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# Does trigger point sensitivity affect proprioception? Effects of trigger point sensitivity in the upper trapezius muscle on proprioception

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## ABSTRACT

**Aims:** Trigger points are classified into two types: active and latent. Both are commonly associated with muscle dysfunction and restricted range of motion. Active trigger points cause localized or referred pain, while latent trigger points elicit pain only upon palpation. This study was aimed to investigate the effects of trigger point sensitivity in the upper trapezius muscle on proprioception.

**Methods:** A total of 69 participants aged 18–40 years were included in this study and were divided into three groups: the control group (n=23), the active trigger point group (n=23), and the latent trigger point group (n=23). Sociodemographic data were collected from the participants, and cervical joint range of motion, neck functions and joint position errors in flexion, extension, and rotation movements were assessed. Cervical joint range of motion was evaluated using a universal goniometer. Neck function was assessed using the Neck Disability Index (NDI). Joint position errors in flexion, extension, and rotation movements were measured using a laser pointer repositioning test. All evaluations were performed by the same physiotherapist to ensure consistency.

**Results:** Significant differences were found between the groups in terms of cervical joint range of motion ($p<0.001$) and joint position errors ($p<0.001$), with the active trigger point group exhibiting the most pronounced impairments. Both the active and latent trigger point groups demonstrated higher joint position errors compared to the control group, with the active trigger point group showing the most severe dysfunctions.

**Conclusion:** The data indicate that trigger points, particularly active ones, negatively impact joint position sense, affecting movement and posture. Therefore, it is crucial to address trigger point sensitivity more frequently in clinical practice and future research, as it plays a critical role in pain and functional loss. The findings highlight the need for further studies investigating the effects of trigger points in different muscles and regions on proprioception.

**Keywords:** Position sense, trigger points, joint range of motion

## INTRODUCTION

Myofascial trigger points are sensitive, palpable taut nodules within skeletal muscle fibers.[1] There are two types of trigger points: active and latent. Active trigger points cause constant pain in the region where they are located and/or in referred areas, and their presence is diagnostic of myofascial pain syndrome.[2] Latent trigger points, on the other hand, elicit pain upon palpation in their immediate or referred areas; unlike active trigger points, they only produce pain when stimulated.[3] Both latent and active myofascial trigger points have been associated with muscle dysfunction, weakness, and restricted range of motion.[2]

The cervical spine plays a critical role in determining the position of the head relative to the body and coordinates input from the vestibular and visual systems through a highly sensitive proprioceptive mechanism.[4] Pain in this region can disrupt proprioceptive signals by interfering with afferent input from proprioceptors, potentially resulting in faulty proprioceptive information. This misinformation can trigger prolonged reflex activation of neck muscles, eventually leading to neck pain and a vicious cycle of dysfunction.[4,5]

Studies have shown that proprioception is negatively affected in individuals diagnosed with cervical spondylosis, spondyloarthritis, idiopathic neck pain, and cervical disc herniation.[6-9]

Attention to proprioception in myofascial pain has increased with the discovery of fascial structures. It has been found that

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fascia, similar to the presence of trigger points, may transmit erroneous positional signals when under stress. Furthermore, due to its memory-like properties, this dysfunction may become persistent over time. Langevin, who emphasized the need to investigate the relationship between trigger point sensitivity and proprioception, served as an inspiration for the design of this study.[10]

To date, no studies have been found in the literature that specifically examine how proprioception is affected by the presence of trigger points, which are a major contributor to neck pain. Although individuals with active trigger points have been included in mechanical, idiopathic, or chronic neck pain groups, the presence of trigger points has not been specifically addressed in these studies. Since latent trigger points may also affect proprioception due to their similarities with active points in terms of palpation sensitivity, twitch response, and pain, this study aimed to compare cervical proprioceptive sense in healthy individuals, and those with active and latent trigger points. By classifying participants with active and latent trigger points under the heading of "trigger point sensitivity," this study is expected to contribute to the literature by revealing its impact on proprioception.

## METHODS

### Participants

Ethical approval was obtained from the Gazi University Ethics Committee (Date: 25.04.2024, Decision No: 2024-648), and written informed consent was collected from all participants. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. The flowchart of the study is presented in Figure.

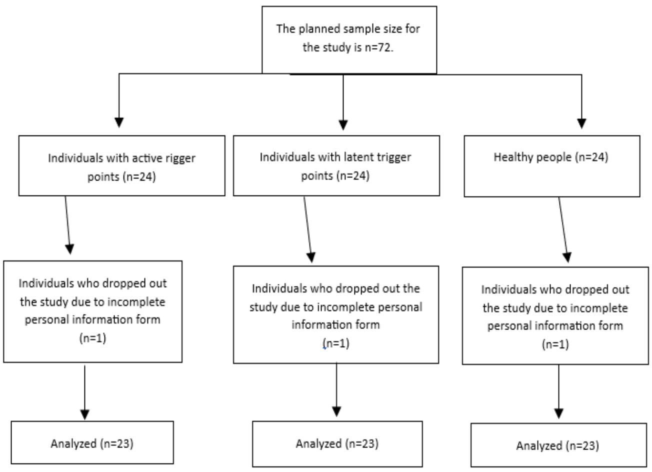


**Figure.** Flow chart

Between August 15 and September 15, 2024, a total of 69 individuals aged 18-40 years were recruited from the Physical Medicine and Rehabilitation outpatient clinic of Tokat State Hospital. The sample included 23 individuals with one or two active trigger points in the upper trapezius muscle, 23 individuals with latent trigger points, and 23 healthy volunteers.

The diagnosis of active trigger points was based on three widely accepted clinical criteria: point tenderness, referred pain, and local twitch response. Latent trigger points were defined as clinically silent regions that presented with tenderness and referred pain only upon stimulation.[11]

Healthy volunteers were recruited from among the relatives of patients and hospital staff who had provided informed consent. Individuals with vestibular, neurological, or inflammatory rheumatic diseases, as well as those with a history of cervical spine surgery, were excluded.

Sample size was calculated using the G*power software (Version 3.0.10, Universität Düsseldorf, Düsseldorf, Germany). Based on a referenced study, a minimum of 63 participants was required to achieve 80% power at a 0.05 significance level. Accounting for a potential 10% data loss, 72 individuals were enrolled in the study. Due to incomplete data from three participants, data from 69 individuals were analyzed.

### Measurements

**Personal Information Form:** This form collected demographic and clinical data, including age, sex, body-mass index (BMI), dominant side, history of previous injuries or illnesses, and current medication use.

**Neck Disability Index (NDI):** The NDI, developed by Vernon and Mior, assesses the impact of neck pain on daily activities. Its Turkish validity and reliability were confirmed by Arslan et al.[12,13] NDI scores range from 0-4 (no disability), 5-14 (mild), 15-24 (moderate), 25-34 (severe), and ≥35 (complete disability).[14]

**Cervical joint position error (JPE):** Proprioceptive deficits were evaluated using the protocol developed by Revel et al.[15] A specially designed laser pointer (Tracker™ USA) was affixed to each participant's forehead. Participants were seated comfortably 90 cm from an A2-sized target paper placed at eye level.

The laser beam was calibrated to the Cartesian center point while the head was in the neutral position, defined as the zero position. All measurements were conducted with eyes closed. Each participant was given three practice trials for each movement direction (flexion, extension, right rotation, left rotation), which were excluded from data analysis. During the actual trials, participants returned to the zero position with eyes open before each test, then moved their head through the full range of motion at a comfortable pace and attempted to return as precisely as possible to the starting position. Each movement was performed six times. The distance (in centimeters) between the final laser position and the zero point was recorded and averaged. This average was defined as the 'absolute error'. To convert the error into degrees of deviation, the formula Arctan (absolute error/90) was used. The results were recorded as the "cervical joint position error."[16]

**Cervical range of motion (ROM):** A universal goniometer, a reliable and valid instrument, was used to assess cervical ROM.[17] While in a seated position, participants were tested for active cervical flexion, extension, right rotation, and left rotation. Normal ROM values were recorded in degrees.

### Statistical Analysis

Mean, standard deviation, or frequency and percentage values were reported for sociodemographic data. Categorical variables were compared using Pearson's Chi-square test and Fisher's exact test. For numerical data, normally distributed variables were compared using One-Way ANOVA, while non-normally distributed variables were analyzed with the Kruskal-Wallis test. One-way ANOVA was used for parametric data analysis, and Kruskal-Wallis analysis was performed for non-parametric data. The significance level was set at p<0.05. Post-hoc analyses were conducted to determine the source of any significant differences.

## RESULTS

The study included a total of 69 individuals, divided equally into three groups: those with active trigger points (n=23), those with latent trigger points (n=23), and healthy controls (n=23). The mean age of the participants was 27.75±5.46 years. The sociodemographic characteristics of 69 participants are presented in Table 1. Age, smoking history, gender, dominant side, and presence of musculoskeletal disorders in medical history were found to be similar between groups (p>0.05). However, a significant difference was detected in body-mass index values between the groups (p=0.02).

The cervical joint flexion, extension, right and left rotation measurement values of the groups are presented in Table 2. Flexion and extension values showed significant differences between the groups (p<0.001), (p=0.003); however, no significant differences were found between the right and left rotation values (p>0.05). Post hoc analyses revealed that the cervical joint flexion and extension values in the active trigger point group were statistically significantly lower than those in both the latent trigger point group (p=0.005) and the healthy control group (p<0.001), while no significant difference was observed between the latent trigger point group and the healthy control group (p>0.05).

Neck Disability Index total scores differed significantly among the groups. Post hoc analyses revealed that the active trigger point group had significantly higher scores than the latent trigger point group (p<0.001) and the healthy control group (p<0.001). Additionally, the latent trigger point group had significantly higher scores than the healthy control group (p=0.007) (Table 3).

The data related to cervical joint position errors for flexion, extension, and both rotation directions are presented in Table 4. Significant differences were found between groups in cervical joint position errors during flexion, extension, and rotation movements. Following post hoc analyses, the pairwise comparisons revealed the following findings for flexion, extension, right rotation, and left rotation: In flexion, significant differences were found between the active and latent trigger point groups (p=0.002), the active and healthy control groups (p<0.001), and the latent and healthy control groups (p=0.03). In extension, the active trigger point group had significantly higher position errors than both the latent trigger point group and the healthy control group (p<0.001 for both comparisons), while no significant difference was found

**Table 1. Sociodemographic characteristics**

| | | Control group n=23, X±SD | Active trigger point group n=23, X±SD | Latent trigger point group n=23, X±SD | p |
|---|---|---|---|---|---|
| **Age (years)** | | 25.57±5.58 | 31.13±7.62 | 26.57±6.72 | p=0.059 |
| **BMI (kg/m²)** | | 21.92±3.26 | 25.17±3.78 | 24.09±4.32 | *p=0.025 |
| **Smoking history (pack-years)** | | 1.02±4.14 | 1.00±2.58 | 1.39±3.88 | p=0.539 |
| | | **n (%)** | **n (%)** | **n (%)** | |
| **Gender** | Women | 16 (69.60) | 20 (87) | 17 (73.90) | p=0.347 |
| | Men | 7 (30.40) | 3 (13) | 6 (26.10) | |
| **Dominant side** | Right | 20 (87) | 21 (91.30) | 21 (91.30) | p=0.853 |
| | Left | 3 (13) | 2 (8.70) | 2 (8.70) | |
| **History of musculoskeletal disorders** | Yes | 4 (17.40) | 3 (13) | 4 (17.40) | p=0.897 |
| | No | 19 (82.60) | 20 (87) | 19 (82.60) | |

The level of statistical significance was set at p<0.05. n: Number of participants. X: Mean. SD: Standard deviation, BMI: Body-mass index, *p-values were obtained using Kruskal-Wallis test

**Table 2. Normal range of motion of the cervical joint**

| | Control group n=23, X±SD | Active trigger point group n=23, X±SD | Latent trigger point group n=23, X±SD | p | η2 |
|---|---|---|---|---|---|
| Cervical joint flexion (degree) | 77.04±10.55[a] | 59.78±11.12[b] | 73.35±17.17[a] | *p<0.001 | 0.24 |
| Cervical joint extension (degree) | 66.74±9.95[a] | 55.22±14.80[b] | 66.43±12.30[a] | **p=0.003 | 0.16 |
| Cervical joint right rotation (degree) | 76.70±10.14 | 73.04±17.49 | 75.09±11.40 | p=0.933 | 0.01 |
| Cervical joint left rotation (degree) | 80.22±11.25 | 79.57±13.39 | 79.70±9.99 | p=0.909 | 0.001 |

Statistical significance level was assumed to be p<0.05, n: Number of subjects, x: Mean, SD: Standard deviation, $\eta^2$= effect size measure indicating eta squared, a, b: Different letters indicate statistically significant differences. while similar letters indicate statistical similarity. *p-values were obtained using Kruskal Wallis test. Post hoc pairwise comparisons were performed using the Mann-Whitney U test, **p-values were obtained using one way ANOVA. Post hoc analysis was performed using the Tukey HSD test

**Table 3. Neck Disability Index points**

| | Control group n=23, X±SD | Active trigger point group n=23, X±SD | Latent trigger point group n=23, X±SD | p | $\eta^2$ |
|---|---|---|---|---|---|
| Neck Disability Indexes total point | 1.65±1.49[a] | 15.65±4.74[b] | 4.65±4.33[a] | p<0.001* | 0.72 |

Statistical significance level was assumed to be p<0.05, n: Number of subjects, x: Mean, SD: Standard deviation, $\eta^2$= effect size measure indicating eta squared, a. b: Different letters indicate statistically significant differences. while similar letters indicate statistical similarity

**Table 4. Cervical joint position error test results**

| | Control group, n=23, X±SD | Active trigger point group, n=23, X±SD | Laten trigger point group, n=23, X±SD | p | η2 |
|---|---|---|---|---|---|
| Flexion (⁰) | 2.38±0.92[a] | 4.66±1.52[b] | 3.32±1.30[c] | p<0.001* | 0.35 |
| Extension (⁰) | 2.65±1.01[a] | 5.59±2.37[b] | 3.11±1.11[a] | p<0.001* | 0.39 |
| Right rotation (⁰) | 2.71±0.90[a] | 5.30±2.16[b] | 3.93±1.77[c] | p<0.001* | 0.28 |
| Left rotation (⁰) | 2.70±1.27[a] | 5.26±2.48[b] | 3.74±1.45[c] | p<0.001* | 0.25 |

p<0.05. Statistical significance level was assumed to be p<0.05. ⁰: Degree, $\eta^2$= Effect size measure indicating eta squared, n: Number of subjects, X: Mean, SD: Standard deviation, a, b, c: Different letters indicate statistically significant differences. while similar letters indicate statistical similarity

between the latent trigger point and healthy control groups (p>0.05). In right rotation, significant differences were found between the active and latent trigger point groups (p=0.023), the active and healthy control groups (p<0.001), and the latent and healthy control groups (p=0.045). In left rotation, significant differences were found between the active and latent trigger point groups (p=0.016), the active and healthy control groups (p<0.001), and the latent and healthy control groups (p=0.003).

In summary, post hoc analyses showed that position errors in flexion and both rotation directions differed significantly between all pairwise group comparisons (p<0.05). In extension, the active trigger point group had significantly higher position errors compared to the other two groups (p<0.05), while no significant difference was found between the latent trigger point group and the healthy control group (p>0.05).

## DISCUSSION

This study aimed to evaluate the impact of active and latent myofascial trigger points on cervical proprioception. The findings revealed that individuals with trigger points-both active and latent-exhibited significantly greater cervical joint position error (JPE) and decreased range of motion (ROM) compared to healthy individuals.

While prior research has examined proprioceptive deficits in individuals with idiopathic neck pain, cervical spondylosis, or disc herniation, to our knowledge, this is the first study that specifically evaluates proprioceptive sense in relation to trigger point sensitivity.[6-9]

The results showed that the active trigger point group had significantly higher JPE values in flexion, extension, and left rotation compared to both the latent and healthy groups, consistent with the hypothesis that increased pain and muscle tension from active trigger points may interfere with proprioceptive feedback.[2] The presence of significant JPE values in the latent group as well suggests that even subclinical trigger points can affect joint position sense.

Interestingly, no significant difference was observed in JPE during right rotation. One possible explanation is that the affected side may have been the right side in a significant portion of the participants, causing the head to return more easily to the right due to motor preference or familiarity. This hypothesis could be further explored in future studies by stratifying trigger point locations by side.

In terms of ROM, the reduced movement in the active trigger point group aligns with existing literature, which attributes limited cervical mobility to muscle stiffness, pain avoidance behavior, and tissue sensitivity.[2,19-21] The latent group also exhibited decreased ROM, suggesting that even in the absence of spontaneous pain, muscle tightness associated with latent trigger points can limit mobility.

Another important outcome was the variation in disability levels among the groups. Based on the NDI, no disability was observed in the healthy group, while the latent group showed mild disability and the active group showed moderate disability. These results are consistent with Martín-Sacristán et al.[22] and other studies that found moderate disability in individuals with active MTrPs and no reported disability in healthy subjects.[23] In populations with more severe underlying conditions-such as whiplash-associated disorders-MTrPs often coexist with moderate to severe disability, as reported in several studies.[24-26]

The role of fascial structures in proprioceptive regulation has gained increasing attention in recent years. Myofascial dysfunction may alter the quality and quantity of sensory input, contributing to impaired joint position sense.[10] The fact that proprioception was impaired even in the latent trigger point group supports this emerging view.

### Limitations

This study has some limitations. First, it only included individuals aged 18-40, limiting generalizability to older populations. Second, only the upper trapezius muscle was evaluated; future studies could include other muscles with high trigger point prevalence. Finally, while a laser-based method was used for JPE measurement, other tools such as 3D motion analysis could provide more precise data.

## CONCLUSION

This study showed that trigger point sensitivity, especially when active, impairs cervical joint position sense and reduces neck function. These findings highlight the importance of including trigger point assessment in clinical evaluations of cervical proprioception. Addressing trigger points during rehabilitation may help improve sensorimotor control and reduce the risk of recurrent neck pain.

## ETHICAL DECLARATIONS

### Ethics Committee Approval

The study was carried out with the permission of the Gazi University Ethics Committee (Date: 25.04.2024, Decision No: 2024-648).

### Informed Consent

All patients signed and free and informed consent form.

### Referee Evaluation Process

Externally peer-reviewed.

## Conflict of Interest Statement

The authors have no conflicts of interest to declare.


## Financial Disclosure

The authors declared that this study has received no financial support.


## Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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