Journal of Carcinogenesis
Covering Genesis to Therapeutics

Journal of Carcinogenesis, ISSN: 1477-3163
2025; Vol 24: Issue 6s, https://carcinogenesis.com/

Effect Of Proprioceptive Neuromuscular Facilitation (PNF) And Sub occipital Muscle Inhibition Technique (SMIT) On Neck Pain And Disability In Head And Neck Cancer Patients-A Randomized Control Trail

Aditi Ashok Somade[1*] Trupti S. Yadav[2]

[1*]Aditi Ashok Somade, MPTh in Oncology, Department of Oncologic Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth Karad

[2]Trupti S. Yadav, Associated Professor, HOD, Department of Oncologic Physiotherapy, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth Karad

ABSTRACT

Introduction- Head and neck cancer (H&N) is the 6th most common type of cancer, representing about 6% of all cases, accounting for an estimated 65,000 new cancer cases and 3,50,0000 cancer deaths worldwide every year. Received medical treatment like surgery, radiotherapy, and chemotherapy. Radiation induced neck pain and disability is common problem for H&N Cancer and experience functional limitation. Radiation can cause stiffening of neck tissues & reduced mobility. This can result in the formation of scar tissue in the neck region, leading to reduced flexibility and increased tightness.

Aim- To study the effect of proprioceptive neuromuscular facilitation and sub occipital muscle inhibition technique on neck pain and disability in head and neck cancer patients.

Method – Total of 106 participants were eligible as per inclusion criteria. Participants were randomly assigned into 2 groups. Experimental Group A (n=53) received proprioceptive neuromuscular facilitation and sub occipital muscle inhibition technique and Control Group B (n=53) received conventional treatment. Will undergo a 3 week of intervention. Pre and post numerical pain rating scale, cervical goniometer & inclinometer for range of motion and neck disability index were assessed.

Result - Both groups significantly effective to improved neck range of motion as well as to reduced neck pain but Experimental group A are more significantly improved range & reduced neck pain and Also improve quality of life ($p<0.0001$).

Conclusion- In this study Proprioceptive Neuromuscular Facilitation and Sub occipital Muscle Inhibition Technique are more effective on neck pain, range of motion and disability during radiotherapy.

Keywords: *Head and neck cancer, Physiotherapy, Proprioceptive Neuromuscular Facilitation, Sub Occipital Muscle Inhibition Technique, neck pain & disability, Cervical ROM*

How to Cite: Aditi Ashok Somade, Trupti S. Yadav., (2025) Effect Of Proprioceptive Neuromuscular Facilitation (PNF) And Sub occipital Muscle Inhibition Technique (SMIT) On Neck Pain And Disability In Head And Neck Cancer Patients-A Randomized Control Trail, *Journal of Carcinogenesis*, *Vol.24, No.6s*, 468-474.

1. INTRODUCTION

In recent years, there has been a notable shift in the medical field towards addressing a range of non-communicable diseases, often referred to as modern epidemics. Among these, cancer stands out as the second most common cause of mortality in advanced international countries. In developing nations, cancer ranks among the top ten leading causes of death. Cancer, characterized by abnormal and uncontrolled cell growth that infiltrates and damages nearby tissues, presents a significant health challenge globally. Early signs of oral cancer often manifest as peculiar and unexplained growths in the mouth, signaling the need for prompt attention and diagnosis. Oral squamous cell carcinoma, the most prevalent form of oral cancer, can be identified even in its preclinical stage, highlighting the importance of early detection.

Recent research on the prevalence and mortality rates of oral cavity cancer reveals staggering numbers, with a worldwide total of 300,373 cases reported. India shoulders a significant portion of this burden, contributing over one-third of the total cases. Furthermore, the second- highest number of oral cancer cases is found in another country, underscoring the substantial impact of this disease, which accounts for 50%–70% of total cancer mortality and exhibits the highest incidence among Asian countries.

Cancers affecting the head and neck region, including the nasal cavity, sinuses, pharynx, larynx, and oral cavity, present unique challenges. Head and neck cancers represent a significant health burden globally, affecting various structures including the oral cavity, pharynx, larynx, and adjacent regions. Radiotherapy plays a crucial role in the treatment of head and neck cancer patients, serving as a primary or adjunctive modality to surgery and chemotherapy. While radiotherapy is effective in targeting cancer cells, it can also lead to adverse effects, including neck pain and disability, which can significantly impact patient's quality of life and functional outcomes.

The neck serves as a vital anatomical region housing essential structures such as the cervical spine, muscles, nerves, and blood vessels. The complex interplay of these structures makes the neck susceptible to radiation-induced damage, leading to various manifestations of neck pain and functional impairment. Understanding the mechanisms underlying radiotherapy-induced neck pain and disability is crucial for optimizing treatment strategies and improving patient outcomes.

aims to provide an in-depth analysis of the impact of radiotherapy on neck pain and disability in head and neck cancer patients.

Intervention Procedure: The patients were instructed to sit on the chair with their feet placed shoulder width apart and place their hands on the knees to start with the intervention.

a) **Neck Flexion PNF Pattern:** The therapist stood behind the patient on the right side and placed the tip of her right finger below the patient's chin. Then the therapist placed her left hand on top of the patient's head slightly on the left side in a diagonal direction. The therapist slightly pulled the chin so that it was lifted and causing the neck to extend. Commands such as "pull your chin in" and "look at your left hip" were given to the patient. Resistance was given against left rotation, flexion and lateral flexion along with the traction to the patient's chin

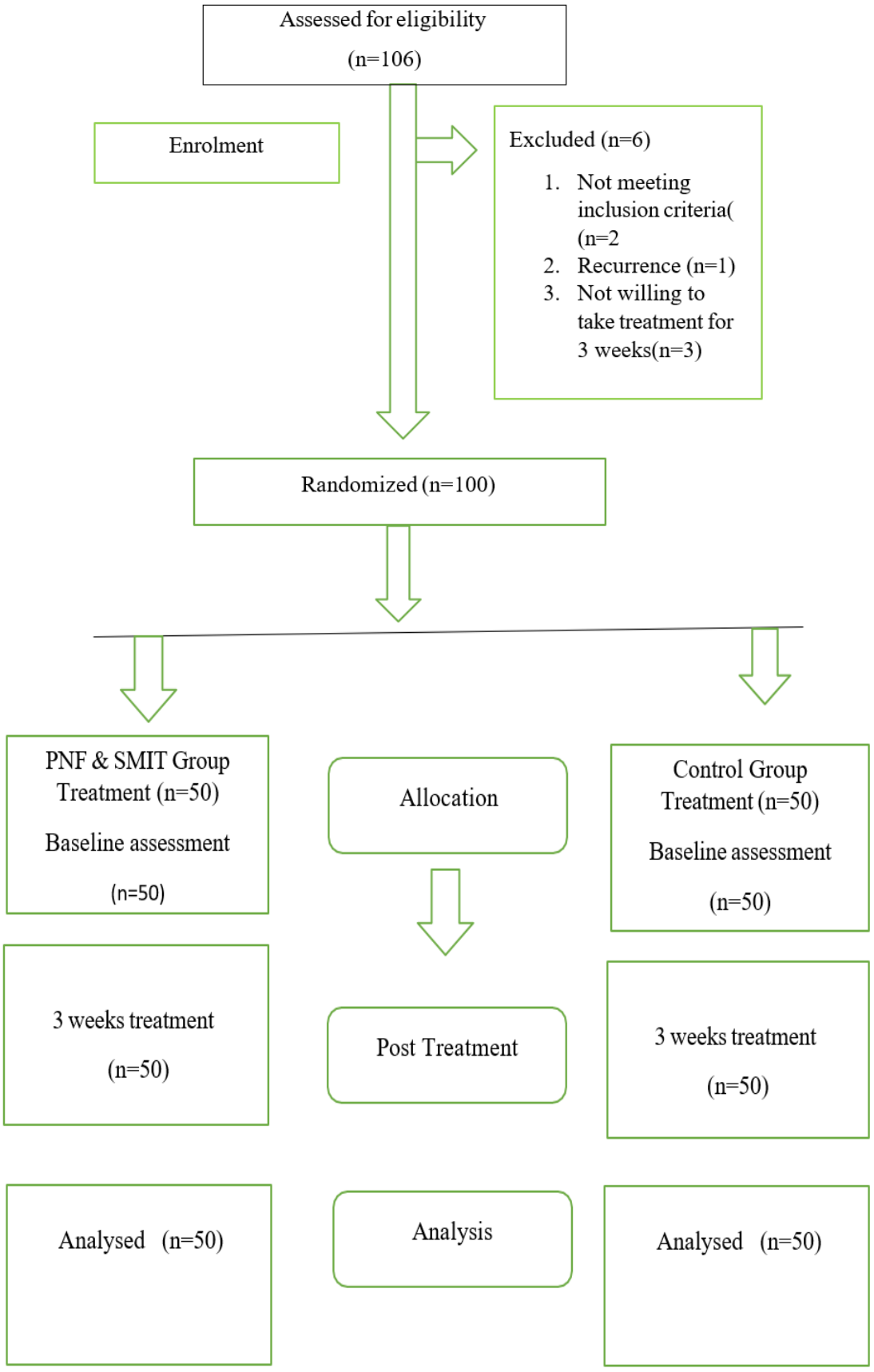
b) Neck Extension PNF Pattern: The therapist stood behind the patient on the right side and placed her right thumb on the right side of the patient's chin. Then the therapist placed her left hand on top of the patient's head slightly on the right side in a diagonal direction. The therapist slightly pulled the chin so that the neck was flexed, head was rotated and tilted to the left. Commands such as "lift your chin and then "lift your head to look above were given to the patient. Passive resistance was provided against right rotation, extension and lateral flexion

Dosage of Exercises: Each of the above mentioned PNF patterns were performed 10 times of 3 sets once a day, approximately 30 mins for a duration of 3 week & SMIT 30 min for 3 week during their treatment.

Outcome Measures: Numerical pain rating scale, Neck disabilities like neck pain with the associated restriction of ADLs were measured using Neck Disability Index (NDI) Cervical range of motion was measured using the inclinometer.

2. MATERIALS AND METHODS:

After receiving approval from the institutional ethical committee, this study was carried out in Oncologic Department Krishna college of Physiotherapy, KVV, Karad. A total of 106 head and neck cancer radiotherapy receiving patients of both genders with the age of 18-70 years were randomly allocated into two groups by simple random sampling method using computer- generated SPSS software (IBM Corp, Armonk, New York, USA). As per inclusion and exclusion criteria, cancer survivors with numerical pain rating scale is 5-10 and neck disability index as well as cervical range of motion affected included in the study. Patients with any trauma, infection, and fracture were excluded. The study protocol was explained to all the patients in their vernacular language (English, Marathi.). A brief demographic data was noted prior to the initiation of the intervention.



3. RESULT:

Table 1: Distribution of types of head and neck cancer patients in the study.

Types of Head and Neck cancers	Number of patients	% of Distribution
1. Ca. Buccal Mucosa	48	45.28%
2. Ca. Esophagus	22	20.75%
3. Ca. Larynx	18	16.98%
4. Ca. post cricoid	9	8.4%
5. Ca. Tongue	6	5.6%
6. Ca. Pharynx	3	2.83%

Table 2: Comparison Both Groups of pretest & posttest scores of Numerical Pain Rating Scale (NPRS) of all patients in the study.

NPRS Outcome Measure	Test	Mean and SD	P value
Experimental Group A	Pre Test	6.553±1.295	<0.001
	Post test	2.100±1.502	<0.001
Control Group B	Pre Test	6.242±1.354	<0.001
	Post test	5.798±1.257	<0.001

Table 3: Comparison Both Groups of pretest & posttest scores of Neck Disability Index (NDI) of all patients in the study.

NDI Outcome Measure	Test	Mean and SD	P value
Experimental Group A	Pre Test	24.736±3.071	< 0.001
	Post test	6.849±4.651	< 0.001
Control Group B	Pre Test	43.88±6.759	< 0.001
	Post test	28.24±7.358	< 0.001

Table 4: Comparison Both Groups of posttest scores of Cervical Range of Motion (ROM in degrees) of all patients in the study.

Cervical ROM Post	Experimental Group A (Meanand SD)	Control Group B (Mean and SD)	P value
Cervical Flexion	81.67±7.753	70.67±12.11	< 0.001
Cervical Extension	61.17±7.125	23.39±7.61	< 0.001
Right cervical Rotation	82.43±6.375	18.77±5.49	< 0.001
Left cervical Rotation	82.18±5.828	23.28±4.95	< 0.001
Right Cervical Side flexion	41.03±2.653	27.66±5.18	< 0.001
Left Cervical Side flexion	42.34±2.353	26.26±4.55	< 0.001

4. DISCUSSION:

The purpose of this research is to evaluate the effects Proprioceptive Neuromuscular Facilitation (PNF) with sub occipital muscle inhibition techniques (SMIT) on cervical discomfort, neck impairment, cervical range of motion (ROM), and overall quality of life. These elements have a vital role in improving the quality of life and functional ability of patients with head and neck cancer receiving radiation therapy. Because of the tissue damage and inflammation caused by radiation therapy, patients often have substantial cervical discomfort that significantly interferes with their everyday activities.

The purpose of this research is to reduce cervical discomfort in order to enhance patient comfort and allow them to continue receiving radiation therapy without unnecessary suffering or interruption. Based on the sample size formula, 106 patients with head and neck cancer those were receiving radiation therapy, age group between18-70 is selected for this study there are multiple risk factors that are frequent in this age group, such as alcohol and tobacco use, which are common in both young and older patients. The participants were split into two groups- Group A (Experimental) received PNF and SMIT techniques, whereas Group B (Control) received isometric exercise, The similar patient distribution in both groups improves the validity and dependability of the study's conclusions.

According to this study research, the age categories of 18–35 and 36–53 had the highest prevalence of head and neck cancer. Furthermore, 81% of participants were men and 19% were women, indicating that men are more prone than women to get head and neck cancer. This is probably because of males are more habitual to smoke, drink alcohol, and chew tobacco.

According to our research findings, buccal mucosa cancer is most common types in head and neck cancer. This incidence is connected to lower socioeconomic position, which raises the risk of buccal mucosa cancer by being linked to poor food, increased tobacco use, and restricted access to healthcare. Furthermore, a key contributing cause to India's high prevalence of oral buccal cancer is the country's extensive usage of gutkha and betel quid (with or without tobacco), both of which considerably increase the chance of developing oral sub mucous fibrosis. Neck discomfort and impairment are common side effects for these people following surgery and radiation treatment. Radiotherapy is common treatment in this patients. A common side effect of radiotherapy, is radiation-induced fibrosis, which can cause stiffness, muscular tightness, and discomfort in the neck and cervical region.

Eighty percent of patients report pain, which is treated with NSAIDs, opioids, and steroids as part of a pharmaceutical regimen. Physical therapy is another treatment option for mobility limits in the neck, jaw, and shoulder. It includes manual therapy, exercise regimens, and electrotherapeutic techniques. Reduced shoulder strength and mobility as a result of loss of motor innervation to the sternocleidomastoid and trapezius muscles reduces cervical range of motion.

Participants in this research were chosen according to predetermined inclusion and exclusion criteria's. For three weeks, both techniques were given for thirty minutes session each, three times a week. The Numeric Pain Rating Scale (NPRS), cervical range of motion (ROM) using a Inclinometer, and the Neck Disability Index were used to quantify neck pain and impairment both before and after the intervention.

PNF techniques such as Contract-Relax (CR) and Hold-Relax (HR) specifically target muscle tightness and shortness by incorporating isometric contractions followed by passive stretching. This method helps in lengthening the muscles, thus increasing flexibility and improving overall ROM. The muscle contractions generate tension, which when followed by a stretch, helps in reducing muscle stiffness and extending the muscle fibres. Stronger muscles support better joint stability and control, which can alleviate pain and prevent further injury and dysfunction. This Techniques agonist and antagonist muscles, promoting Neuromuscular Re- education by practicing this specific movement patterns and alternating contractions, PNF enhances the communication between nerves and muscles, leading to improved motor control. On Pain Reduction By addressing the underlying muscular and neuromuscular issues, also PNF helps in reducing pain associated with neck stiffness and immobility. Stretching and muscle activation can reduce muscle spasms and discomfort.

Neuromuscular control prevents abnormal movement patterns that can cause pain. Increasing Joint Mobility PNF techniques enhance the mobility of the cervical joints by increasing the range through which the muscles and joints can move. This is particularly beneficial in conditions like radiation-induced fibrosis where joint stiffness is common. The combination of muscle contraction and stretching not only affects the muscles but also the connective tissues and joint capsules, contributing to greater overall joint mobility and Functional Improvement, PNF is improved ROM and muscle function into better performance of daily activities. By improving neck mobility and reducing pain, patients can perform tasks more effectively and comfortably.

Sub-occipital muscle inhibition technique is a manual therapy approach used to alleviate cervical pain, particularly pain originating from the sub-occipital region. These muscles, located at the base of the skull, play a crucial role in head and neck movements. Tension or dysfunction in these muscles can contribute to headaches, neck pain, and restricted cervical mobility. The inhibition release technique aims to relax these muscles, reduce pain, and improve cervical range of motion (ROM). Gentle pressure and stretching of the sub- occipital muscles stimulate mechanoreceptors and proprioceptors. Decreased pain perception and an increase in the sense of muscle relaxation and comfort.

Facial Release Technique Sustained pressure can also affect the facial tissue surrounding the sub-occipital muscles Fascia can become tight and restricted, contributing to pain and limited mobility. The inhibition technique helps release facial adhesions and restore normal tissue mobility. Enhanced mobility of the neck and reduced Myofascial pain. Sub- Occipital Muscle Inhibition Technique Improvement in Cervical ROM and Relaxed sub- occipital muscles allow for greater neck mobility, making it easier to perform daily activities without pain or restriction. Decreased Neck Pain The technique alleviates pain by addressing muscle tension and improving neural and vascular function in the cervical region improvements in pain levels, neck pain frequency, and cervical ROM, leading to enhanced daily function and quality of life.

The deeper neck flexors and extensors, which are frequently atrophied in individuals with persistent neck pain, are less effectively treated with isometric exercises, which mainly target the superficial neck muscles. As opposed to PNF and SMIT approaches, which incorporate dynamic motions and muscular contractions that enhance muscle coordination and promote proprioception, isometric exercises do not offer the same degree of proprioceptive feedback.

Also Isometric exercises do not address the range of motion limitations that are common in patients with chronic neck pain. PNF techniques and SMIT involve dynamic movements that improve range of motion and reduce stiffness. Isometric

exercises can lead to muscle fatigue and tension, which can exacerbate pain and stiffness.in PNF and SMIT techniques, involve muscle relaxation and lengthening contractions that help reduce muscle tension and improve overall muscle functions.

Contract relax and antagonist contract relax method is increase muscle strength, maintain rom, reduced pain, and also improve flexibility; similar findings observed in our study that PNF contract, and hold relax method is improve all functions, according to KAYLA B. HINDLE. PNF is beneficial for ROM & Muscular functions because of antogenic inhibition, reciprocal inhibition, stress relaxation, and pain gate theory enhance ROM.

According to SONALI RAJOPADHYE conducted study, PNF is target all cervical muscles groups & improving ROM and reduced pain with improve flexibility because of elongation of shortened muscle fibres and reduction in neck pain.in head and neck cancer during radiotherapy causes shortened muscle fibres so PNF is elongation this muscle fibres.

Hold relax method of PNF isometric and isotonic contraction that is increase rom and reduced neck dysfunction; similar findings seen in our study; PNF is reduced pain as well as improve Cervical ROM and dysfunction chances are reduced. MADE HENDRA SATRIA NUGRAHA state that PNF are neurophysiological principles such as sensory motor system evaluate treat neuromuscular problems and structural dysfunction.

According to a study by ROBINA MALIK, SMIT reduces muscle tension in the deep superior neck muscles, releases fascia bilaterally in the sub occipital area, improves neck muscle relaxation, breaks adhesions in the neck muscles, and improves motor control in patients with neck pain. Similar results were seen in our investigation, which showed that SMIT improved neck discomfort and decreased pain.

There was a significant mean difference in pain reduction for Experimental Group A< 0.0001, as evidenced by significant changes in NPRS, cervical ROM, and NDI following the intervention. This shows that the increased cervical ranges, decreased risk of impairment, and decreased cervical pain are all achieved by the intervention. Furthermore, patients in the PNF & SMIT group experienced a greater degree of pain relief and significant improvements in activities of daily living, such as sleeping, lifting, reading, taking care of oneself, working, and maintaining proper posture. A reduction in both the frequency and intensity of pain accompanied each of these improvements. All cervical ranges showed improvements, with Group A demonstrating highly substantial increases in both flexion and extension (p-value < the significance level).

5. CONCLUSION:

The study results indicate that the treatment involving Proprioceptive Neuromuscular Facilitation (PNF) techniques and Sub occipital Muscle Inhibition (SMIT) provided to Experimental Group A was significantly more effective in reducing pain, increasing cervical range of motion, and decreasing disability, compared to the performed by Control Group B.

REFERENCES:

[1] Negi P, Pruthi HS, Srivastava H. Cancer Epidemiology in Radiation Oncology: An Institutional Experience from North India During 2016-2022. Epidemiology and Health System Journal. 2023 Jun 17; 10(2):83-8.

[2] Iliescu MG, Stanciu LE, Uzun AB, Cristea AE, Motoască I, Irsay L, Iliescu DM, Vari T, Ciubean AD, Caraban BM, Ciufu N. Assessment of Integrative Therapeutic Methods for Improving the Quality of Life and Functioning in Cancer Patients—A Systematic Review. Journal of Clinical Medicine. 2024 Feb 20; 13(5):1190.

[3] Taylor JC, Terrell JE, Ronis DL, Fowler KE, Bishop C, Lambert MT, Myers LL, Duffy SA. Disability in patients with head and neck cancer. Archives of Otolaryngology–Head & Neck Surgery. 2004 Jun 1; 130 (6):764-9.

[4] Olivo SA, Fuentes J, Major PW, Warren S, Thie NM, Magee DJ. The association between neck disability and jaw disability. Journal of oral rehabilitation. 2010 Sep;37(9):670-9.

[5] Silveira A, Gadotti IC, Armijo-Olivo S, Biasotto-Gonzalez DA, Magee D. Jaw dysfunction is associated with neck disability and muscle tenderness in subjects with and without chronic temporomandibular disorders. BioMed research international. 2015 Apr; 2015.

[6] Sung YH. Suboccipital muscles, forward head posture, and cervicogenic dizziness. Medicina. 2022 Dec 5;58 (12):1791.

[7] Yip CH, Chiu TT, Poon AT. The relationship between head posture and severity and disability of patients with neck pain. Manual therapy. 2008 Apr 1; 13 (2):148-54.

[8] De Cássia Libardoni T, Armijo-Olivo S, Bevilaqua- Grossi D, de Oliveira AS. Relationship between intensity of neck pain and disability and shoulder pain and disability in individuals with subacromial impingement symptoms: A cross-sectional study. Journal of Manipulative and Physiological Therapeutics. 2020 Sep 1; 43 (7):691-9.

[9] Ramia P, Bodgi L, Mahmoud D, Mohammad MA, Youssef B, Kopek N, Al-Shamsi H, Dagher M, Abu-Gheida I. Radiation-induced fibrosis in patients with head and neck cancer: a review of pathogenesis and clinical outcomes.

Clinical Medicine Insights: Oncology. 2022 Jan; 16:11795549211036898.
[10] da Costa DR, de Lima Ferreira AP, Pereira TA, Porporatti AL, Conti PC, Costa YM, Bonjardim LR. Neck disability is associated with masticatory myofascial pain and regional muscle sensitivity. Archives of oral biology. 2015 May 1;60(5):745-52.
[11] Bijur PE, Friedman BW, Irizarry E, Chang AK, Gallagher EJ. A randomized trial comparing the efficacy of five oral analgesics for treatment of acute musculoskeletal extremity pain in the emergency department. Annals of emergency medicine. 2021 Mar 1;77(3):345-56.
[12] Akman TC, Duray M, Dengız A, Korkmaz NC. Issue Archive.
[13] Alzamil AA, Tabassum Saher DN. Role of Physiotherapy in Management of Cancer Related Pain and Fatigue During Palliative Care-A Review.
[14] Lee JH, Park SJ, Na SS. The effect of proprioceptive neuromuscular facilitation therapy on pain and function. Journal of physical therapy science. 2013 Jun 25;25 (6):713-6.
[15] Jamal A. Physiotherapists' and mothers' lived experiences of family-centred care for children with physical disabilities in Saudi Arabia: An interpretative phenomenological analysis (Doctoral dissertation, Cardiff University).
[16] Hassan SS, Ameen FH, Draz AH, Raouf NA. Effect of two different manual therapy techniques for treatment of forward head posture: A comparative study. SPORT TK- Revista Euro Americana de Ciencias del Deporte. 2023 Dec 31; 12: 19-.
[17] Mendes-Fernandes T, Puente-González AS, Márquez-Vera MA, Vila-Chã C, Méndez- Sánchez R. Effects of global postural reeducation versus specific therapeutic neck exercises on pain, disability, postural control, and neuromuscular efficiency in women with chronic nonspecific neck pain: study protocol for a randomized, parallel, clinical trial. International Journal of Environmental Research and Public Health. 2021 Oct 12; AD18 (20):10704.
[18] Parab A, Pattanshetty R. Effect of Myofascial release versus muscle energy technique on trapezius spasm in head and neck cancer patients: A randomized clinical trial. Indian J Phys Ther Res 2019;1: 114-20.
[19] Felser S, Behrens M, Liese J, Strueder D, Rhode K, Junghanss C, et al. Feasibility and effects of a supervised exercise program suitable for independent training at home on physical function and quality of life in head and neck cancer patients: A pilot study. Integr Cancer Ther 2020;19:1-12.
[20] Krisciunas G, Golan H, Marinko L, Pearson W, Jalisi S, Langmore S. A novel manual therapy programme during radiation therapy for head and neck cancer-our clinical experience with five patients. Clin Otolaryngol 2016;41: 425-31.
[21] Gugliotti M. The use of mobilization, muscle energy technique, and soft tissue mobilization following a modified radical neck dissection of a patient with head and neck cancer. Rehabil Oncol 2011; 29: 3-8.
[22] Carter B. Physical Therapy Treatment for a Patient with Complex Rehabilitation Needs During and after Chemo radiation for Head and Neck Cancer (Doctoral Dissertation, Florida Gulf Coast University); 2015. p. 1-35.
[23] Kawczyński P, Pyszora A, Krajnik M. Are soft tissue therapies beneficial for patients
[24] diagnosed with head and neck cancer Palliat Med Pract 2019;12:203-6