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How physical relaxation exercises help reduce muscle tension in dentists: a thermal imaging study

Submission date
14/09/2026

Recruitment status
No longer recruiting

Registration date
14/09/2026

Overall study status
Completed

Last Edited
14/09/2026

Condition category
Musculoskeletal Diseases

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[X] Record updated in last year

Plain English summary of protocol

Background and study aims
Dentists can be at risk of developing work-related muscle and joint problems because their work often involves staying in the same position for long periods, bending the neck and upper body, and making small repetitive movements. The neck, back, shoulders, wrists and hands are among the areas most commonly affected. When muscles remain contracted for a long time, they produce more heat. This change in temperature can be measured non-invasively using infrared thermal imaging (thermography).

The aim of this study was to use thermal imaging to assess muscle fatigue and tension in dentists while they performed endodontic (root canal) procedures using a dental operating microscope. The study also looked at whether stretching and relaxation exercises performed during breaks could help reduce muscle tension.

Who can participate?
The study included 35 healthy male dental residents aged between 24 and 30 years. Participants had relatively similar body characteristics and a body mass index (BMI) below 25. Dentists with a history of muscle pain or problems affecting the neck or lower spine were excluded from the study. Before taking part in the experiment, participants were instructed on appropriate ergonomic posture when working with a dental microscope.

What does the study involve?
Participants performed repetitive movements similar to those used when mechanically preparing root canals. To make the activity consistent between participants, they worked on plastic endodontic training blocks rather than patients. Their wrist was kept in a fixed position and their elbow was supported by the arm of an ergonomic chair. All procedures were carried out using a dental operating microscope at 15× magnification.

Muscle activity was assessed using a FLIR B200 infrared thermal imaging camera. Thermal images were taken before the activity began, after different periods of work and following breaks during which participants performed physical exercises. Participants completed 20-

minute work sessions alternating with 10-minute stretching breaks, with a total observation period of 60 minutes.

To make the measurements as consistent as possible, the room temperature was maintained at 21°C. Participants kept their upper body uncovered during the experiment, and thermal images were taken from a standard distance of three metres. The researchers analysed temperature changes in standardised areas of the neck, upper/middle back and lower back.

What are the possible benefits and risks of participating?
The protocol does not specifically describe benefits or risks for individual participants.

The study was designed to investigate whether stretching, muscle-relaxation and similar exercises during breaks could reduce muscle fatigue and tension associated with dental work. However, the protocol does not state that participants themselves were expected to receive a direct health benefit from taking part.

No specific risks or adverse effects are described in the provided protocol. Participation involved repetitive movements resembling those used during root canal treatment, periods of stretching and non-invasive thermal imaging.

Where is the study run from?
Periodontology University Clinic, Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy Timisoara, Romania

When is the study starting and how long is it expected to run for?
The study was conducted between September 2018 and January 2019.

For each participant, the experimental protocol described a total observation period of 60 minutes, consisting of 20-minute work sessions alternating with 10-minute stretching breaks.

Who is funding the study?
Investigator initiated and funded

Who is the main contact?
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Study information

Scientific Title
Thermographical evaluation of muscle strain and effects of decontracting/relaxing physical exercises in dental practitioners per-forming endodontic treatments under the microscope

Study objectives
The aim of this study was to use thermal imaging to assess muscle fatigue and tension in dentists while they performed endodontic (root canal) procedures using a dental operating

microscope. The study also looked at whether stretching and relaxation exercises performed during breaks could help reduce muscle tension.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 09/08/2026, Scientific Research Ethics Committee of Victor Babes University of Medicine and Pharmacy Timisoara Romania (Piaţa Eftimie Murgu Nr. 2, Timișoara, 300041, Romania; +40 256 204 400; esanda2000@yahoo.com), ref: No. 80/2018 revised 08.09.2026

Primary study design
Observational

Secondary study design
Cross sectional study

Study type(s)

Health condition(s) or problem(s) studied
Musculo-skeletal disorders in dentists

Interventions
The study included 35 healthy male dental residents aged between 24 and 30 years. Participants had relatively similar body characteristics and a body mass index (BMI) below 25 kg/m². Dentists with a history of muscle pain or problems affecting the neck or lower spine were excluded from the study. Before taking part in the experiment, participants were instructed on appropriate ergonomic posture when working with a dental microscope.
Participants performed repetitive movements similar to those used when mechanically preparing root canals. To make the activity consistent between participants, they worked on plastic endodontic training blocks rather than patients. Their wrist was kept in a fixed position and their elbow was supported by the arm of an ergonomic chair. All procedures were carried out using a dental operating microscope at 15× magnification.
Muscle activity was assessed using a FLIR B200 infrared thermal imaging camera. Thermal images were taken before the activity began, after different periods of work and following breaks during which participants performed physical exercises. Participants completed 20-minute work sessions alternating with 10-minute stretching breaks, with a total observation period of 60 minutes.

Intervention Type
Behavioural

Primary outcome(s)
1. Changes in muscle temperature in the cervical, thoracic and lumbar regions as an indicator of muscle fatigue and tension measured using infrared thermography using a FLIR B200 thermal imaging camera. Thermal images are analysed using FLIR Tools software in standardised regions corresponding to the cervical, thoracic and lumbar areas. Temperature changes associated with muscle activity and changes in blood circulation are assessed at baseline (before starting the activity), after work sessions, and after stretching/exercise breaks during the 60-minute experimental period

Key secondary outcome(s)

Completion date
05/05/2019

Eligibility

Key inclusion criteria
1. Study population: Dental students (final year) + resident dentists
2. Gender: Males only
3. Age range: 24–30 years
4. Health status: Healthy
5. Similar body characteristics, BMI <25kg/m²

Healthy volunteers allowed
Yes

Age group
Adult

Lower age limit
24 Years

Upper age limit
30 Years

Sex
Male

Total final enrolment
35

Key exclusion criteria
History of muscle pain, cervical or lumbar spine disorder

Date of first enrolment
02/09/2018

Date of final enrolment
20/01/2019

Locations

Countries of recruitment
Romania

Sponsor information

Organisation
Victor Babeș University of Medicine and Pharmacy Timișoara

ROR
https://ror.org/00afdp487

Funder(s)

Funder type

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Other files	Consent form		14/09/2026	No	No