Protocol Title: Telehealth Exercise and Mindfulness for Pain in Osteoarthritis: A feasibility study
Principal Investigator: Deepak Kumar, PT, PhD
Description of Study Population: Adults with knee pain and osteoarthritis
Version Date: 2022-12-22

Study Summary

The purpose of this research study is to test the feasibility and acceptability of using telehealth (i.e., video conferencing) for exercise and mindfulness treatments for people with knee osteoarthritis (OA). To test this, 40 adults with knee osteoarthritis will be given either a telehealth mindful exercise intervention or a telehealth exercise intervention. Each person who participates in this study will have an equal chance of being in either of the treatment groups and their groups will determined by chance (like a coin toss). Feasibility of the study will be measured by the number of people recruited, number of people attending the sessions, etc.

Participants who take part in this research study will be in this research study for approximately 17-18 weeks. Participants in both groups will receive 8 supervised treatment sessions (once a week) via telehealth for 8 weeks. Participants will also receive a home program. For all telehealth sessions, participants will use their own computing devices (e.g., tablet computer) and will need to have access to high-speed internet. Before the start of the telehealth interventions, participants will be given a telehealth training session (details described below). All participants will be asked to complete a short survey weekly and longer surveys at three time points (i.e.) before the start of the 8-week intervention (baseline visit), end of the 8-week intervention (post-intervention), and at week-14 (follow-up). For baseline and post-intervention visit, participants will be given an option to make in-person data collection visits to Boston University. These visits will include testing of the participant's function, muscle strength, sensitivity to painful stimulus, and brain function during walking and other activities. At the end of the 8-week intervention, 20 participants will be invited for individual interviews to discuss their experiences related to the acceptability of the intervention they received.

The risks of taking part in this research study are minimal. You may feel emotional or upset when answering some of the questions in the questionnaires. There is a risk that for some persons the pain may get worse with exercise. There is a risk of loss of privacy since your information will be stored for research. If you opt in for the in-person data collection visits, you will be asked to perform walking and stair climbing activities, and as with any such activity, there is a risk that you may lose balance, stumble, fall, and experience an injury. There is a risk of soreness after strength testing. Tests of pain sensation may cause brief discomfort. There are also some risks to taking part in this research study due to the brain function device/equipment being used or the research procedures. These risks include some discomfort or mild pain due to the cap that you will wear on your head.

A detailed description of the risks are outlined in the **"**What are the risks of taking part in this research study?" section of the consent form.

If you are interested in learning more about this study, please read the rest of this form.

Introduction

Please read this form carefully. The purpose of this form is to provide you with important information about taking part in a research study. If you have any questions about the research or any portion of this form, please ask us. Taking part in this research study is up to you. If you decide to take part in this research study we will ask you to sign this form. We will give you a copy of the signed form.

The person in charge of this study is Deepak Kumar, PT, PhD. Deepak can be reached at kumard@bu.edu or 617-305-3037. We will refer to this person as the "researcher" throughout this form.

What should I know about a research study?

Participation in research is voluntary, which means that it is something for which you volunteer. It is your choice to participate in the study, or not to participate. If you choose to participate now, you may change your mind and stop participating later. If you decide not to participate, that decision will not result in any penalty or loss of benefits to which you are otherwise entitled.

Why is this study being done?

Knee Osteoarthritis (OA) is a chronic painful condition that affects many people in the US and globally. Exercise and mindfulness can both help people with knee pain due to OA. However, these interventions are often not accessible to people as they require a visit to a healthcare provider. This study is to determine the feasibility of using telehealth for delivering these interventions for people with knee OA. The findings of this study will be used for a larger study using telehealth to deliver these interventions for people with knee OA.

We are asking you to take part in this study because you have knee pain indicative of osteoarthritis. About 40 people with knee pain due to osteoarthritis will take part in this research study at Boston University.

Who is Funding the Study?

This study is sponsored by Boston University.

How long will I take part in this research study?

We expect that you will be in this research study for a total of 17-18 weeks. You will either receive mindful exercise OR exercise sessions at no cost for 8 weeks via telehealth. During this time, you will be asked to fill in surveys at various time points. You will also be given an option to make two in-person visits (i.e., before the start of and at the end of the 8-week intervention) to Boston University. If you agree to the in-person visits, your physical function, muscle strength, sensitivity to painful stimuli, and brain function during walking and other exercises will be assessed.

What will happen if I take part in this research study?

If you agree to take part in this study, we will ask you to sign the consent form before we conduct any study procedures. The timeline of the study visits is shown in the table below.

Visit	Week	Type of visit	Duration	Payment
Remote Baseline Visit	2-4 weeks before start of treatment	Remote	30 min	$25
[OPTIONAL] In-person Baseline Visit	2-4 weeks before start of treatment	In-person at Boston University	4 hours	$50
Remote Randomization and Telehealth training visit	Two to four weeks prior to intervention sessions	At-home using telehealth	45-60 minutes	Randomization and Telehealth training visit
Remote Treatment visits	Over 8-weeks (once a week)	At-home using telehealth	1 OR 2 hours per visit	[redacted]
Remote Weekly Survey	Each week during treatment	At-home using email	5 min each week	
Remote Week 8 visit	At end of treatment	Remote	30 min	$25
[OPTIONAL] In-person Week 8 visit	At end of treatment	In-person at Boston University	4 hours	$50
Remote Individual Interview ***(only for selected participants)***	At end of treatment	At-home using telehealth	1 hour	$25
Remote Week 14 surveys	6 weeks after end of treatment	At-home using email	30 min	$25

Study Visit 1: Remote Baseline Visit (30 minutes)

During this visit, we will ask you complete surveys about physical and mental health, quality of life, physical activity, and knee pain. The questionnaires include information on other medical conditions that you may have including heart disease, diabetes, kidney disease, AIDS, etc. A link to these surveys will be emailed to you and you will be able to complete these using any computing device (e.g., smartphone, tablet computer, personal computer).

[OPTIONAL] Study visit: In-person Baseline Visit [4 hours]

The total visit duration will be up to 4 hours if you agree to participate in the in-person baseline data collection visit. During this in-person visit, along with completing various surveys, you will be assessed for the following:

- **Knee Examination:** A standard clinical exam of the knee that is typically used in physical therapy clinics will be performed. This includes assessment of knee tenderness, and visual assessment of knee alignment.
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- **Functional testing:** We will also ask you to perform a few tests for speed, balance, and movement control that are similar to those performed in general outpatient physical therapy. These tests include repeatedly getting up from a chair, walking back and forth about 7 meters each way (about 23 feet), walking for 6 minutes, and going up and down stairs.

- **Pressure Response Testing**:
  During the first test, a set of flat-end nylon filaments (see below photo A) will be used to measure pain sensitivity. We will first select a probe based on your pain rating (on the 0-10 scale) and then the selected probe will be tapped 10 times on your wrist and on your knee. You will be asked to rate the pain sensation on the 0-10 scale.

  In the second test, we will use a device called an algometer (see below photo B) which will measure the amount of pressure applied to the skin by a small rubber tip. We will use the algometer to press the skin of your kneecap and wrist just until you feel the sensation of pressure change to a sensation of pain (called the pressure pain threshold). We will record the amount of pressure needed for this to occur.

  Lastly, we will place a blood pressure cuff on your arm and inflate it until the number reaches your 10 mmHG above systolic blood pressure (the measurement of the pressure in your arteries when your heart beats). And then, you will be asked to squeeze and relax your hand multiple times while we ask you to rate the pain in your forearm. We then will re-test for the pressure pain threshold using the same algometer.

  You may stop any of these tests at any point if you are too uncomfortable.

A.  B. 

- **Strength testing**: We will measure the strength of your leg muscles by asking you to push as hard as you can against a sensor. We will test your response to pressure using the same algometer again

We will also provide you with some exercise equipment either at this visit or we can mail it to your home address.

Brain Function Test:

If you are eligible for this test based on a survey that you will be asked to complete, you will participate in the following procedures.

You will complete a cognitive task, walking, dual-task walking, step-up, and sub-maximal knee extension exercise for about 6 minutes for each session. We will also measure your brain activity using functional near-infrared spectroscopy (fNIRS). We will place a non-invasive cap that holds light sources and detectors (which we call "optodes") on to your head. This cap allows us to use light to measure your brain activity. You will wear the cap while performing various tests. This does not hurt or create any sensation, except for slight application of pressure to temporarily connect the optodes.

Before setting up the fNIRS cap, we will also place two different types of sensors on your body. Using wraps, we will place ten sensors that measure movement on your shoes, lower legs, upper legs, lower back, and chest. These are the same sensors that we used in the "Functional Testing" section described above. Additionally, we will also place four small sensors over the muscles of your leg called electromyography (EMG) sensors. These sensors measure the electrical activity in your muscles, similar to EKG or ECG for the heart muscles. Before placing these sensors, we will shave the regions, clean with alcohol, lightly rub with gauze to ensure we receive a good signal from your muscles.

Once all the sensors are in place, we will ask you to complete the following tasks:

- Resting: We will collect a total of three minutes of baseline state brain activity while sitting and during simple movements (i.e., walking and step-up)

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- Serial 7: You will serially subtract seven aloud from a random three-digit number while sitting. Your responses will be audio recorded.
- Normal walking (NW): you will walk around a 10m walk-way at a self-selected pace.
- Dual-task walking (DTW): you will walk around a 10m walk-way while subtracting seven aloud from a random three-digit number at a self-selected pace. Your responses will be audio recorded.
- Step-up: First, the height of the step evoking knee pain 4/10 at the affected side will be determined. Starting from 10cm high step, 5cm of the riser will be added at the bottom until the level of pain reaches 4. You will be asked to step up 2 times at each height. If the pain level doesn't reach 4 until the height reaches 25cm, 25cm will be used. You will do a series of stepping up and down with determined height.
- Sub-maximal isometric knee extension exercise: You will do knee-extension strengthening exercise with 20% of maximal effort. Three trials of pressure pain thresholds will be assessed right after the exercise on the affected side of the knee.

Study Visit 2: Remote Randomization and telehealth training (45-60 minutes)

In this remote visit, we will assign you by chance (like a coin toss) to one of two study groups. One group will receive telehealth exercise and the other group will receive telehealth mindful exercise. You and the researcher cannot choose your study group. You will have an equal chance of being assigned to either study group. You will be trained in how to use Zoom for the telehealth treatment. Specifically, you will be given instructions on how to set up the camera on your computing device (tablet, laptop, or computer) and your questions related to setting up your device and how to access the classes will be answered. The instructor will also discuss basic instructions or ground rules for participating in the telehealth sessions including space and materials needed, mutual respect for participants, and appropriate clothing for the telehealth session. Finally, you will be asked to complete two surveys about your expectations and familiarity with health related terms.

Treatment

- *Exercise group:* Participants in this group will receive a group-based supervised exercise session once a week for 8 weeks along with a structured home exercise program. Each session will be 45-60 min long and will include strengthening exercises and neuromuscular re-education exercises. These sessions will be delivered in a group setting via a HIPAA-compliant videoconferencing software.
- *Mindful exercise group:* Participants in this group will receive a group-based supervised integrated mindful exercise program once a week for 8 weeks along with a structured home program. The mindfulness component of the intervention will be based on the John Kabat-Zinn's Mindfulness Based Stress Reduction program. The goal of this mindful exercise intervention is to teach participants how to focus their awareness on the present moment without reacting or being judgmental - during their exercises, during everyday movements like walking, and during stressful situations such as experiencing pain. Each session will be up to 2 hours long and will be delivered

via a HIPAA-compliant videoconferencing software.

Study Visit 3: in-person OR Remote Post-intervention (8-week) visit

Similar to the baseline visit, you will have an option of participating in an in-person or remote data collection visit. The procedures that will take place during both types of visits are identical to the baseline visit. For the remote visit, you will be asked to complete various surveys. For the in-person visit, you will complete functional tests, muscle strength tests, pain sensitivity tests, and brain function testing (described above in baseline visit) along with completing the surveys

Study Visit 4: Remote Post-intervention 8-week visit (30 minutes)

Similar to the remote baseline visit, you will be emailed a link to complete surveys about your health.

[OPTIONAL] Study Visit: in-person Post-intervention (8-week) visit (4 hours)

The procedures that will take place are identical to the baseline in-person visit. You will complete functional tests, muscle strength tests, pain sensitivity tests, and brain function testing (described above in baseline visit).

Study Visit 5: Remote individual interviews (about 45 min - 1 hour)

You might be asked to participate in individual interviews after the end of the 8-week intervention and after you have complete the remote 8-week visit. The goal of these individual interviews is to understand your experiences of participating in the intervention in order to determine the acceptability of the intervention. These interviews will be audio-recorded, but your identification will be removed from the transcripts and the final reporting of the findings.

Study Visit 5: 14-week remote visit (about 30 minutes)

We will email you a link to complete questionnaires related to your physical health, mood, quality of life, and expectation of treatment, similar to the link to the weekly surveys.

At-home weekly remote monitoring (about 5 minutes each week)

Every week, we will email you a link to complete brief questionnaires related to your knee pain, exercise, physical activity, and medication use. These surveys will start during the first week of intervention and continue for the subsequent 14 weeks.

What are the risks of taking part in this research study?

Intervention risks
You may experience pain or swelling after exercises that usually dissipates 24-h after exercising. There are no known major risks to exercise or mindfulness-based interventions. You will be given a home exercise manual that will provide instructions on what to expect, and what to do if the pain or swelling lasts for more than 24-h.

Questionnaire/Post-intervention interview risks
You may feel emotional or upset when answering some of the questions in the questionnaires or the post-intervention interview. You do not have to answer any questions that make you feel uncomfortable

Unknown risks
This study may include risks that are unknown at this time. Throughout the study, the researchers will notify you of new information that may become available and might affect the decision to remain in the study. This includes, but is not limited to, information that may affect your safety, well-being or medical care. Due to the possibility of unknown risks, if you are pregnant or think that you might be pregnant, you should not participate in this research.

Loss of Confidentiality
The main risk of allowing us to use and store your information for research is a potential loss of privacy. We will protect your privacy by labeling your information with a code and keeping the key to the code in a password-protected computer.

Strength and functional testing risks [for those who opt in for the in-person data collections]

Some soreness can be present immediately after or the next day after performing maximal force contractions during the strength testing. Since you will be asked to perform walking, stair climbing type activities, as with any such activity, there is a risk that they may lose balance, stumble, fall, and experience an injury. To minimize soreness, you will be provided adequate rest between contractions, and advised to apply ice to involved muscle groups in case of soreness. To minimize the risk of falling during functional tests, you will be demonstrated each activity and you will be able to perform a few practice trials to become familiar with each activity prior to data collection. The testing area will be well lit and clear of any obstacles, and a member of the study team may accompany you during these activities to assist in guarding against falling. During stair climbing activities, you will also be allowed to use the staircase handrails for support.

Pressure Response Testing risks [for those who opt in for the in-person data collections]
The main risks from this testing are discomfort and possible bruising and/or bleeding. The pressure generated while the nylon filaments touch the skin during test 1, and the pressure generated by the algometer used in test 2 have been used safely in other studies, including those of participants with chronic pain. The tests will be stopped if bruising or bleeding occur or if the discomfort is too great. Application of the blood pressure cuff will cause decreased blood flow to the hand, which

may cause pain or tissue damage. To minimize the risk of pain or tissue damage resulting from the blood pressure cuff, cuff inflation will be limited to a maximum of two minutes.

Brain Function using fNIRS (functional near infrared spectroscopy) risks [for those who opt in for the in-person data collections]

Because the probes are fixed by the spring tops, you could feel uncomfortable or mild pain pain with the pressure from the springs if you wear it for a long time. During cap setting, a study staff member will ask you about your condition and comfort level. If you complain about the cap during the experiment, a staff will adjust the intensity of the spring cap until you agree to continue the session. Also, at the end of every task, staff will ask about your comfort level. If you complain of excessive pain from the optodes during the session, the experiment will be ceased.

The fNIRS brain-measuring device we will use is a safe way to measure activity in the brain. No one has reported harmful effects from using the system. There are no foreseeable risks or side effects of fNIRS. The intensity (amount) of the near-infrared light used to monitor your brain is considered to be harmless. It is less than the intensity of the light your brain would receive during an outdoor walk on a sunny day. There may be other risks or discomforts in the study that we don't know about. If we learn about these risks, we will let you know what they are so that you can decide whether or not you want your child to continue to be in the study.

Electromyography (EMG) Risks [for those who opt in for the in-person data collections]

EMG sensors measure the electrical signals generated by your muscles when you move. We use a commercial wireless EMG system in this study, however some of the EMG sensors may have wires connecting two parts of the sensor. These wires are covered to minimize risk of electric shock or discomfort on the skin. The sensors are placed on your skin using double-sided medical tape, and the tape may cause slight skin redness or irritation and may pull your body hair when removed. This is a normal reaction and will disappear with time. The tape can be removed with hypoallergenic/alcohol wipes if preferred.

EMG sensors may also be wrapped with an elastic material (e.g. PreWrap or Coban) to ensure the sensor remains securely attached to the skin during activities. Pressure indentation, skin redness, or soreness may result from the pressing of the sensor onto the skin. This is a normal reaction and will disappear with time. If discomfort does not subside after a few days, please contact the research team.

Although these sensors are purely observational and do not apply any electrical current to your body, there may be a very rare risk of discomfort or shock from the electronic components. Although the likelihood of system malfunction is rare, we have periodic equipment and data checks in place to minimize this risk. As an additional safety measure, individual electronic devices and sensors will be safety certified by staff engineers and undergo a safety checklist before being applied and worn by participants.

Mandated Reporting

Reporting disabled individual/child/elder abuse, if applicable: If, during your participation in this study, we have reasonable cause to believe that disabled individual/child/elder abuse is occurring, he/she must report this to authorities as required by law. The researcher will make every reasonable effort to protect the confidentiality of your research information. However, it might be possible that a civil or criminal court might demand the release of identifiable research information.

Are there any benefits from being in this research study?

If you agree to take part in this study, you will receive a telehealth exercise intervention or a telehealth exercise and mindfulness intervention. These interventions may help reduce your pain, strengthen your muscles, and make you feel better in general.

What alternatives are available?

You may choose not to take part in this research study. You do not have to take part in this research study to be treated for knee osteoarthritis. Other treatments available for your condition include medications, injections, and/or surgery.

Can I still get medical care at Boston Medical Center if I choose not to participate in this research study?

You may still get medical care at Boston Medical Center if you choose not to take part in this study. Your decision will not change the care you receive now or in the future. Taking part in this research is your choice. If you decide to take part in this study, you may leave/stop the study at any time. There will be no penalty to you and your medical care will not be affected. If you would like to stop taking part in this research you should let us know.

Study Participation and Early Withdrawal

Taking part in this study is your choice. You are free not to take part or to withdraw at any time for any reason. No matter what you decide, there will be no penalty or loss of benefit to which you are entitled. If you decide to withdraw from this study, the information that you have already provided will be kept confidential.

Audio/Video Recording

We would like to audio/video record you during this study. If you are audio/video recorded it will/will not be possible to identify you. We will store these recordings on our computer and only approved study staff will have access to the recordings. We will label these recordings with a code instead of your name. The key to the code connects your name to your recording. The researcher will keep the key to the code in a password-protected computer. The recordings will be stored for 7 years after the study ends.

Do you agree to allow us to audio/video record you during this study?

_____YES _____NO _____ Initials

Use of Your Study Information/Biospecimens

Private information collected from you during this study will NOT be used for future research studies or shared with other researchers for future research, even if the information identifying you are removed from the private information.

How Will You Keep My Study Records Confidential?

We will keep the records of this study confidential by storing the paper files in locked filing cabinets and the electronic files in computer systems with password protection and encryption. We will make every effort to keep your records confidential. However, there are times when federal or state law requires the disclosure of your records.

The following people or groups may review your study records for purposes such as quality control or safety:

- The Researcher and any member of their research team
- The Institutional Review Board at Boston University. The Institutional Review Board is a group of people who review human research studies for safety and protection of people who take part in the studies.
- Federal and state agencies that oversee or review research
- Central University Offices

The results of this research study may be published or used for teaching. We will not include identifiable information on data that are used for these purposes.

After removal of identifiable private information, the information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from you or your legally authorized representative.

Future Contact

We may want to contact you in the future either to follow-up to this study or to see if you are interested in other studies taking place at Boston University.

May we contact you in the future?

_____YES _____NO _____ Participant Initials

Will I get paid for taking part in this research study?

Depending on the research visits you opt in for, your compensation will range from 75-150$

- Baseline Data Collection
  - In-person visit - $50
  - Remote visit - $25
- Post-intervention Data Collection
  - In-person visit - $50
  - Remote visit - $25
- Remote follow-up week-14 visit - $25

[If selected] Individual Interview - $25

What will it cost me to take part in this research study?

There are no costs to you for taking part in this research study.

What happens if I am injured as a result of participating in this research study?

If you think that you have been injured by being in this study, please let the researcher know right away **[Deepak Kumar, 617-358-3037]**. You can get treatment for the injury at Boston Medical Center or at any healthcare facility you choose. There is no program to provide compensation for the cost of care for research related injury or other expenses. Other expenses might be lost wages, disability, pain, or discomfort. You or your insurance will be billed for the medical care you receive for a research injury. You are not giving up any of your legal rights by signing this form.

ClinicalTrials.Gov

A description of this clinical trial will be available on *http://www.ClinicalTrials.gov*, as required by U.S. Law. This Web site will not include information that can identify you. At most, the Web site will include a summary of the results. You can search this Web site at any time.

Who do I ask if I have questions or concerns about this research study?

Please call us with any concerns or questions about the research, or any research-related problems:

- Deepak Kumar, PT, PhD: 617-358-3037 OR kumard@bu.edu
- Nirali Shah, PT, MPT: 617-358-8142 OR nirali05@bu.edu

If you have questions about your rights as a research participant, or if you have any complaints or concerns and want to speak with someone independent of the research team, you may contact the Boston University Charles River Campus IRB at 617-358-6115. The IRB Office webpage has information where you can learn more about being a participant in research, and you can also complete a Participant Feedback Survey.

Consent to participate in optional brain function testing

Please initial in front of the appropriate option below.

_____ I agree to participate in the brain function tests at baseline and post-intervention visits.

_____ I do not agree to participate in the brain function tests at baseline and post-intervention visits.

Statement of Consent

I have read the information in this consent form including risks and possible benefits. I have been given the chance to ask questions. My questions have been answered to my satisfaction, and I agree to participate in the study.

SIGNATURE

_____
Name of Study Participant

_____ _____
Signature of Study Participant Date

I have explained the research to the research participant and answered all their questions. I will give a copy of the signed consent form to the participant.

_____
Name of Person Obtaining Consent

_____ _____
Signature of Person Obtaining Consent Date

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