EFFECTIVENESS OF BODY POSITION ON PAIN, DYSPHAGIA, TEMPOROMANDIBULAR JOINT (TMJ) MOBILITY AND NECK MOBILITY IN POST RADICAL NECK DISSECTION PATIENTS.

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KEYWORDS

Post-radical neck dissection, Targeted body position, Temporomandibular joint dysfunction.

ABSTRACT

: Anatomic and functional disorders after surgical resection of various head-and-neck cancers have been well documented. Postoperative complications are observed to be caused by decreased swallowing efficiency and temporomandibular joint and cervical joint mobility[1,2]. Dysphagia and related post-operative complication lead to malnutrition, reduces the quality of life, and cause postural malalignment[2]. As per the study, alteration of tongue and swallowing muscle properties are associated with different body positions[1]. The effect of body posturing on pain, dysphagia, temporomandibular joint (TMJ) mobility, and neck mobility in post-radical neck dissection patients is unclear.

Aim and Methodology: This study aims to investigate the effectiveness of body position on pain, dysphagia, temporomandibular joint (TMJ) mobility, and neck mobility in post-radical neck dissection patients. The study design was a randomized controlled trial, and the sample size was 40 post-radical neck dissection patients. The intervention group received physiotherapy treatment that included Swallowing exercises with targeted body position, while the control group received standard care containing swallowing exercises alone. The outcome measures was pain, dysphagia, TMJ mobility, and neck mobility, which was assessed using validated scales and measurements. Data was analysed using descriptive statistics and inferential statistics, including t-tests and ANOVA.

Results: The study reviewed 40 subjects with head and neck cancer. These included radical neck dissection at surgical levels, II to VII as per inclusion criteria and were assigned into two groups, Scores were lower when swallowing exercises were given without body positioning, and scores were improved when swallowing exercises were given with body positioning ($P < 0.0001$).

The results of this study provide valuable information on the effectiveness of physiotherapy treatment in improving pain, dysphagia, TMJ mobility, and neck mobility in post-radical neck dissection patients when the two groups were compared ($P<0.05$).

Conclusion: The present study concludes that swallowing exercises along with Targeted Body Position was beneficial for reducing post operative pain and improving swallowing ability, Temporomandibular joint, and cervical joint mobility in post-radical neck dissection patients.

INTRODUCTION: Radical neck dissection is a surgical procedure performed for the control of metastatic neck disease in patients with squamous cell carcinomas of the upper aerodigestive tract[1]. Surgery is done to remove of lymph nodes and other structures in the neck[2]. There are three types of neck dissection that vary by the structures removed, which are radical neck dissection, modified radical neck dissection, and selective neck dissection[2,3]. Radical neck dissection is a standard method that refers to removing all ipsilateral levels I-V along with the Sternocleidomastoid (SCM), internal jugular vein (IJV), and Cranial Nerve XI (accessory nerve) , as well as the submandibular gland[4]. In modified radical neck dissection, levels I-V are removed but at least one non-lymphatic structure (SCM, IJV, or CN XI) is spared[2,3]. In radical neck dissection levels II to VII, The Long thoracic nerve is at risk during procedures in the thoracic region. Post-radical neck dissection patients often experience pain, dysphagia, temporomandibular joint (TMJ) dysfunction, and neck mobility issues[3,4], it can persist for 1 to 2 months after surgery[2,3,4].

The postural disturbance after the surgery is basically caused by either mechanical obstruction or neuromuscular motility dysfunction[5]. longer cervical immobilization was associated with the severity of dysphagia.[5] here the study focused on the body restoring positioning.

The tongue has autocrine and paracrine mechanisms of action, through which it is intact with the whole body, as per the studies tongue tone and posture may affect lower muscles strength and posture[4,6,8.]

Early mobilization and stress reliving positions are effective to reduce the pain intensity as well as neck dissection syndrome.[7,11]

The position of the TMJ is important, and the standard position of the TMJ is with the tongue resting on the hard palate and the proximity of the teeth[6,8]. TMJ disorder causes pain and discomfort, which is characterized by craniofacial pain involving the joint, and masticatory muscle[1,4]. TMJ affects the spine, causing irregular blood pressure and deterioration of digestive function can cause gastroesophageal reflux disease (GERD) symptoms is a condition in which the stomach contents leak backward from the stomach into the esophagus and distorts muscle movement of the cervical, thoracic, and lumbar spine which indirectly affects balance[9]. As per the studies, backward shifted bite causes the forward and tilted head posture, causing a forward head posture and headache[7,10]. TMJ and cervical post-operative immobility cause body posture changes leading to musculoskeletal stress. These symptoms can significantly impact the quality of life of these patients and can make it difficult for them to perform daily activities[10,11]. Therefore, it is important to investigate the effectiveness of body position on pain, dysphagia, TMJ mobility, and neck mobility in post-radical neck dissection patients to develop effective rehabilitation strategies and improve outcomes for these patients. There are limited studies that have examined the effects of body position on pain, dysphagia, TMJ mobility, and neck mobility in post-oral tumour patients. This experimental study aims to fill this gap and provide preliminary evidence on the effectiveness of body position as a non-pharmacological intervention. Reclining position has an indirect effect on neck and TMJ mobility[10,11]. Also, it can aid oral transit and reduce pain in patients after surgery on oral tumors,[10,12].

Previous studies have investigated the effectiveness of physiotherapy and manual therapy programs that focus on TMJ and cervical spine mobility in reducing pain and improving the range of motion in patients with TMJ dysfunction[7,13]. Patient-specific mobility therapy programs have been found to be effective in restoring range of motion and overcoming functional limitations of the TMJ, neck, and shoulder in post-submandibular gland tumour surgery patients[13,14]. Additionally, a direct relationship exists between the movements of TMJ and cervical spine and posture, and balancing TMJs through exercise corrects dysfunctions and changes the position of the centre of gravity, which has effects on the mobility of the spine and the stability of the limbs[13,15]. Proper patient positioning during surgery and rehabilitation can impact outcomes, with the care necessary to ensure that the head is supported to prevent neck

injury[15,16]. Radical neck dissection surgery can cause major structural changes, leading to a limited range of motion[2,3,7]. Therefore, effective rehabilitation strategies are necessary to improve pain, dysphagia, TMJ mobility, and neck mobility in post-radical neck dissection patients. As per the WHO, the rehabilitation intervention for a patient with chronic disease should be cost-effective, evidence-based and encourage patient empowerment.

METHODS AND METHODOLOGY (Participants, outcome measure and rating):

The study investigates the effectiveness of body position on pain, dysphagia, TMJ mobility, and neck mobility in post-radical neck dissection patients. After the institutional Ethical Clearance, the screening for Inclusion and Exclusion criteria was done.

Table:1- Inclusion and exclusion criteria

INCLUSION CRITERIA	EXCLUSION CRITERIA
1. Patients underwent for radical neck dissection for oral tumor.	1. Individuals with any history of recent fracture (nasal bone fracture, maxillary, or mandible).
2. Patients who can follow instructions and participate in the study.	2. Patients who have undergone surgery for a tumor other than radical neck dissection.
3. Patients who do not have any other medical conditions such as rheumatoid arthritis or any neurological disorder, that may affect the outcome of the study.	3. Patients who are not able to follow instructions or participate in the study.
4. Both males and females.	4. Patients who have undergone any other major surgery apart from the oral tumor surgery.
-	5. Patients who have any other medical conditions that may affect the outcome of the study, such as rheumatoid arthritis or any neurological disorder.
-	6. Individuals not willing to participate.

also informed consent was obtained from each of the participant before the study. Post-operative counselling was done about the intervention. Pre assessment was done post operatively after 7 days using outcome measure.

1. Pain intensity was assessed using a Numerical Rating Scale (NRS).
2. The ability to swallowing was assessed by using M.D.Anderson Dysphagia Inventory.
3. The mobility of the temporomandibular joint (TMJ) was assessed by measuring the maximum mouth opening, later protrusion, and protrusion with the help of a vernier caliper device.
4. Neck mobility was assessed by measuring the range of motion of the cervical spine in flexion, extension, rotations, and lateral flexion with a goniometer.

A total of 40 participants were eligible, with radical neck dissection at surgical levels, II to VII . Participants were randomly assigned into 2 groups. Group A received Body positioning alone and group B received Targeted body position with swallowing exercises. Exercises was given post operative after 7 days to 4 weeks.

Data was analysed using descriptive statistics and inferential statistics, including t-tests and ANOVA, to determine the effectiveness of body positioning interventions on the outcomes of interest.

A) Control group
Here swallowing exercises were performed alone without Targeted body positioning.
Table: 2- Swallowing Exercise

A. Swallowing element-based exercise		**B. Swallowing activity-dependent exercise**	
1. Oral element exercise	**2.** Pharyngeal element exercise	**1.** Behavior-based exercise	**2.** Swallowing maneuver
a) Lingual ROM	a) Tongue base exercise	a) Therapeutic learning	a) Supraglottic swallowing
b) Lingual strength exercise	b) Tongue holding exercise	-	b) Super-supraglottic swallowing
-	-	-	c) Mendelson's maneuver
-	-	-	d) Effortful swallow

B) Intervention Group-
Here targeted body positioning was performed with swallowing exercises, as mention above.

a) Patient bed reclined around 45-60 degrees.
b) Head is raised up to 60 degrees.
c) Supine lying on back with towel roll under the head with the head back posture.
d) With left side head rotation.
e) Above the shoulder ear position with chest opening.
f) Knee 15-20 degrees bending.
g) Hand and footrest with use of postural wedges and pillows were kept under the arm, knee, and foot.

- The total treatment protocol was for 30-45 min for five consecutive days per week, for four weeks, After the intervention period, the outcome measures were recorded.
- The data obtained was analysed using appropriate statistical methods.

STATISTICAL ANALYSIS OF CONTROL AND INTERVENTIONAL GROUP :
Table:3- Baseline patient demographics (n = 40)

Demographics/characteristic	**n (%)**
Region	
Rural	32 (80%)
Urban	8 (20%)
Habits Status	
Present	38 (95%)
Absent	2 (5%)
Gender	
Male	35 (87.5%)
Female	5 (12.5%)
Age	
≤50	28 (70%)
>50	12 (30%)

The present study included 40 Participants among which most of the patient population was from rural region which was 32 (80%), by statistics patients who had habits like tobacco, mishri, smoking, alcohol was more 38 (95%) , By analysis of gender males were more than the females. Regarding the age distribution 28 (70%) were less than and equal to 50 years age group and 12 (30%) were more than 50 years age respectively (Table 3)

Table :4.1- Comparison of pain between the Control and interventional group with the help of the Numerical Pain rating Scale.

Numerical Pain Rating Scale			
Groups	Pre	Post	P value
Control groups	7.3±1.433	4.7±1.490	0.0059
Interventional Group	7.2±1.431	1.95±1.432	0.003
P value	-	<0.0001	-

After intervention patients in both groups showed improvement in pain , documented in Table 4.1 but in addition, improvement in pain was extremely significant in the interventional group as compared to the Control group (p value <0.0001)

Table:4.2- Comparison of swallowing ability between the Control and interventional groups with the help of M.D Andersons Dysphagia Inventory.

M.D Andersons Dysphagia Inventory			
Test	Pre-test	Post-test	P value
Control Group	42.8±7.752	54.1±7.732	0.0745
Interventional Group	41.15±6.334	60.4±10.354	0.036
P value	-	0.0355	-

After intervention patients in both groups showed improvement in swallowing ability, as shown in Table 4.2 but as compared to the control group the swallowing ability was considered significantly improved in the intervention group. (P value 0.0355).

Tab:4.3.1- Comparison of TMJ Mobility: Max. Opening between Control and interventional groups with the help of Vernier caliper device (mm)

TMJ Mobility			
Outcome measures	Max. Opening(mm)		
Group	Pre	Post	P value
Control group	26.9±4.642	39.450±4.662	0.037
Intervention group	26.9±4.583	30.350±4.880	0.001
P value	-	<0.0001	-

Post-intervention patients in both groups showed improvement in TMJ mobility, for Max. mouth opening, as documented in Table 4.3.1 but in addition, improvement in Max. mouth opening was extremely significant in the interventional as compared to the controlled group (P value <0.0001)

Tab:4.3.2- Comparison of TMJ Mobility: Lat. protrusion between Control and interventional groups with the help of Vernier caliper device (mm)

TMJ Mobility			
Outcome measures	Lat. protrusion(mm)		
Group	Pre	Post	P value
Control group	3.8±1.754	5.950±1.731	0.096
Intervention group	3.8±1.744	7.200±1.704	0.027
P value	-	0.025	-

Post-intervention patients in both groups showed improvement in TMJ mobility, for The Lat. protrusion, as documented in Table 4.3.2 As compared between both the post intervention groups ,the intervention group was considered a significant improvement of Lat. Protrusion as compared to the control group (P value 0.025)

Tab:4.3.3- Comparison of TMJ Mobility: Protrusion between Control and interventional groups with the help of Vernier caliper device (mm)

TMJ Mobility			
Outcome measures	Protrusion (mm)		
Group	Pre	Post	P value
Control group	29.85±4.789	33.5±4.979	0.0559
Intervention group	29.85±5.362	38.45±5.443	0.0001
P value	-	0.00053	-

After intervention patients in both groups showed improvement in TMJ Protrusion, as documented in Table 4.3.3 but in addition, improvement of Protrusion was considered significant in the intervention group as compared to the controlled group (P value 0.00053)

Tab:4.4.1- Comparison of Cervical Mobility: Flexion between the Control and the interventional group with the help of Universal half goniometer.

Neck mobility			
Outcome measures	Flexion		
Group	Pre	Post	P value
Control group	30±6.585	35.55±6.108	0.071
Intervention group	33.5±4.612	41.85±4.511	0.007
P value	-	0.0019	-

After intervention patients in both groups showed improvement in Neck flexion documented in Table 4.4.1 but in addition, improvement of Neck flexion was considered significant in the interventional group as compared to the controlled group (p-value- 0.0019)

Tab:4.4.2- Comparison of Cervical Mobility: Extension between Control and interventional group with the help of Universal half goniometer.

Neck mobility			
Outcome measures	Extension		
Group	Pre	Post	P value
Control group	32.25±7.258	37.3±6.974	0.17
Intervention group	32.95±7.188	44.2±7.185	0.0015
P value	-	0.0038	-

Post-intervention patients in both groups showed improvement in Neck Extension as documented in Table 4.4.2 but as compared in between both the groups, the post-intervention group was considered a significant improvement in neck extension as compared to the post-control group (P value 0.0038)

Tab:4.4.3- Comparison of Cervical Mobility: Rt. Lat. Flexion between Control and interventional group with the help of Universal half goniometer.

Neck Mobility			
Outcome measures	Rt. Lat. Flexion		
Group	Pre	Post	P value
Control group	31.5±5.067	31.75±5.046	0.267
Intervention group	25.9±5.088	41.4±3.283	0.029
P value	-	0.00053	-

After intervention patients in both the groups show improvement in Rt. Lat. Flexion of neck as documented in Table 4.4.3 but in addition, improvement in Rt. Lat. Flexion of neck was consider significant in the interventional group as compared to the controlled group (P value 0.00053)

Tab:4.4.4- Comparison of Cervical Mobility: Lt. Lat. Flexion between Control and interventional group with the help of Universal half goniometer.

Neck mobility			
Outcome measures	Lt. Lat. Flexion		
Group	Pre	Post	P value
Control group	31.5±4.657	33.95±3.338	0.17
Intervention group	31.1±4.622	40.4 ±4.248	0.0015
P value	-	<0.0001	-

After intervention patients in both groups showed improvement in Lt. Lat. Flexion of neck as documented in Table 2.4.4 but as compared in between both the groups, the post-intervention group showed extremely significant improvement in Lt. Lat. Flexion of neck as compared to the post-control group (P value <0.0001)

Tab:4.4.5- Comparison of Cervical Mobility: Rt. Rotation between Control and interventional group with the help of Universal half goniometer.

Neck mobility			
Outcome measures	Rt. Rotation		
Group	Pre	Post	P value
Control group	46.1±8.745	31.1±10.015	0.35
Intervention group	45.7±9.569	59.2±9.828	0.001
P value	-	0.0138	-

Post-intervention, patients in both groups showed improvement in Rt. Rotation of neck as documented in Table 2.4.5 but as compared in between both the groups, the post-intervention group showed considered significant improvement in Rt. Rotation of neck as compared to the post-control group (P value 0.0138)

Tab:4.4.6- Comparison of Cervical Mobility: Lt. Rotation between Control and interventional group with the help of Universal half goniometer.

Neck mobility			
Outcome measures	Lt. Rotation		
Group	Pre	Post	P value
Control group	46.1±5.723	49.9±10.682	0.39
Intervention group	46.15±6.211	62.55±6.739	0.0031
P value	-	<0.0001	-

After intervention patients in both groups showed improvement in Lt. Rotation of neck as documented in Table 4.4.6 but in addition, improvement of Lt. Rotation was extremely significant in the intervention group as compared to the control group (P value <0.0001).

DISCUSSION :

The study was conducted to find out the effect of body positioning on pain, dysphagia, temporomandibular joint (TMJ) mobility, and neck mobility in post-radical neck dissection patients.

The Tongue is the most frequent intraoral area affected by carcinoma[17], occurring after the age of 40 on average, with men affected more than women (12.5%), Surgery combined with radiotherapy, and chemotherapy is the gold standard treatment for head and neck cancer[14,16,17]. Which results in motor and functional impairment, which is also referred to as neck dissection syndrome.[14,15] >90% of patients have significantly shown neck dissection syndrome [2,18,19,20].

In the study, 40 individuals participated and were divided into 2 groups by random sampling method with the help of SPSS software. Group A was a Control group and group B was an Intervention group.

The assessment of Post-operative Pain was calculated with the help of a Numerical rating scale (NRS), Dysphagia assessed with the use of an MD Anderson dysphagia inventory scale, Temporomandibular joint (TMJ) mobility was assessed with the use of vernier Calliper, and cervical mobility with the help of goniometry[7,8,13,14]. Were taken on the post-operative 7th day and repeated after 4 weeks of intervention.

On analysis, the present study found that most oral cancer patients were in the age group of less than and equal to 50 years with a male predominance. According to the study by Ajay et .al , they found most oral cancer patients were in the age group of 60 years and above followed by 40–59, with a male predominance, and buccal mucosa was the most common site, as men have been more likely to use tobacco and alcohol also HPV-related oropharyngeal cancers are also seen more often in men.[23]

On analysing post-intervention pain between the groups, for group A (4.7±1.490) and group B (1.95±1.432), the result showed an extremely significant reduction of pain with a P value <0.0001 in the interventional group as compared to the control group.

According to the study by Gogna et al, after neck surgery, certain postures can cause neck stiffness and pain.[6,10,11,15] Also, a Study by Wistermayer et al. concluded that patients should be positioned supine with the bed rotated to address neck pain [8,10,12,24,25,26], considering the previous studies it was contradictory with the present study and present study was proved that a 45-60 degree reclining bed with supine lying on back with towel roll under the head also 60 degrees head raised position and Hand and footrest with the use of postural wedges and pillows were kept under the arm, knee, and foot can help to manage post-operative contracture also it was concluded that swallowing exercises reduce the intensity of pain index.[8,10,11,13,16]

On analysing post-intervention dysphagia between the groups, with group A (54.1±7.732) and group B (60.4±10.354) the result showed a considered significant improvement in swallowing ability with a P value of 0.0355 in the interventional group as compared to the controlled group. Study conducted by Hasegawa et al the therapeutic postures and exercises can help maximize swallow function and minimize aspiration.[1,2,6,11]also the study conducted by Nutting et al. patients with severe dysphagia often use a 30° reclining position and chin down position to help reduce the aspiration in patients experiencing with a dysphagia also study results found that rotating the head to the left side can help to reduce aspiration.[16,24,26] As mentioned in previous studies rotating the head to left side can expand the piriform fossa on the right and narrow it on the left side , this position can help reduce the aspiration.[15,16,24,26] Study conducted by Karim Mashhour et al. it was concluded that swallowing exercises can increase strength, mobility, and control of the muscles involved in swallowing, which can make proper swallowing easier.[2,8,19,21,22,26,] By analysing the previous study findings, the present study conclude that targeted body positioning was an effective position for swallowing.

On analysing TMJ mobility between the groups with the use of a vernier calliper, it was proven that improvement of Max. mouth opening was extremely significant in the intervention group as compared to the control group with P value <0.0001. For lateral protrusion of jaw, present study proved that a considered significant improvement in the intervention group as compared to the control group with P value of 0.025. Also, for a protrusion of mouth with the considered significant improvement with a P value 0.00053 the intervention group showed improvement as compared to the control group.

Study conducted by Joo Lee et.al was examined the relationship between Temporomandibular disorder and body posture and reported that temporomandibular disorder (TMD) and body posture was significantly correlated with each other by its anatomical correlations and states that post operative radical neck dissection causes cervical malalignment with forward head posture, rounded shoulders and altered tongue palatal support , this faulty postures can courses an unnecessary or unwanted load on surrounding musculatures, ligaments and joints which lead to an temporomandibular dysfunction [4,6,11,13,22,26]. A study by Sambataro et al concluded that sleeping on the back will reduce the unwanted stress on joints and nearby tissues [6,8,10,18] also study by Fondriest et al TMJ immobility and cervical pain is an cause of dysphagia and other body postural disorders [13,15], the study discuss that altered tongue position can lead to an functional impairment in TMJ and cervical joint[13]. Also can lead to an difficulty in breathing and swallowing [6,10.] Following the previous studies the present study conclude that sleeping on

the back with the head and neck is supported with quality care with 45-60 degree reclining positioning can effectively act on temporomandibular joint mobility and range of motion.

On analysing cervical mobility between the groups with the use of goniometer it was proven that neck flexion was considered significant improvement in an intervention group as compared to a control group with P value 0.0019 , also improvement in cervical extension was significant in the intervention group as compared to the control group with P value 0.0038 . For right lateral flexion of neck and left lateral flexion of neck, present study proved that a considered significant improvement in the right lateral flexion and extreme significant improvement in left lateral flexion of neck in the intervention group as compared to the control group with P value of 0.00053 and <0.0001. Also, for right rotation and left rotation of neck the study concludes that, there was a considered significant improvement in right rotation of neck and extreme significant improvement in left rotation of neck with a P value of 0.0138 and <0.0001 in the intervention group as compared to the control group.

Study conducted by Paul Wistermaye et al, the patient should be positioned supine, with the bed rotated, to allow full access to the patient's head and neck from both sides of the bed, also they use shoulder roll to extend the neck and care is necessary to ensure that the head does not "hang" and is supported to prevent neck injury[19] also neck should be hyper-extended with the use of a shoulder roll, and rotated to the left side. As considering the previous study the present study proved that ear position above the shoulder with chest opening and shoulder back position and left side neck rotation including Hand and footrest with use of postural wedges and pillows, were kept under the arm, knee, and foot. This position is an effective for cervical mobility.

CONCLUSION :

The present study concludes that swallowing exercises along with targeted body position is a beneficial for reducing post-operative pain and improving post operative swallowing ability, Temporomandibular joint and cervical joint mobility in post-radical neck dissection patients.

TOPIC OF INTREST :

The anterior part of the tongue is considered important for non-respiratory activities, while the posterior part is important for respiration. So, effect of dysphagia on respiration is following the topic of interest.

Spinal malalignment is a late complication of post operative head and neck cancer , by the previous studies a left convex scoliosis with Cobb angle >30° is associated more strongly with GERD and dysphagia and neck pain so following is the topic of interest.

Individuals with TMD with reduced tongue pressure had greater difficulty in performing the swallowing function adequately.[14] This relationship was also observed in the study of Marim, et al. (2019), who observed that reduced tongue pressure can contribute to altering the swallowing pattern, thus these aspects should be considered in clinical practice. The alteration in the oral motor control regarding the tongue may impair the performance of swallowing in individuals with TMD.

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