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CASE REPORT

Multi-Modal Physical Therapy for a Dancer with Chronic Cervicalgia

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Abstract

Background and Purpose: The purpose of this case report was to examine how a multi-modal treatment program was used to increase upper quarter stability, improve posture, and reduce pain in a patient with chronic cervicalgia. The interventions of this program focused on soft tissue mobilization, neuromuscular re-education, and axioscapular strengthening to reduce the patient's pain, and help her return to her prior level of function.

Case Description: The patient was a 19-year-old female ballet dancer referred to physical therapy, reporting chronic neck and upper back pain for the previous 4 years. This patient's primary impairments included decreased strength of her bilateral shoulder musculature, and decreased cervical range of motion. Secondary impairments for this patient included increased pain with cervical and shoulder movements.

Interventions: The patient received physical therapy treatment twice a week for six weeks. Interventions included soft tissue mobilization to facilitate increased efficacy of stretching targeted muscles, neuromuscular re-education to facilitate increased upper quarter stability, postural training and education, therapeutic activity, therapeutic exercises to strengthen key postural muscles, and modalities to compliment pain relief and lengthening of tight muscles.

Outcomes: Since the beginning of treatment, the patient's pain decreased from 6/10 to 3/10 at the worst level, and 2/10 to 1/10 at the best level. The MCID for the NPRS is 1 point9. The patient had improved her UEFS score by 10 points from 67/80 (83.75%) to 77/80 (96.25%), with the MDC for the UEFS being 8.1 points 11. Values for B shoulder flexor, abductor, and internal/external rotator strength and cervical extension, and R lateral flexion ROM improved since the start of care, in conjunction with decreased cervical pain with movement.

Discussion: After physical therapy treatment, the patient reported improved quality of life, which was demonstrated by increased shoulder strength, increased cervical ROM, and decreased pain with movements. The patient's progress took place over 6 weeks, and her physical therapy program had shown effectiveness in the treatment of chronic upper thoracic and cervical pain.

Keywords: Physical Therapy; Cervicalgia; Multi-Modal; Soft Tissue Mobilization; Neuromuscular Re-education; Posture

Introduction

It is estimated that up to 67% of people will suffer neck pain at some point in their life, with a rate of reoccurrence of 60% among individuals, and an increased rate of occurrence in females [1]. Mechanical neck pain is believed to be due to cervical muscle dysfunction, in which the cervical muscles are impaired in timing of activation, and/or generation and sustainment of the torque required for ideal function [2]. Another speculated cause of neck pain includes poor posture [1]. The deep cervical flexor (DCF) muscles, the longus colli and the longus capitis, have been implicated in helping maintain stability of the cervical spine and head; these muscles weaken in individuals with forward head posture, causing decreased endurance of the DCF and increased activity of the superficial cervical flexors, resulting in increased pain1. In addressing neck pain, a combination of manual therapy and exercise has been indicated to be effective in conservatively treating chronic neck pain [2].

Following the easing of symptoms, cervical muscle function has not been shown to spontaneously recover afterward, emphasizing the importance of cervical muscle training in treatment [2]. In addition to activity limitations and participation restrictions due to neck pain, patients presenting with forward head posture may also present with mobility limitations, and increased tension in additional muscle groups [3]. Myofascial trigger points, which are defined as hyperirritable spots "in a taut band of a skeletal muscle that is painful on contraction, stretching, or stimulation", have also been implicated in reproducing neck pain, notably those found in the upper trapezius (UT), levator scapulae (LS), and the sternocleidomastoid (SCM) [4]. Individuals with chronic neck pain were also found to have poorer quality of sleep due to sleep disturbances, which is considered an essential factor in treating chronic pain [4].

The pain associated with forward head posture has been described as Upper Crossed Syndrome, in which muscular changes in the cervical region occur due to prolonged poor posture3. Due to prolonged misalignment of the cervical spine, forward head posture causes weakness in the DCF and the axioscapular musculature: the rhomboids, the middle trapezius (MT), and the lower trapezius (LT) [3]. Additionally, the UT, LS, pectoralis major, and pectoralis minor become tight [3]. Compared to pain-free individuals, individuals with chronic neck pain have been shown to have increased superficial cervical flexor activity with decreased DCF activity when performing a cervicocranial flexion test; the increased activity of the superficial flexors act as a compensation strategy, indicating DCF weakness [5]. Individuals with neck pain have also been shown to demonstrate abnormalities in scapular position and mobility, similar to individuals with painful shoulder dysfunctions6. Although it is unknown if neck pain helps initiate or perpetuate shoulder dysfunction, or if shoulder dysfunction helps initiate or perpetuate neck pain, awareness of managing the LS and trapezius muscles has since increased in importance for treating neck pain; this is due to their role in helping dissipate loads from the shoulder girdle to the cervical region, in which abnormal coordination of these muscles can contribute to neck pain [6].

The International Classification of Functioning, Disability, and Health (ICF) model emphasizes the ability to function as a component of health; the interplay of the individual's environment on the individual's body function, activity limitations, and participation restrictions all contribute to the individual's health, and degree of disability [7]. Physical therapists can use the ICF model to identify a how a patient's musculoskeletal function is impacting their activity and participation, use the interventions determined to be the most effective in treating the condition, and use appropriate outcome measures to monitor changes in the patient's level of disability [8]. A patient presenting with the health condition of cervicalgia with mobility deficits can present with primary impairments of decreased head and neck mobility, and decreased strength of the postural muscles [8]. A patient could also present with secondary impairments of increased neck and upper back pain, along with increased tone of the affected muscle groups [8]. These impairments in body function can result in activity limitations for a patient with neck pain, such as completing daily routines, and handling various responsibilities8. These activity limitations in turn create issues in the patient's participation levels in the community or at home. For example, a patient with neck pain could experience difficulty in their recreational or leisure activities, completing housework, and driving [8].

To improve a patient's symptoms and decrease their level of disability due to neck pain, certain interventions have been shown to help improve patient outcomes, and return them to their prior level of function. To increase pain free cervical range of motion (ROM), applying stretches to the affected muscle groups (UT, LS, scalenes, and pectoralis muscle group) can be an effective, low-cost method to include throughout treatment8. To address postural strength deficits, training the DCF for strength and endurance, along with isometric cervical strengthening, has been shown to decrease pain levels and disability levels in patients with non-specific neck pain [8].

Upon performing an initial evaluation, progress note, and discharge, objective measurements and outcome measures are used to monitor changes in a patient's condition. Outcome measures that can be applied to a patient with neck pain include the Numeric Pain Rating Scale (NPRS), and the Upper Extremity Functional Scale (UEFS). Objective measures that can be applied to a patient with neck pain include ROM, and an upper extremity (UE) manual muscle test (MMT). The NPRS was found to have excellent test-retest reliability (r=0.79-0.92), and was found to be a valid outcome measure to assess pain (p=0.0001) [9,10]. The UEFS was also shown to have excellent test-retest reliability (r=0.95) and was shown to be a valid outcome measure to determine a patient's difficulties [11]. To monitor changes in mobility, ROM measurements should be taken; ROM values have been shown to demonstrate good inter-rater reliability (ICC= 0.79-0.92) and concurrent validity (r=0.93-0.98) [12,13]. Changes in a patient's UE strength should be monitored by MMT, which was found to have good reliability and validity in patients with neuromusculoskeletal dysfunction [14].

Musculoskeletal injuries and joint pain have been implicated as a result of an individual presenting with generalized joint hypermobility [15]. The prevalence of joint hypermobility is especially increased in populations such as dancers and gymnasts, due to increased need for flexibility in these disciplines, and especially for aesthetic reasons in the case of dance [15,16]. Decreased muscular strength and muscular stability have also been associated with joint hypermobility, and associated with increased risk of musculoskeletal injury [15]. While increased flexibility and mobility would normally be advantageous for participants in dance and gymnastics, it has been suggested that hypermobility would not be advantageous for these populations without the required musculoskeletal strength needed for increased stability with movements [15]. With this knowledge, a physical therapist can apply the appropriate interventions and outcome measures to treat populations that require increased mobility in their activities. The purpose of this case report is to examine a case in which a multi-modal physical therapy treatment program was used to increase upper quarter strength and stability, reduce pain with movement and activities, and improve postural habits to return a dancer with chronic neck and upper back pain to her prior level of function.

Case Description

The patient was a 19-year-old female of Asian descent with a petite, ectomorphic build that was referred to physical therapy presenting with cervicalgia. The patient was a university student and had been a ballet dancer for 11 years, in which she both practiced and taught ballet part time. The patient reported that her pain had started insidiously 4 years ago, and had been getting worse over time. The patient had been following the advice of her physician to rest in order to manage her pain, but this gave minimal relief, and had sought the help of physician 3 times total before being referred to physical therapy. The patient stated her

pain increased after performing ballet, and attributed this to increased use of her upper extremities while teaching. The patient also reported increased pain and limitations with lifting objects to waist level or overhead, looking down and rotating her head, and driving. The patient stated that her pain was constant, that she would wake up in pain most mornings, and that her sleep was disturbed by pain.

During the initial examination, the physical therapist took the patient's history and performed a system review to determine whether the patient would benefit from physical therapy [17]. The NPRS, determined to have good reliability and validity based on literature based on Karciouglu, *et al.* [10] was used to determine current pain levels at the least painful and most painful (Table 1), in which the patient pointed to the bilateral (B) UT and LS region as the source of her "dull and aching" pain10. The patient is right (R) handed and reported that her R side had recently been more painful than her left (L) side. The patient also reported that her pain would travel up her posterior neck, but denied the occurrence of headaches. The patient reported that she did not have any additional health conditions in her past medical history, and that she did not have any previous surgeries or injuries that would impact her progress in physical therapy. The patient was provided with the UEFS to determine her functional ability, and the level of her functional limitations (Table 2). This outcome measure has been shown to have good reliability and validity according to literature by Hamilton, *et al.* [11]. The patient scored 67/80, meaning she could use both her UE to perform at 83.75% of her ability. Major areas of limitations included lifting objects to waist level or overhead, driving, and performing recreational activities or hobbies.

At Best	**10-Feb**
At Worst	**10-Jun**

Table 1: Pain Scale

	Total Score	**Percentage**
UEFS	**67/80**	**83.75%**

Table 2: Upper Extremity Functional Scale

For the initial examination of this patient, thorough objective measurements were taken by the physical therapist to determine impairments and the best plan of care for the patient [17]. The patient presented with forward head posture and rounded shoulders upon postural inspection. The patient's active range of motion (AROM) for both shoulders were assessed and found to be full and within normal limits (WNL), but symptomatic with R ER. Cervical AROM was assessed and found to be limited and symptomatic for all directions. The patient reported increased pain with flexion, B lateral flexion, and R rotation (Table 3).

	AROM
Flexion	30°; increased pain
Extension	40°
R Rotation	45°; increased pain
L Rotation	50°
R Lateral Flexion	20°; increased pain
L Lateral Flexion	20°; increased pain

Table 3: Cervical Active Range of Motion

Due to the need for increased ROM, dancers demonstrating hypermobility and experiencing painful symptoms were found to have reduced neuromuscular control and increased instability with movements, increasing the risk of injury [16]. If instability is identified, the risk of injuries in dancers could be decreased by addressing neuromuscular control to reduce disability and self-manage painful symptoms [16]. MMT, shown to have good reliability and validity, for both shoulders revealed R>L weakness for B shoulder flexion, abduction, internal rotation (IR), and external rotation (ER) (Table 4). The patient tested negative for cervical compression and cervical distraction testing. Neurological testing indicated the B UE dermatomes and myotomes were intact. Upon palpation of the B UT, LS, and cervical paraspinals, the patient reported increased tenderness on the R side, greater than on the L side. As determined by this examination, the patient required interventions to improve posture, cervical AROM, UE strength, and pain, in order to improve her life as a ballet teacher and student, and help her return to her prior level of function [17].

	Right	**Left**
Flexion	4-/5	4/5
Abduction	4-/5	4/5
Internal Rotation	4/5	4+/5
External Rotation	4-/5	4/5

Table 4: Shoulder Manual Muscle Test

Patient Evaluation

The ICF model is used by clinicians to describe the state of an individual's disability or illness, and examine how this affects how an individual functions in their environment [17]. Using the ICF model would be applicable to this patient due to the primary and secondary impairments affecting her functioning. Primary impairments for this patient included decreased strength of B shoulder and postural musculature, decreased muscle length, and decreased cervical ROM. For an individual between the ages of 20 and 29 years old, the normal values for cervical ROM has been reported to be 60° for flexion, 75° for extension, 45° for R lateral flexion, 46° for L lateral flexion, 79° for R rotation, and 78° for L rotation [18]. Secondary impairments for this patient included increased upper back/neck pain. Due to the patient's weakness, muscle length deficits, decreased cervical ROM, and pain, the patient's hobbies and work commitments were more difficult17; this included the inability to lift objects to waist level or overhead, drive, look down, rotate her head, or dance without increased pain. Participation restrictions for this patient due to her primary and secondary impairments included teaching ballet classes to younger students due to increased pain with the cervical and UE movements required for ballet.

After gathering subjective and objective information during the patient's initial examination, the physical therapy diagnosis was determined to be postural related neck pain/postural related back pain (ICD-10 code: R29.3), general muscle weakness (ICD-10 code: M62.1), and decreased cervical ROM (ICD-10 code: M53.82) secondary to poor postural awareness.

Plan of Care

Intervention goals for this patient included decreasing pain level, increasing pain-free cervical ROM, increasing B shoulder MMT strength, and increasing postural strength. The short-term goals for the patient were intended to be met at 3 weeks into treatment and included reporting pain level decreased from 6/10 to 3/10, increasing MMT strength of the B shoulder musculature to 4+/5, and reporting improved postural awareness. The long-term goals for this patient were made in consideration for the patient's impairments and existing schedule:

1. In 6 weeks, the patient's cervical ROM will increase to WNL in order for the patient to perform pain free cervical movements when dancing.
2. In 6 weeks, the patient will have 5/5 MMT strength in the B shoulder flexors, shoulder abductors, shoulder internal rotators, shoulder external rotators, and postural muscles, in order to maintain improvements in postural awareness and upper extremity stability with movements.
3. In 6 weeks, the patient will report pain level decreased from 6/10 to 0/10 in order to perform and teach ballet dancing multiple times per week without increased pain.
4. In 6 weeks, the patient will score 80/80 (100%) on the UEFS in order to perform recreational activities, driving, and upper extremity movements without increased pain.

These 4 goals were written for this patient because they were relevant to her interests, her duties as a teacher, and her quality of life. The patient reported that she was hopeful physical therapy treatment would help decrease her pain and allow her to perform movements and activities without increased pain. The patient also received a home exercise program (HEP), postural retraining, and electrical stimulation (E-stim) combined with a moist hot pack (MHP) to the cervical region after the examination was performed.

The patient's prognosis to return to her prior level of function and reach her long-term goals in 6 weeks was good as she was young and relatively active, and did not have additional comorbidities that would complicate the rehabilitation process. However, the patient's progress was limited due to the chronicity of her condition. The patient was also motivated to be compliant with therapy and was willing to perform exercises should they help decrease her pain. Due to these factors, the patient was given a time frame of 2 sessions per week for 6 weeks, in order to reach her goals, and to return to her prior level of function.

The treatment strategy focused on mobilizing and lengthening of the affected muscle groups to improve pain free cervical ROM, and improve UE and postural strength in order to maintain improved postural stability. The focus of the first phase of treatment was to improve pain free cervical ROM by initiating soft tissue mobilization (STM) and stretching. Another focus of the first phase was initiating neuromuscular re-education of the patient's postural muscles, which focused on activation of the axioscapular musculature (MT, LT, and rhomboids), as well as the DCF. In the literature, DCF training has been associated with positive outcomes for patients with chronic neck pain, as evidenced by Falla, *et al.* [19]. Axioscapular musculature has also been shown to display abnormal activation patterns in patients with neck pain, as evidence by Zakharpva-Luneva, *et al.* [6] in which training for improved scapular function was emphasized6. The focus of the second phase of treatment was placed more on increasing UE strengthening, and increasing the intensity of neuromuscular re-education activities.

The degree to which the patient was receiving STM was decreased during this period, and only given as needed, as increased pain free ROM was still a focus during this phase. UE closed-chain stability exercises were introduced in this phase, in which the patient required cues for proper form and position maintenance. The focus of the last phase of treatment was to increase the intensity of therapeutic exercises, and increase the intensity of control needed for upper quarter stability training. Throughout treatment, the patient was instructed to perform her HEP twice per day (2 sets), which included postural exercises and stretches. The patient was also educated on the importance of postural awareness and its effects on certain muscle groups during her treatment, and was encouraged to use better posture during her activities, and make postural adjustments as needed throughout the day.

The timeframe for this patient's treatment was set for 2 sessions a week for 6 weeks. This was due to the patient's prognosis, the patient's schedule, and the number of treatment sessions she was allowed by her insurance. The clinic staff were instructed to keep the patient on a single student physical therapist's schedule, and was mostly treated by a single provider for the duration of her treatment.

Implementation of Intervention/Re-assessment

The first week of treatment included the initial examination and a second treatment session. During this week of physical therapy, the patient started performing therapeutic exercises and initiated neuromuscular re-education activities while being supervised by the student physical therapist (Table 5). The focus of the first week was to decrease pain, increase cervical ROM, and increase strength in the UE and postural muscles. The patient received STM to her B LS, UT, cervical paraspinal muscles, and scalene muscles, with a suboccipital release (SOR) and ischemic compression for a trigger point in the R UT, in order to decrease adhesions in the aforementioned muscles and increase ROM. According to a study by Gauns and Gurudut, patients receiving myofascial release, a type of STM, had shown greater positive outcomes due to freed restrictions in movement, and improved health of soft tissue when pressure was applied to fascia [20]. Treating trigger points was also important for this stage of treatment because according to a study by Munoz-Munoz, *et al.* [4] the presence of trigger points was associated with increased pain and disability levels in patients with neck pain [4]. Afterwards, the patient received manual stretching to her B LS, UT, and scalene muscles, and initiated DCF activation training in supine with cues for decreased SCM activation, 5 seconds of sustained contraction, and proper force of contraction (Table 5).

Phase 1: Visits 1-4, Weeks 1 and 2	
Manual therapy: - STM to B LS, UT, cervical paraspinals, scalene muscles - R UT ischemic compression, SOR - Manual stretch to B LS, pectoralis minor **Neuromuscular Re-education:** - Scapular retraction/depression with facilitation - DCF training: 2 sets, 10 reps, 5 second holds, supine position **Therapeutic Activities:** - Y's and T's prone on table with cues for UE position, and facilitation for scapular retraction	**Therapeutic exercises:** - UBE: 5 minutes - Rows: red TheraBand (RTB), 2 sets, 10 reps - Shoulder extension: RTB, 2 sets, 10 reps - Shoulder ER: yellow TheraBand (YTB), 2 sets, 10 reps, progressed to RTB at 3rd visit - Shoulder IR: YTB, 2 sets, 10 reps, progressed to RTB at 3rd visit - Horizontal abduction 90°: RTB, 2 sets, 10 reps - Horizontal abduction 135°: RTB, 2 sets, 10 reps - B UT stretch: 2 sets, 30 seconds - Pectoralis doorway stretch: 2 sets, 30 seconds **Modalities:** - MHP and E-stim, 10 minutes
Phase 2: Visits 5-8, Weeks 3 and 4	
Manual therapy: - STM to B LS, UT, scalene muscles - L UT ischemic compression - Pin and stretch to B UT, LS, scalene muscles **Neuromuscular Re-education:** - DCF training: 2 sets, 10 reps, 10 second holds, seated position **Therapeutic Activities:** - Y's and T's: 2 sets, 10 reps, prone over SB with cues for UE position, and facilitation for scapular retraction	**Therapeutic exercises:** - UBE: 5 minutes - Rows: RTB, 2 sets, 10 reps, progressed to green TheraBand (GTB) at 7th visit, progressed to 3 sets at 8th visit - Shoulder extension: RTB, 2 sets, 10 reps, progressed to GTB at 7th visit, progressed to 3 sets at 8th visit - Shoulder ER: RTB, 2 sets, 10 reps - Shoulder IR: RTB, 2 sets, 10 reps - Horizontal abduction 90°: RTB, 2 sets, 10 reps, progressed to 3 sets at 8th visit - Horizontal abduction 135°: RTB, 2 sets, 10 reps, progressed to 3 sets at 8th visit - SA punches: 2 lbs., 2 sets, 10 reps - B UT stretch: 2 sets, 30 seconds - Pectoralis doorway stretch: 2 sets, 30 seconds - B LS stretch: 2 sets, 30 seconds - B Scalene stretch: 2 sets, 30 seconds **Modalities:** - MHP and E-stim, 10 minutes
Phase 3: Visits 9-12, Weeks 5 and 6	
Manual therapy: - L UT ischemic compression - Pin and stretch to B UT **Neuromuscular Re-education:** - Cervical Isometric holds: flexion, extension, B sidebending, 10 reps per direction, 5 second holds - DCF training: 3 sets, 10 reps, 10 second holds, seated position **Therapeutic Activities:** - Pushup plus: 2 sets, 10 reps, with cues for SA activation - Modified planks with arm raise: 2 sets, 30 seconds, cues for maintaining head, neck, and body position - Bosu planks: 2 sets, 30 seconds, cues for maintaining body position and stability with movement - Y's and T's: 2 sets, 10 reps, prone over SB with cues for UE position, and facilitation for scapular retraction - Planks: 2 sets, 30 seconds, cues for maintaining DCF contractions and proper form	**Therapeutic exercises:** - UBE: 5 minutes - Rows: GTB, 3 sets, 10 reps, progressed to blue TheraBand at 10th visit, progressed to black TheraBand at 12th visit - Shoulder extension: GTB, 3 sets, 10 reps, progressed to blue TheraBand at 10th visit, progressed to black TheraBand at 12th visit - Shoulder ER: progressed to GTB at 10th visit, 2 sets, 10 reps - Shoulder IR: progressed to GTB at 10th visit, 2 sets, 10 reps, progressed to black TheraBand at 12th visit - Horizontal abduction 90°: RTB, 3 sets, 10 reps, progressed to GTB at 10th visit - Horizontal abduction 135°: RTB, 3 sets, 10 reps, progressed to GTB at 10th visit - SA punches: 3 lbs., progressed to 3 sets at 10th visit, 10 reps - B UT stretch: 2 sets, 30 seconds - Pectoralis doorway stretch: 2 sets, 30 seconds - B LS stretch: 2 sets, 30 seconds **Modalities:** - MHP and E-stim, 10 minutes

Table 5: Interventions

According to a study by Bae, *et al.* [3] stretching exercises in combination with strengthening exercises has been shown to improve positive outcomes in patient with posture-related syndromes due to physiological changes of the involved tissues [3]. The importance of DCF training was due to their importance as postural muscles, as impaired performance of the DCF is associated with increased neck pain due to imbalance of activity between the DCF and superficial cervical flexors [5,21]. The patient then warmed up on the upper body ergometer (UBE) for 5 minutes at a pace that would not reproduce pain (Table 5). The patient was then instructed in performing therapeutic exercises with proper form and posture targeted to strengthen her rotator cuff (RTC) muscles, shoulder extensors, and scapular retractors (Table 5). For the last 10 minutes of treatment, the patient was given E-stim and a MHP to her cervical region in order to increase muscle lengthening with stretches, and manage pain (Table 5). According to a study by Gauns and Gurudut, use of a MHP and E-stim, in combination with stretching and strengthening exercises, was shown to improve outcomes in patients with neck pain due to relief from spasm and pain [20]. For all sessions, the student physical therapist would gather subjective information from the patient at the beginning of the session pertaining to current pain levels, what events or activities increased pain, and if she felt therapy was helping her symptoms.

The second week of therapy included all the interventions from the first week, along with an increased emphasis on activating and strengthening the MT and LT. The patient began performing resisted horizontal abduction at 90° and 135° of coronal abduction using a TheraBand (Table 5) in order to strengthen the MT and LT, respectively. Performing resisted horizontal abduction at these positions was shown to be important to emphasize the activities of the different areas of the trapezius [22]. The LT in particular was shown to have more isolated activity when placed in increased coronal abduction, emphasizing its role as an upward rotator, while maintaining the position of the scapula [22]. The patient also received tactile facilitation for scapular retraction while performing activation of the MT and LT against gravity (Table 5). Therapeutic exercises that were progressed included resisted shoulder IR and ER using a TheraBand, in which she progressed to using a band with increased resistance (Table 5).

For the third week of treatment, the patient received neuromuscular re-education with increased challenge to improve neuromuscular control; the patient was instructed to maintain DCF activation for 10 seconds per contraction, and performed MT and LT activation over a swiss ball (SB) with cues for UE position and scapular retraction while maintaining her position (Table 5). A therapeutic exercise requiring resisted serratus anterior (SA) activation was added, in which the patient used 2 lb. weights, in order to increase stability with scapulothoracic movements (Table 5). The patient was still receiving STM at this point in treatment for increased ROM and pain management, in which she reported she was sore after teaching ballet for 5 hours during the previous weekend. The patient reported her L UT became more symptomatic after that weekend, in which she received ischemic compression to the L UT, and stretches to the B LS, UT, and scalene muscles using the pin and stretch technique for an increased intensity of lengthening to a local area of tissue (Table 5). At this point in treatment, the patient reported she was performing her home exercises every day.

For the fourth week of treatment, the patient continued to progress toward meeting her long-term goals. The patient was able to progress in resistance and number of sets for certain therapeutic exercises, due to increased strength, and the patient reporting that the exercises had become easier throughout therapy sessions. Resisted rows and resisted shoulder extension were progressed by using a TheraBand with increased resistance (Table 5). The previously mentioned exercises, along with resisted horizontal abduction at 90° and 135° of coronal abduction, were progressed by increasing the number of sets by 1 (Table 5).

For the fifth week of treatment, more emphasis was placed on strengthening and stability training. The patient received less STM due to reporting decreased pain levels, and additionally reported that she did not wake up with pain that week. Along with DCF training in a seated position, the patient also performed cervical isometric exercises in flexion, extension, and B sidebending, with cues for direction of contraction, maintaining position, and 10 seconds of sustained contraction (Table 5). For therapeutic activities aimed at increasing upper quarter stability, the patient performed table pushups with cues for maintaining head and neck position with SA activation, and planks using a Bosu with cues for maintaining head and neck position while balancing using her UEs on an unstable surface (Table 5).

For the sixth and final week of treatment, a progress note was created, and the patient's interventions were progressed due in order to build increased upper quarter stability before discharge, as the patient reported she felt like she could manage her symptoms independently without additional therapy sessions. At this point in treatment, the patient was still performing therapeutic exercises, in which all had been progressed to higher resistances since the previous week of treatment using a TheraBand of an increased resistance (Table 5). The patient was also performing therapeutic activities from the previous week, which were made more challenging to increase neuromuscular control of her upper quarter movements (Table 5). Planks using a Bosu were progressed by having her roll a small ball in certain directions on the flat surface of the Bosu, while maintaining her head and neck position and preventing the ball from rolling off (Table 5). The patient also performed planks with cues for maintaining DCF contractions against gravity to maintain neck position (Table 5).

The patient reported her symptoms had improved by the end of her treatment, as she was not in pain despite a stressful weekend teaching ballet. The patient also reported she had been compliant in performing her HEP throughout treatment, and was given an updated HEP to continue independently after discharge. The updated HEP included the exercises and stretches from the previous HEP, in addition to modified planks with arm raises, prone MT and LT activation, and table pushups to maintain upper quarter stability.

Outcomes

The total length of treatment equated to 12 sessions in 6 weeks. On the 11th visit between the student physical therapist and the patient, a progress note was performed in which pain level, activity limitations, cervical ROM, and shoulder MMT strength were re-assessed (Tables 6, 7, 8, 9). The patient also filled out a second UEFS to compare with the values taken on the initial examination (Table 7). When assessing change in pain levels using the NPRS, the patient reported her pain decreased from 6/10 to 3/10 at its worst level, and from 2/10 to 1/10 at its best level. The minimal clinically important difference (MCID) for the NPRS is 1 point in patients with chronic musculoskeletal pain [9]. When assessing the UEFS, the patient did reach the minimal detectable change (MDC), which is 8.1 points [11], as her score improved by 10 points from 67/80 (83.75%) to 77/80 (96.25%). Although the patient had reported significant improvements since beginning treatment, she still had not reached her long-term goals for pain level, shoulder MMT strength, UEFS score, and cervical ROM, implicating the need for further intervention. However, the patient reported feeling confident that she could manage her symptoms independently without additional therapy sessions, and decided against continuing with therapy.

At Best: Initial Examination	2/10	At Best: Progress Note	1/10
At Worst: Initial Examination	6/10	At Worst: Progress note	3/10

Table 6: Pain Scale Comparison

	Total Score	Percentage
UEFS: Initial Examination	67/80	83.75%
UEFS: Progress Note	77/80	96.25%

Table 7: Upper Extremity Functional Scale

Initial Examination		Progress Note	
Flexion	30°; increased pain	**Flexion**	27°, decreased pain
Extension	40°	**Extension**	60°
R Rotation	45°; increased pain	**R Rotation**	40°, no pain
L Rotation	50°	**L Rotation**	37°
R Lateral Flexion	20°; increased pain	**R Lateral Flexion**	27°, no pain
L Lateral Flexion	20°; increased pain	**L Lateral Flexion**	20°, no pain

Table 8: Cervical Active Range of Motion

At Initial Examination	Right	Left	At Progress Note	Right	Left
Flexion	4-/5	4/5	Flexion	4/5	4/5
Abduction	4-/5	4/5	Abduction	4/5	4/5
Internal Rotation	4/5	4+/5	Internal Rotation	4+/5	4+/5
External Rotation	4-/5	4/5	External Rotation	4+/5	4+/5

Table 9: Shoulder Manual Muscle Test

Since the beginning of her physical therapy treatment, the patient reported her pain-free activity levels and participation levels had "improved by 85%". The patient reported that since starting therapy treatments, while she still had lingering pain, her pain did not "slow down her day" like it had previously. While the patient had previously reported activity limitations with moving objects to waist level and overhead, driving, and rotating her head, the patient stated these activities did not cause her pain, compared to the beginning of treatment. The patient reported having some pain with looking down and dancing, but reported that these activities were less painful compared to the beginning of treatment, and that she felt she was more aware of her posture while dancing. The patient's participation levels had also improved as she was able to teach ballet to younger students, even if teaching a particular class was "stressful", with less pain compared to the beginning of treatment, because she was able to move her neck and rotate backward without increased pain.

Discussion

The patient was a 19-year-old female with a chief complaint of increased upper back and neck pain, and decreased ability to dance and perform functional activities requiring neck and UE movements. Before treatment, the patient reported experiencing pain for 4 years, seeking the advice of her physician but getting minimal relief. After physical therapy treatment, the patient reported improvements in all three areas of the ICF Framework, stating an increased ability to perform and teach ballet, drive, turn her head, and lift objects overhead with decreased pain. Primary impairments for this patient initially included decreased strength of the B shoulder and postural musculature, decreased muscle length, and decreased cervical ROM. The main secondary impairment initially included increased pain in the neck and upper back. At the end of treatment, both primary and secondary impairments had improved as shown by an increase in B shoulder flexion, abduction, IR, and ER MMT strength (Table 9).

An increase in B shoulder strength allowed for increased stability with neck and UE movements, allowing the patient to improve and maintain her posture during her activities with decreased pain. An increase in cervical extension and R lateral flexion ROM was indicated using goniometric measurements (Table 8). While these were the only ROM measurements that were increased since the initial evaluation, the patient reported decreased pain or no pain with movements that were previously painful. Although the patient did not progress to reaching normal cervical ROM, she reported that the improvements in pain level with ROM allowed for her to make certain repetitive head, neck, and arm movements with decreased pain when teaching ballet. Compared to the start of treatment, the patient's pain levels at the best and worst had decreased, as demonstrated by the NPRS (Table 6). The patient also stated that the decreased pain with her movements allowed her to teach ballet classes more often due to decreased pain, even if her week had been stressful. The patient had previously reported that she noticed her symptoms would increase with stress; since stopping therapy, she has since reported improved management of her stress levels as to not let it affect her musculoskeletal symptoms. Additionally, the patient reported that she was no longer waking up in pain, and was able to perform her other activities with decreased pain. Both measurements for primary and secondary impairments were compared from the initial examination to the progress note taken at the 11th visit.

In the context of the ICF model, activity limitations and participation restrictions demonstrated how the patient's pain affected her ability to perform daily activities, or participate in her recreational activities. The activity limitations of this patient included an inability to look down, rotate her head, drive, lift objects to waist level or overhead, or dance without increased pain, which discouraged the patient from performing these activities. By the end of treatment, activity limitations and participation restrictions had improved for this patient as demonstrated with the UEFS (Table 7). The patient reported that her ability to participate in her hobbies and recreational activities, drive, and lift objects with decreased pain had improved, and that they had become less difficult to perform; the patient reported that even if she had a stressful week teaching ballet, she would not have increased pain such as before starting treatment. Although the patient was not fully returned to her prior level of function, the patient reported that she felt her condition had improved greatly with therapy sessions, and felt she was able to manage her care independently without additional sessions.

The purpose of this case was to examine how a multi-modal physical therapy treatment program was used to reduce chronic upper back and neck pain, and improve postural habits in a dancer, while improving all three areas of the ICF framework. The goal throughout this patient's physical therapy sessions and treatment interventions was to return her to her prior level of function. While the patient's long-term goals were not achieved, the patient achieved some short-term goals for reporting decreased pain and increased postural awareness; although her B shoulder musculature MMT strength did not completely meet the short-term goal, the patient's B IR and ER MMT strength had increased to 4+/5. The patient's impairments, pain, and disability improved in many areas, and is similar to the findings of a 2009 article on the treatment of neck pain [2]. In terms of DCF strengthening, the outcomes for this patient were similar according to a 2012 study, in which increased DCF activation in training was associated with decreased neck pain [19].

During the course of treatment, there were several limitations during the physical therapy treatments for this patient. The first limitation was that the patient was limited to 12 sessions of physical therapy due to her insurance. This limitation may have prevented the patient from returning to her prior level of function, especially since she reported having "lingering" pain and had not reached her long-term goals prior to the end of treatment. Another limitation was that the patient had been involved in a minor car accident between the first and second sessions, in which she reported her symptoms had gotten worse due to her muscles being tenser since the accident. This may have affected her initial progress due to her increased symptoms, due to increased stress, due to increased soreness with exercises, and due to increased tenderness upon mobilization of the affected tissues. Despite these limitations, the patient remained compliant with her HEP, and was given an updated HEP to continue after discontinuing therapy.

Alternative explanations for why this patient made the improvements she did could include improved tolerance to her pain. The patient reported her pain was still "lingering" at the end of treatment, despite increases in her activity and participation levels; this was possibly due to the chronicity of her symptoms, and treatment may have needed to be longer than 6 weeks in order to completely resolve her pain Although decreased pain was reported when cervical ROM was tested for the progress note, the values for flexion and B rotation had decreased since the initial evaluation (Table 8); the reason for reporting decreased pain with movements could have been due to the patient not actively moving into the previously recorded ROM, limiting the opportunity for pain. Excessive cervical ROM may have been causing pain, but she still had improved awareness to know where the limit was to avoid the painful areas of movement.

Areas of improvement for this case report included making interventions more pertinent and functional to the patient's interests, such as by including interventions geared toward ballet. These interventions could have included neuromuscular re-education geared toward maintaining improved postural control while performing her dance activities. While improvements were found in all three areas of the ICF model for this patient, the goal throughout treatment was to return her to her prior level of function, which was not achieved by the end of treatment. Although the patient reported her symptoms had improved greatly, she reported that she would still experience pain sometimes when performing ballet. Had the number of available sessions not been a limitation, more challenging activities targeting stability progression could have been implemented to further improve the patient's upper quarter stability. Although the patient was compliant with the HEP given to her after the initial evaluation, the HEP could have been updated with new exercises targeted towards upper quarter stability throughout the course of treatment, maximizing the potential for positive outcomes.

The clinical relevance of this case report is that it supports the usage of a multi-modal physical therapy treatment program to treat chronic posture-related upper back and neck pain. Another aspect of the clinical relevance is that it supports the strengthening of key muscle groups implicated in neck pain. Treatment for posture-related pain, including patient education in integrating improved posture into everyday activities, and postural muscle strengthening, has been shown to be more effective for creating positive outcomes in patients with neck pain, compared to the patient attempting to current their posture without prior instruction, due to increased activation of the key cervical muscles involved [2].

Future physical therapy research should include more on axioscapular muscular strengthening concerning the treatment of postural-related upper back and neck pain. Aberrant movements of the axioscapular muscles have been implicated in patients with neck pain, especially if they also report pain with activities involving use of the upper extremities2. Future physical therapy research should also include more on the prevalence of upper back and neck pain in dancers, especially studies that are not single case reports, in order to better apply findings to patient care. Another area of potential research should include the normal cervical ROM found in patients of disciplines requiring increased mobility, such as dancers or gymnasts, and the potential conditions associated with requiring increased mobility. With all of these topics, future research should focus on methods of physical therapy intervention aimed at treating upper back and neck pain in patients who require increased ROM for their disciplines.

Neck pain is a common condition that affects a variable but large number of individuals at some point in their lives. Due to alterations in the neuromuscular activation patterns throughout an individual's lifespan, neck pain has the increased potential for chronicity and reoccurrence throughout an individual's lifetime [19]. By increasing the strength in weakened postural muscle groups, and reducing adhesions while stretching muscles that have become tight due to poor posture, neck and upper back pain can be treated with physical therapy, allowing for increased quality of life for affected patients.

Conclusion

This case report illustrates a multi-modal program of physical therapy treatment for a 19-year-old female patient with symptoms of chronic neck and upper back pain. Muscle length impairments and pain from trigger points in the cervical and scapular regions were identified and addressed using a combination of soft tissue mobilization, modalities, and stretching. Strength imbalances identified in the cervical and axioscapular musculature were addressed using therapeutic exercise, therapeutic activity, and neuromuscular re-education. Throughout the course of 6 weeks, the patient demonstrated improved neuromuscular control, and reported increased postural awareness. Improvements in these variables correlated with decreased intensity of the patient's pain over the course of treatment, allowing the patient to better participate in the activities she enjoys.

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