} However, the efficacy of such parameters based on age remains uninvestigated.

Mechanistic research has elucidated age-related changes in laboratory correlates of central pain excitability. Specifically, older adults are reported to have enhanced pain facilitation, whereby application of a repetitively delivered painful stimulus is perceived to be progressively more painful despite unchanging intensity of the stimulus.^{12,33} Older adults have also demonstrated attenuated pain inhibition such that pain reduction after a painful stimulus is either less than or slower than that in younger adults.^{13,31,49,65} Collectively, these findings suggest that age-related neuroplastic changes may reduce the capability of older adults to respond to pain-relieving treatments such as TENS because the mechanism of action includes activation of the central descending inhibitory pain system.^{52,54,61}

Therefore, our purpose was to test whether response to high-frequency, high-intensity TENS differed by age group among individuals with axial CLBP. This study had 2 principal aims. The first aim was to assess age differences in experimental pain response to TENS during rest. We hypothesized that older adults with axial CLBP would have decreased response to TENS due to enhanced pain facilitation and reduced pain inhibition.³² The second aim was to assess age group differences in CLBP measures of TENS response, including resting pain, movement-evoked pain, and disability. Although studies have yet to compare response to TENS for CLBP across age groups, we anticipated that older adults would have a reduced response based on

age-related changes in the descending inhibitory pain system.³² In addition, this study had 2 exploratory aims. The first was to assess daily pain across multiple TENS treatment sessions to ascertain whether the effects of TENS were cumulative under the current design. The second was to assess age group differences in TENS amplitude to provide a preliminary indication of dose and response by age group using a standard stimulus intensity instruction set. The overarching goal of this study was to determine age-specific effects of TENS using both experimental pain and axial CLBP self-report measures to provide novel information regarding the pain reduction capacity of TENS among older adults.

Methods

Study Population

Simple purposive sampling stratified to a priori age group quotas was used to enroll screened participants with axial CLBP (Fig 1). Once adequate group sampling had occurred, enrollment to that particular age group ceased. All participants were not currently seeking care and were recruited from the community via printed advertisements. In addition, a community health program that linked research opportunities with prospective participants via social and media services was used. Participants were categorized based on the following age groups: young (18–39 years old), middle-aged (40–56 years old), and older (57–79 years old). Age group ranges were determined a priori based on previous research.^{31,48} This study was approved by the University

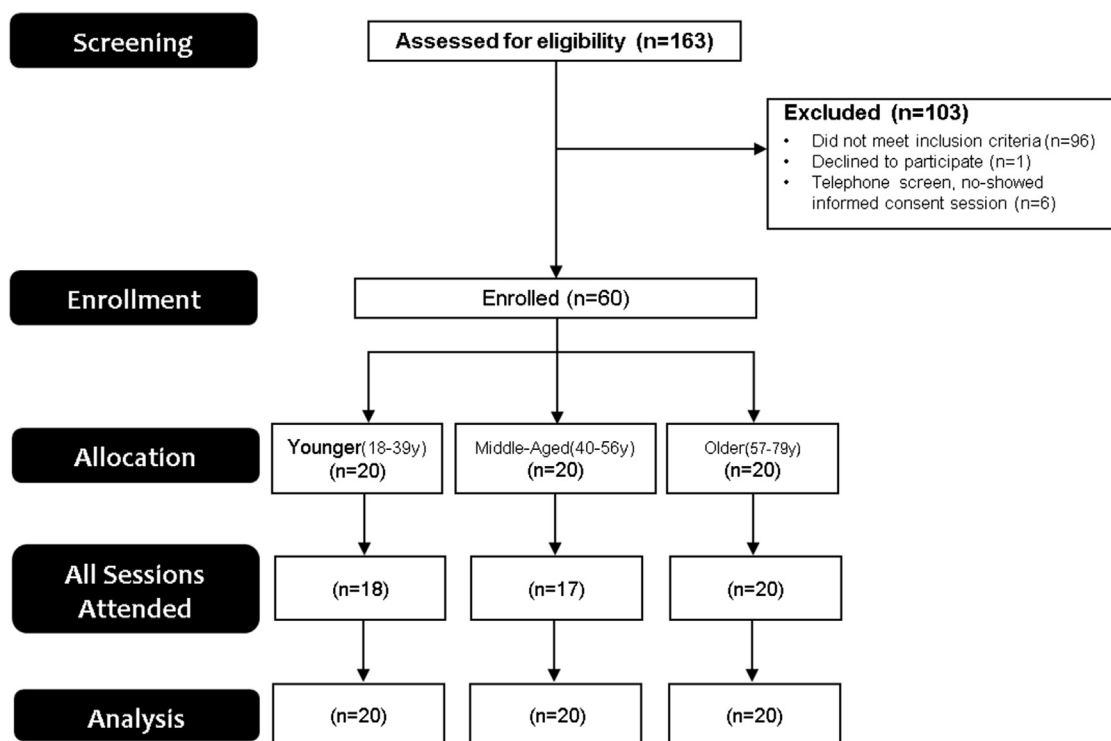


Figure 1. Flow diagram of patient enrollment.

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