

**PAIN RESPONSE OF TRANSCUTANEOUS  
ELECTRICAL NERVE STIMULATION TO  
DIFFERENT GRADES OF KNEE  
OSTEOARTHRITIS**

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# AGENDA



# INTRODUCTION OF KNEE OA

- ❖ Knee Osteoarthritis (OA)
  - ❖ “Wear and tear” of cartilage
  - ❖ Diagnosed globally
  - ❖ Prevalent disease provoking pain and/or disability

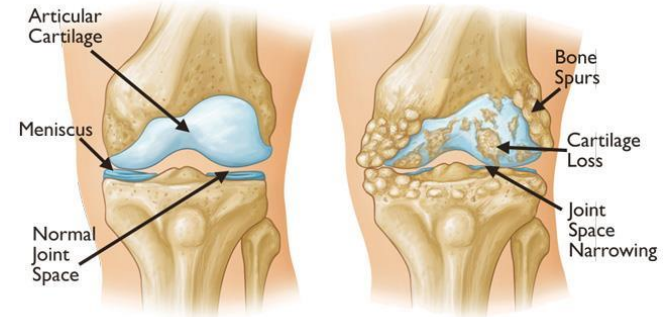


Photo provided by the American Academy of Orthopaedic Surgeons (AAOS) under article titled “Arthritis of the Knee”.

## Symptoms include:

- Stiffness
- Pain
- Decreased ROM
- Swelling

## Diagnosed

- MRI
- Radiological assessments
- Ultrasound (MSK US)
  - Reliability and validity
  - Kellgren-Lawrence (K&L) grading scale

# INTRODUCTION CONT.

- Knee OA affects:
  - 250 million worldwide
  - 27 million people in U.S.
  - 19% of people aged 45 years and older



IMPORTANCE  
OF TOPIC

(Mora et al., 2018, pg. 2189; Wallace et al., 2017, pg. 1)

# IMPORTANCE CONTINUED

## Concern for quality of life

- Progressive disease
- Symptom control

## Nonpharmacological treatments options

- Tailored to the patient's tolerance
- Transcutaneous Electrical Nerve Stimulation (TENS) units
  - High/low frequency
  - CNS → activate inhibitory system

## Exploring TENS and Knee pain

Lack of effects for pain (Palmer et al., 2014, pg. 390-393).

Study by Vance et al., (2014)  
• Inconclusive results (pg. 203)

Study by Shimoura et al., (2019)  
• + response to reducing pain while walking (pg. 303-305)

Lack of studies analyzing pain specifically

Is TENS successful for pain levels & grades of knee OA?

Thesis aim:

- Investigate different levels of knee osteoarthritis and analyze their pain response to TENS units during functional testing.

WHAT HAS BEEN  
DONE ALREADY?

## BRIEF OVERVIEW OF STUDY ANALYZED

- ❖ Study by Dr. Lawson et al., (2020) titled “The use of transcutaneous electrical nerve stimulation (TENS) along with functional tasks for immediate pain relief in individuals with knee osteoarthritis (OA)”
  - ❖ Recruitment
  - ❖ Eligibility criteria
  - ❖ Use of MSK-US machine
    - ❖ Kellgren-Lawrence grading scale
  - ❖ Functional testing
    - ❖ 1-6 weeks

<b>Grade 0</b> -No osteophytes. Regular femoral condyle without any projection.
<b>Grade 1</b> - Minor osteophyte (small projection) from the femoral condyle.
<b>Grade 2</b>
<i>2A</i> -Small osteophytes (small projections) from the femoral condyle that appears to have an inferior part in the joint space zone.
<i>2B</i> -Large osteophyte (large projection) that appears to be separated from the femoral condyle and has an inferior part in the joint space zone.
<b>Grade 3</b> -Large osteophyte (large projection) that appears to be separated from the femoral condyle and has an inferior part in the joint space zone with small superior extension parallel to the femoral bone.
<b>Grade 4</b> -Mainly superior osteophyte (superior projection) parallel to the femoral bone, with or without an inferior part in the joint space zone.

- Note. Adapted from “Reliability of a Proposed Ultrasonographic Grading Scale for Severity of Primary Knee Osteoarthritis”, by Mortada et al., 2016, Clinical Medicine Insights: Arthritis and Musculoskeletal Disorders, pg. 162 (DOI:10.4137/CMAMD.S38141), licensed under CC-BY-NC 3.0.



# GENERAL OVERVIEW OF RESULTS



Goal was to analyze pain responses of subjects for different levels of knee OA



Total of 20 subjects

Pain responses during testing to levels:

- 2A
- 2A or 2B
- 2A, 2B, or 3

## RESULTS OF LEVEL 2A

Test	Active	Placebo	p-value
Star Climb Test	2.67 (2.07)	3.01 (2.14)	0.3048
Time Up and Go Test	1.54 (1.11)	2.11 (1.69)	0.1861
Six Minute Walk Test	3.08 (2.14)	2.52 (2.12)	0.7975
Knee Extensor Strength Test	2.12 (1.96)	2.42 (2.35)	0.0571(*)
Locomotive Syndrome Risk 2-Step Test	1.63 (1.65)	2.56 (2.19)	0.0076(**)

(Lawson& Lee et al., 2020)

RESULTS OF  
LEVELS 2A OR 2B

Test	Active	Placebo	p-value
Star Climb Test	2.44 (1.95)	2.72 (2.08)	0.2303
Time Up and Go Test	1.48 (1.01)	1.96 (1.58)	0.2014
Six Minute Walk Test	2.74 (2.09)	2.29 (2.00)	0.7951
Knee Extensor Strength Test	1.93 (1.83)	2.19 (2.22)	0.0437(**)
Locomotive Syndrome Risk 2-Step Test	1.49 (1.54)	2.31 (2.09)	0.0074(**)

## RESULTS OF LEVELS 2A, 2B, OR 3

Test	Active	Placebo	p-value
Star Climb Test	1.90 (1.99)	2.57 (2.23)	0.0313(**)
Time Up and Go Test	1.30 (1.36)	1.85 (1.73)	0.0411(**)
Six Minute Walk Test	2.25 (2.11)	2.31 (2.13)	0.4548
Knee Extensor Strength Test	1.72 (1.89)	2.07 (2.12)	0.2025
Locomotive Syndrome Risk 2-Step Test	1.44 (1.74)	2.03 (1.92)	0.0154(**)

(Lawson & Lee et al., 2020)



## DISCUSSION

- More rejection of the null hypothesis to support that TENS units decreased pain during functional tests
  - Table including 2A, 2B or 3
    - TUG
    - SCT
    - LSR\_2ST
- Combined Data of 3 different grading levels suggests that this treatment can be useful in decreasing pain during functional tests
- Mean pain values suggested reduced pain while using active TENS
- Unclear if TENS worked better for solely one grading level vs another.
  - Lack of participants
  - Grouping of levels

### Restatement of aim:

- Investigate different levels of knee osteoarthritis and analyze their pain response to TENS units during functional testing.

### Was the end goal of the thesis reached?

- YES
  - Mean values for active vs placebo
  - Significant P-value in one grade level vs combined levels

### Future recommendations:

- Longer treatment
- Larger group of subjects

# CONCLUSION

# Q&A

Do you have any questions for me?



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