Research Article

The Effect of Corrective Exercise on Pain Referred to The Jaw Joint (TMJ) in Elderly Women With Upper Crossed Syndrome

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Abstract

Background: Upper crossed syndrome is a muscular imbalance disorder associated with various referred pains, especially jaw discomfort. Complications like temporomandibular joint (TMJ) osteoarthritis may link to forward head posture and mechanical head pains resulting from this syndrome.

Objectives: The objective of this study was to compare the impact of corrective exercise on pain of TMJ in elderly women with upper cross syndrome.

Methods: A total of 30 elderly women with upper crossed syndrome were enrolled at the Kahrizak Elderly Care Center and randomly assigned to either a corrective exercise group or a control group. The experiment group underwent an eight-week training program. Pain levels and neck range of motion were assessed using a pain ruler and goniometer, respectively. In order to measure neck extension, the mean difference and effect size were determined using paired t-test and Cohen's d, respectively. Referred pain ratings were analyzed using Mann-Whitney U and Wilcoxon signed-rank tests, with effect size calculations, to further understand the intervention's effect on pain perception.

Results: Both groups demonstrated significant changes in referred pain perceptions ($P = 0.0441$) post-intervention. However, regarding neck extension, neither the control nor the experiment group exhibited statistically significant alterations in neck extension ($P = 0.4309$).

Conclusions: These findings indicate that corrective exercises have a positive effect on alleviating referred pain in the jaw joint caused by muscle imbalance. Given the merits of corrective exercises as a non-pharmacological intervention, they are recommended as an effective approach for improving referred pain in the jaw.

Keywords: Corrective Movements; Proximal Cross Syndrome; Neck Range of Motion; Referred Pain; Temporomandibular Joint; Corrective Exercise

1. Background

Upper crossed syndrome is a muscular imbalance disorder associated with various referred pains, including headaches, neck pain, and jaw discomfort (1). Complications like temporomandibular joint (TMJ) osteoarthrosis may link to forward head posture and mechanical head pains resulting from this syndrome. Temporomandibular joint disorders have different forms and opinions on their prevalence, diagnosis, and treatment divergence. Epidemiological studies on this disorder are primarily descriptive, leading to lower incidence rates compared to prevalence rates, which vary significantly from 10.2% to 91% in different societies (2-6). Approximately 20 - 30% of adults experience TMJ disorders, with most seeking treatment for related symptoms (7). The prevalence of TMJ disorders is higher in women and young individuals, but it tends to decrease with age (8).

Upper crossed syndrome causes extensive changes in the upper body, including abnormal head posture and scapular protraction, leading to an imbalance in head alignment. This can result in breathing difficulties, altered oral breathing patterns, and chronic neck pain (9). Additionally, it increases the likelihood of developing osteoarthritis in the TMJ, leading to inflammation and referred pains (10, 11). Temporomandibular joint pain is typically described as pain radiating to the lower jaw, neck, and head, worsening with activities like talking and chewing (12). Treatment methods include patient education, physiotherapy, drug therapy, behavioral therapy, and various other interventions (13-15). Exercise-based approaches, particularly corrective exercises, have shown promising achievements in managing TMJ pain due to their alignment with the nature of upper crossed syndrome (16). Further research is needed to compare the effectiveness of corrective exercises with other treatments, such as massage (17).

2. Objectives

Considering the prevalence of upper crossed syndrome among adults, investigating non-pharmacological treatments is crucial. This study aimed to compare the effects of corrective exercises, a self-administered exercise approach, with massage to validate their efficacy as interventions for TMJ pain.

3. Methods

The current study employed a semi-experimental design with a pre-test/post-test approach. The participants consisted of 30 women aged between 60 and 70 years, experiencing pain, dryness, and a painful clicking sensation in the TMJ area while closing their mouths with the arm. The subjects were purposively selected and available with the assistance of a doctor. Ethical considerations were strictly followed, which included obtaining informed consent from all participating volunteers and ensuring the confidentiality of collected information. After selecting the volunteer participants, the research procedure and its overall objectives were thoroughly explained to each subject, and written informed consent forms were obtained. The subjects were randomly divided into 2 experiments and 1 control groups. Information regarding the participants was collected confidentially both before and after the intervention. Pain levels and neck range of motion were measured during the pre-test and post-test phases using a pain ruler scale and a goniometer, respectively (18).

The age range was 65 ± 5. The individuals in the control group did not perform any corrective exercises over the course of 8 weeks, while the experiment group received the benefits of corrective movements. The research aimed to prescribe functional and effective exercises to alleviate TMJ pain in elderly individuals with upper crossed syndrome. The selection of these exercises was based on the elderly's ability to perform them and was deemed acceptable by rehabilitation specialists.

Pain measurement: Pain levels were recorded using a pain chart with a numerical rating scale (NRS), which is a common rating scale. The participants rated their pain on a scale of 0 to 10, where 0 indicated "no pain at all" and 5 or 10 represented "the worst pain imaginable." Pain intensity levels were measured at the initial encounter, after treatment, and periodically, following guidelines and clinical requirements (19). Measurement of neck extension range: The extension of the cervical spine was measured by determining the distance from the occipital to the wall using a tape measure. The degree of flexibility in the extension direction of the cervical region was assessed by calculating the difference between these two measurements. The test was performed twice, and the average value was recorded as an individual record (20).

Training protocol: The exercise protocol was carried out three times, with a total duration of 20 minutes. The exercises consisted of a combination of stretching and isometric contractions targeting the anterior and posterior neck extensors, as well as the deep neck flexors, to address part of the syndrome involving the functional potential of joints between the cervical vertebrae and the TMJ. Special attention was paid to the elderly participants during the exercise design process, considering their specific needs for a physical fitness program. The exercises were performed at a low intensity to suit most elderly patients. Functional and effective exercises were prescribed to address misalignment and muscle imbalance in the upper quadrant of the body, adhering to the standards and exercise patterns presented in ACSM guidelines (21).

3.1. Statistical Data Analysis Methods

To find the mean difference and the effect size with a significant level for the variable of the distance from the occipital to the wall to measure neck extension, paired t-test and Cohen's d, respectively. We also conducted a comprehensive analysis of referred pain ratings that were measured by a pain ruler on a 10-degree scale using both the Mann-Whitney U test and the Wilcoxon signed-rank test, along with effect size calculations, to gain deeper insights into the impact of an intervention on pain perception. All statistical analyses were conducted using SPSS v.21, and the significance level for tests was set at $P \leq 0.05$.

4. Results

In this comprehensive study, our exploration ventured into two distinct dimensions of pain perception: neck extension dynamics and referred pain assessment. We undertook a meticulous analysis of the distance from the occipital to the wall during neck extension, scrutinizing the effects of interventions on control and experiment groups. Additionally, we measured referred pain using a 10-degree scale, revealing invaluable insights into the quantification and impact of pain experiences.

4.1. Neck Extension and Intervention Effects

Analyzing the control group, participants' assessments before and after a designated timeframe indicated a minor increase in the mean distance from the occipital to the wall in neck extension. Although this change appeared subtle, statistical analysis revealed that it was not significant, potentially attributing it to random variations. The experiment group, on the other hand, demonstrated more pronounced dynamics. A noteworthy decrease in the mean distance suggested the intervention's potential impact; however, statistical significance remained elusive, mirroring the inherent fluctuations seen in the control group (Table 1, Figure 1).

Table 1. Neck Extension Variation in the Control and Experiment Groups

Group	Pre-Test Mean	Post-Test Mean	Mean Difference	Standard Deviation (SD)	Sample Size (n)	Degrees of Freedom (df)	Cohen's d	t-Value	p-Value
Control group	10.6001	10.6439	0.0438	0.0424	15	14	1.0309	1.0342	0.3158
Experiment group	10.5561	10.4104	-0.1457	0.1794	15	14	-0.8146	-0.8124	0.4309

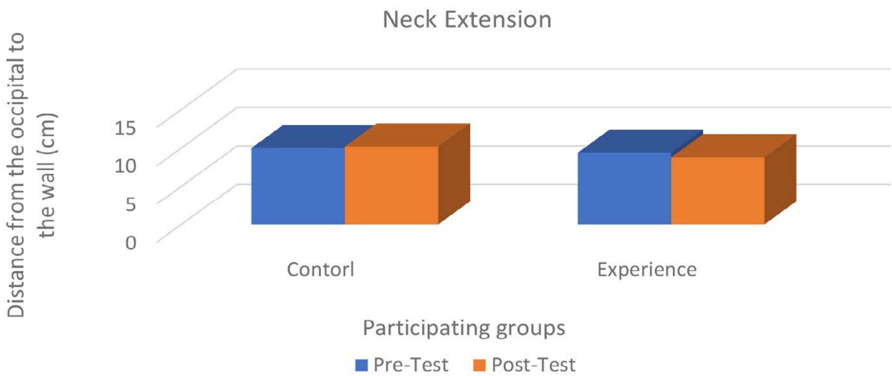

Figure 1. Neck extension variation in the control and experiment groups.

4.2. Comparative Interpretation and Effect Sizes

A crucial facet of our study emerged when comparing these two groups. Despite a notable reduction in the mean distance within the experiment group, statistical insignificance compelled us to tread cautiously in interpreting these results. To examine practical significance, effect sizes were computed. Within the control group, a moderate effect size (Cohen's d = 0.5404) highlighted the influence of time-related factors. In contrast, the experiment group exhibited a smaller effect size (Cohen's d = 0.2582), signifying the intervention's impact on a pain parameter. These relative magnitudes elucidated the distinct nature of change within each group (Table 1, Figure 1).

4.3. Referred Pain and Intervention Impact

Shifting our focus to referred pain, we explored the experiment group's response to a specific intervention. Here, the results took on a different complexion. The experiment group's pain ratings underwent a significant shift before and after the intervention. The median pain rating decreased from 5.600 to 4.334, supported by a Mann-Whitney U test statistic of 3.0. This statistically significant transformation was underscored by a P-value of 0.0441, illuminating the intervention's effect on pain perception. Moreover, the effect size (r = 0.2582) revealed a small-to-moderate practical impact, substantiating the intervention's effectiveness (Table 2, Figure 2).

Table 2. Referred Pain to TMJ Variation in the Control and Experiment Group

Group	Median (Pre-Test)	Median (Post-Test)	Test Statistic	P-Value	Effect Size (r)
Experience group	5.600	4.334	3.0	0.0441	0.2582
Control group	6.724	6.640	32.0	0.1261	0.5404

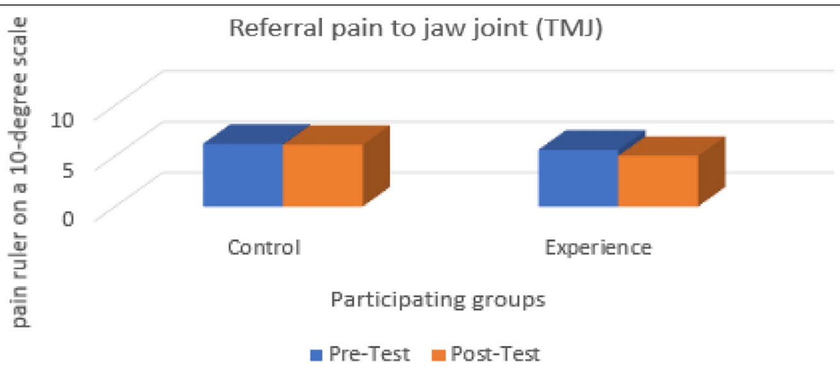

Figure 2. Referred pain to TMJ variation in the control and experiment group.

4.4. Control Group and Time-Related Factors

In contrast, the control group's pain ratings remained relatively unchanged across the same time interval. Statistical tests indicated no significant shift, as the Wilcoxon signed-rank test yielded a p-value of 0.1261. Despite this, the effect size (r = 0.5404) highlighted a moderate practical impact of time-related factors on pain ratings. This underscores the importance of considering various influences when interpreting pain perception changes (Table 2, Figure 2).

In summary, the study suggests that corrective exercise had a positive impact on pain perception related to TMJ in elderly women with upper crossed syndrome, as evidenced by the significant shift in pain ratings and effect sizes in the experiment group. However, it is important to note that the control group showed some influence of time-related factors on pain ratings as well.

5. Discussion

In Oliver's study (2002), it was noted that muscle imbalance might lead to trunk drooping at a young age, which progressed over time, resulting in a rounded back. Concurrently, the front muscles are shortened while the back muscles are stretched and weakened, causing the head to move forward. This forward head posture can increase compressive forces on the cervical vertebrae up to three times the weight of the head (22). Additionally, aging can cause a change in the resting position of the lower jaw, which, over time, may contribute to premature TMJ osteoarthritis and neck pain (23). Taheri and Mahdevinjad (2010) reported two results concerning chronic neck pain: A higher average forward head angle in individuals with chronic neck pain compared to those without neck pain and lower proprioception and mobility in those with chronic neck pain (24).

Kyle Teifel (2012) mentioned that upper cruciate syndrome could lead to postural changes in the upper back over time. It is one of the known causes of spinal kyphosis, which can also lead to breathing problems and asthma (25). Other complications include neck pain, back muscle cramps, and chest and jaw pain, which can be caused by mobility disorders of the back and neck muscles, muscle imbalance, and muscle fatigue (26). Over time, poor body biomechanics and posture can cause early onset of osteoarthritis in the cervical spine, chest, and jaw joint (TMJ) (27). Abdullahzadeh et al. (2017) and Gupta et al. (2013) confirmed the effect of four weeks of corrective exercises on improving the forward head. Also, Shenoy et al. (2010) and Nobri et al. (2018) confirmed the effect of eight weeks of therapeutic exercise on the improvement of the head forward and range of motion of the head (28-31).

Chewing muscle pain after toothache is the most common pain in the oral region. Facial muscle pain disorder syndrome is the most common form of TMJ disorders (32). Middle-aged and elderly people suffer from chronic neck pain over time. The interventions of massage technique and spinal manipulation can significantly reduce TMJ pain during an 8-week period. Controlled exercise programs are effective in reducing neck pain. In conclusion, neck pain and posture-related issues are prevalent among various age groups and can cause significant discomfort and functional limitations, including the experience of pain in the jaw. Corrective exercises, massage therapy, and spinal manipulation can play a crucial role in alleviating pain, improving posture, and enhancing overall quality of life (33, 34).

Upper crossed syndrome is a silent disorder with a slow manifestation and no initial noticeable symptoms (22). Though individuals may tolerate it without pain, complications arise when upper crossed syndrome causes joint dysfunction and referred pain. TMJ disorders are common, with many being muscular(8, 35). Corrective exercises are crucial to the treatment of upper crossed syndrome and have proven beneficial, especially in elderly women. While some studies show positive impacts on variables like neck extension and TMJ pain, the effectiveness of specific exercises may vary among studies. Combining exercises could enhance the management of upper crossed syndrome. Additionally, cooling the affected area has shown a significant pain reduction.

In conclusion, corrective exercises significantly improve upper crossed syndrome in elderly women, potentially surpassing drug therapy and rehabilitation when used alone. Yet, further research and a comprehensive exercise program are necessary to achieve consistent and substantial management improvement of the upper crossed syndrome.

Authors' Contribution:

All authors contributed to the study's conception and design. Mansouri Mahan, Sokhanguei Yahya, and Sohaily Shahram were responsible for material preparation, data collection, and analysis. All authors provided input and revisions. All authors have reviewed and approved the final version of the manuscript.

Conflict of Interests:

The authors have no conflicts of interest, financial or non-financial, to disclose.

Ethical Approval:

Ethical considerations, including maintaining confidentiality in referring to sources, providing a legal letter of introduction, explaining the purpose of the study and the roles of the researcher and participants, obtaining informed consent, and ensuring the confidentiality of information, were observed. The subjects entered the study voluntarily. All data generated or analyzed during this study are included in the published article. However, the datasets are not publicly available to ensure the privacy and confidentiality of the study participants. Informed consent was obtained from all individual participants included in the study.

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