International Journal of Medical Science and Health Research

Vol.9, No. 02; 2025

ISSN: 2581-3366

Effectiveness of Physiotherapy Intervention for Mouth Opening in Surgically Treated Patients for Oral Cancers

[1.]Neha Abhaykumar Modi
Department(s) and institution(s): SPB Physiotherapy college, Surat
Corresponding Author: Name: Neha Abhaykumar Modi
Address: SPB Physiotherapy college, Ugat bhesan road, Surat 395005
Phone numbers: (+91) 9898936121

doi: 10.51505/ijmshr.2025.9209 URL: http://dx.doi.org/10.51505/ijmshr.2025.9209

Received: Mar 03, 2025 Accepted: Mar 25, 2025 Online Published: Apr 05, 2025

Abstract

Restricted mouth opening can be induced by surgical treatment. Restricted mouth opening and pain may impede biting, chewing, speech, laughing, yawning, oral hygiene and may have an impact on quality of life. The purpose of this study was to analyze the effects of manual physiotherapy in mouth opening and pain after surgery in oral cancer. The study design was randomized control trial. Total 30 consecutive patients who had undergone surgery and were referred for physiotherapy rehabilitation were included in the study. Participants were randomized in two groups, Group A (Experimental group) and Group B (Control group)**.** Participants of both groups were assessed on 5th post-operative day (POD) which included measures of mouth opening using vernier caliper and pain in the form of Numeric Rating Scale (NRS). All the participants underwent 10 days of exercise protocol. On 15th POD mouth opening and pain intensity measures were measured again. While comparing between two groups, average increase of mouth opening for Group A and Group B was (12.00±4.47) and (4.93±2.57) respectively, which was statically highly significant (p value<0.001). Average decrease of pain for Group A and Group B was (-2.26±0.88) and (-1.26±0.45) respectively, which was statically highly significant (p value<0.05). The study showed definite positive effect of physiotherapy intervention in surgically treated patients for oral cancers.

Key words: Mouth opening, oral cancer, pain, physical therapy

Introduction

The global burden of cancer continues to increase largely. Cancer is the leading cause of death in economically developed countries and the second leading cause of death in developing countries. [1] Oral cancer or oral cavity cancer defined as any cancerous tissue growth located in the oral cavity. [2] Oral and oropharyngeal cancer is the sixth most common cancer reported globally. The annual incidence is over 300,000 cases, of which 62% arise in developing countries.[3] Age-adjusted rates of oral cancer vary from over 20 per 100,000 populations in India, to 10 per 100,000 in the United States, and less than 2 per 100,000 in the Middle East. [3] In India the

Vol.9, No. 02; 2025

ISSN: 2581-3366

incidence of oral cancer is about 3-7 times more common as compared to developed countries. India is having highest prevalence of oral cancer in the world and remains the commonest cancer amongst the male population. The increased prevalence is attributed to the high exposure to sunlight due to farming, smoking and other smokeless tobacco habits, alcohol, spicy food, and neglect of overall oral health. Male to Female ratio for having oral cancer is 4.18:1. [4] The etiology of oral cancer is found to be multifactorial. [5] Tobacco use and excessive alcohol intake are estimated to account for about 90% of oral cancers. [6] In India, the cancers of gingiva and buccal mucosa are common due to placement of tobacco quid in the oral cavity, is termed as Indian oral cancer (Oral Cancer Prevention and Research Foundation, India). Oncologists and surgeons have made substantial progress in cancer treatment in last few decades. Long term health issue related to cancer and its treatment are becoming more important as both the number of cancer survivors and length of their survival are increasing. Various treatment guidelines are available in the form of surgery, chemotherapy and radiation therapy. [7] Depending on the site and stage of the cancer, the treatment may consist of surgery, radiotherapy, chemotherapy or a combination. Photo dynamic therapy (PDT) also plays important role in treating oral cancer. [8-10] For advanced cases, there has been a shift from surgical treatment towards chemoradiotherapy protocols. These organ preservation protocols are developed to maintain organ anatomy [11-17], unfortunately do not necessarily preserve the organ's function. [11-12, 19, 18-19] The problems occuring due to the cancer disease itself and its treatment vary with the type of cancer, disease stage and type of medical treatment. [20] Following the treatment of oral and oropharyngeal cancer, patients may report several oral symptoms, such as a restricted mouth opening, restricted tongue mobility, lack of saliva, an inability to wear a dental prosthesis or lack of retention of the prosthesis and loss of oral sensory function [21-23]. Restricted mouth opening (Trismus) can be induced by surgical treatment or radiotherapy in approximately 8% of patients. [24] Surgical resection of oral or oral pharyngeal tumors can also cause trismus, particularly those that include contraction of mouth closing muscles. Post-surgical trauma can lead to hematoma, abscess and weakening of lateral pterygoid, digastric, myelohyoid, geniohyoid and infrahyoid muscles. [24-28] Restricted mouth opening may impede biting, chewing, speech, laughing, yawning, oral hygiene and may have an impact on quality of life. [29-30]

If possible, restricted mouth opening related to head and neck cancer should be prevented because once it develops it is very difficult to treat later on. However, limited evidence exists as how trismus, due to head and neck cancer or its treatment, can most effectively be prevented or treated. [31] Treatment regimen include surgery, pharmacotherapy (analgesics and muscle relaxants) and physical therapy. These modalities can be used alone or in any combination. [25, 32-36]

Erik G. Cohen noted that the postoperative period is characterized by a prolonged period of limited jaw motion. Postoperative fibrosis and scar contracture occurs very frequently. Rapid formation of collagen secondary to surgery is contributing factor in limiting jaw motion. Immobilized joints show very rapid degeneration changes which can make remobilization difficult.

Vol.9, No. 02; 2025

ISSN: 2581-3366

Exercises are frequently proposed to treat or prevent trismus. Several manual, mechanical exercises and electrotherapy have been described for treating trismus. This include isometric exercises, stretching exercises using a tongue depressor and mechanical devices, hot and cold compresses. [25, 37-44] Usually some tools are used as incentives to enhance exercise compliance or to increase therapeutic effectiveness. These tools include rubber plugs, wooden tongue blades and TheraBite® exercisers and dynamic bite openers.

Oncological outcomes have improved following the advancement of better surgical and reconstruction techniques and more effective chemo radiotherapy protocols. As a result increasing numbers of patients are confronted with long-term negative side effects of these indispensable therapeutic interventions. Therefore, the development and implementation of evidence-based strategies for the prevention, treatment, and rehabilitation of these side effects are essential. [45]

There are few studies evaluating the effectiveness of physical therapy in ameliorating mouth opening in patients with trismus and most of them describe the comparative analysis of different techniques. In a randomized clinical study involving treated patients with head and neck cancer, Buchbinder et al. [39] reported that the use of TheraBite® increased mouth opening significantly more than was achieved by exercises with wooden tongue blades or manual stretching. (Buchbinder D, Currivan RB, Kaplan AJ, Urken ML). A similar study done by Cohen el al. [41] involving patients treated for oropharyngeal cancer demonstrated better mouth opening in the course of treatment, using the TheraBite® apparatus. (Cohen EG, Deschler DG, Walsh K, Hayden RE) Shulman et al. [42] showed a significant benefit for irradiated patients using the biomechanical device DTS (Dynasplint® Trismus System). (Shulman DH, Shipman B, Willis, FB)

All the studies mentioned above lack the evidence of role of manual physiotherapy in reduced mouth opening followed by surgery in oral cancer. So, the purpose of this study was to analyse the effects of manual physiotherapy in mouth opening and pain after surgery in oral cancer.

Materials and Methodology

This was a randomized control trial study carried out at Shree Krishna Hospital (SKH), Karamsad. The study proposal was prepared, submitted and subsequently approved by Human Research and Ethics Committee of H.M. Patel Centre for Medical care and education, Karamsad (HMPCMCE/HREC/UG/PG/19(2)/6). Patients with all the age group of either gender undergone surgical treatment for oral cancer in SKH who were referred for physiotherapy and those providing consent to participate were included in the study. Patients having any previous treatment for oral cancer, having trismus due to pathology other than oral cancer, patients with history of previous trauma, tetanus, temporo-mandibular disorder, Neuromuscular condition affecting function of face, patients with either types of diabetes, psychologically unstable patients were excluded from the study. Total 38 participants were recruited, out of which 8 were excluded.

Vol.9, No. 02; 2025

ISSN: 2581-3366

Material

1) Vernier caliper

Methodology

Participants were randomized in two groups, **Group A (Experimental group)** and **Group B (Control group)** through computerized randomization method prepared by Central Research Services. All the participants were attended immediately after reference for physiotherapy was given. Participants of both groups were assessed on 5th post-operative day (POD), which included mouth opening using vernier caliper and pain in the form of Numeric Rating Scale (NRS). All the participants underwent 10 days of exercise protocol. On 15th POD mouth opening and pain intensity measures were measured again.

On the 5th POD Group A (Experimental group) received treatment directly from physiotherapist once in a day for 10 days. Position of patient was high sitting and the treatment protocol was accordingly:-

1. Active range of motion exercise of mouth (mouth opening, side to side movements, protrusion) (10 repetitions)
2. Active movements of tongue (protrusion, side to side) (10 repetitions)
3. Manual stretching for mouth opening (low intensity stretch for 30 sec, one cycle)
4. Contract-relax technique for mouth opening (isometric contraction for 10 sec, three cycles)

On 5th POD Group B (Control group) received handout of exercises and were asked to do exercises as explained in it both in the form of diagrams and explanation. Participants were asked to read from handouts in the presence of physiotherapist and clarifications were done if needed. They received treatment once in a day for 10 days in high sitting position in the presence of physiotherapist. They were asked to maintain the exercise diary given on 5th POD which included time, duration and frequency of exercises. Physiotherapist ensured that participants complied with the exercise program by checking the exercise diary daily. On 15th POD, the participants were asked to submit the diary which was followed by final assessment. The treatment protocol was accordingly:-

1. Active range of motion exercise of mouth (mouth opening, side to side movements, protrusion) (10 repetitions)
2. Active movements of tongue (protrusion, side to side) (10 repetitions)

Group A (Experimental group) and Group B (Control group) participants were rated for maximum mouth opening by universal measurement technique using vernier caliper and pain using numerical rating scale before and after therapeutic intervention. i.e. on the 5th POD and 15th POD. For maximum mouth opening, measurements were done by a trained another one person.

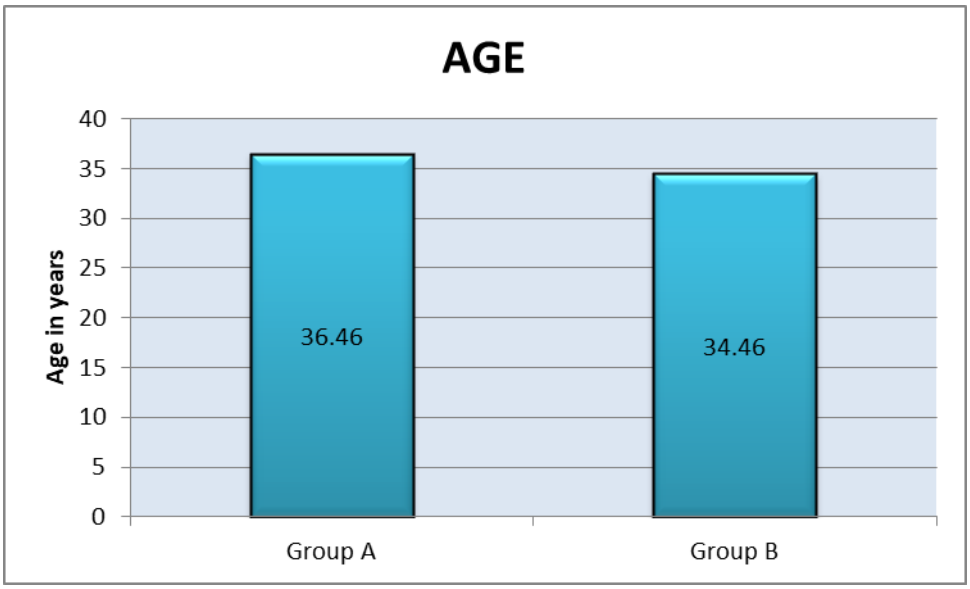
Vol.9, No. 02; 2025

ISSN: 2581-3366

Results

SPSS (Statistical package for social science) version 16 was used to analyse data.

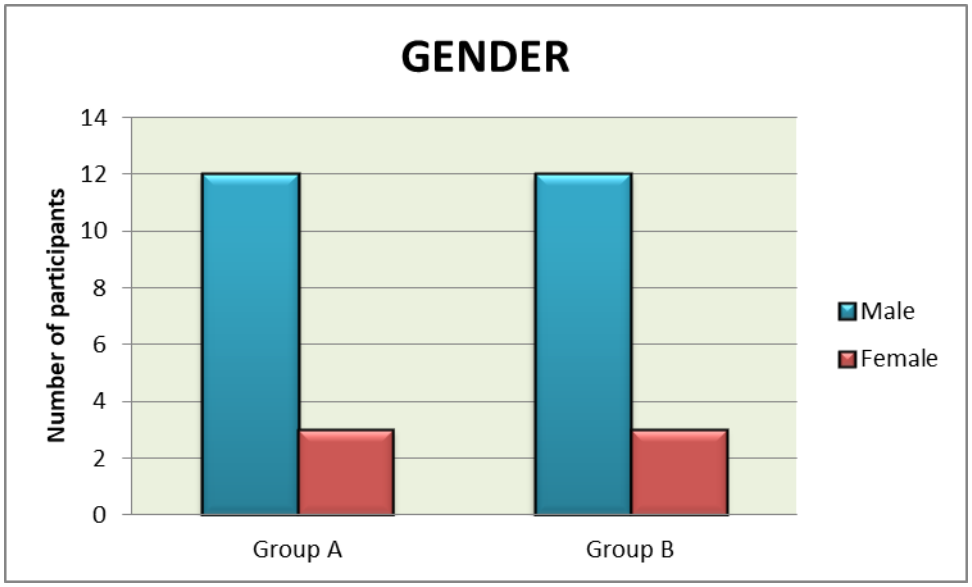
Graph 1 and 2 shows comparison of mean and standard deviation of age and gender for both the groups.



Graph 1- Mean age of Group A and Group B

Vol.9, No. 02; 2025

ISSN: 2581-3366



Graph 2 - Gender distribution in Group A and Group B

In the present study to check normality of data **Kolmogorov-Smirnov Test** was used. p value was not significant (>0.05) for all variables.

For all the statistical tests, significance level was fixed at 5%, i.e. the results were considered statistically significant when p value was < 0.05.

Paired t –test was applied to compare mean value of variable within the group, t-test for independent samples was applied to compare mean value of variable between two groups.

Vol.9, No. 02; 2025

ISSN: 2581-3366

Table 1 Unpaired T-Test

Parameter	Group	N	Mean± Std. Deviation	P value
Mouth Opening 5th POD	Group A	15	23.93±4.33	0.295
	Group B	15	25.40±3.08	
Mouth Opening 15th POD	Group A	15	35.93±5.87	0.006
	Group B	15	30.33±4.32	
Side to Side Rt 5th POD	Group A	15	7.86±1.88	0.583
	Group B	15	7.53±1.35	
Side to Side Rt 15th POD	Group A	15	9.20±1.42	0.075
	Group B	15	8.26±1.33	
Side to Side Lt 5th POD	Group A	15	8.06±1.62	0.620
	Group B	15	7.80±1.26	
Side to Side Lt 15th POD	Group A	15	9.13±1.64	0.143
	Group B	15	8.33±1.23	
PROTRUSION 5th POD	Group A	15	5.86±1.12	0.263
	Group B	15	6.33±1.11	
PROTRUSION 15th POD	Group A	15	6.46±1.64	0.718
	Group B	15	6.66±1.34	
Pain 5th POD	Group A	15	5.80±0.94	0.265
	Group B	15	5.40±0.98	
Pain 15th POD	Group A	15	3.53±1.24	0.177
	Group B	15	4.13±1.12	

Table 1 shows intergroup comparison of pre-test and post-test values of different measures

Table 2

Group			**Mean**	**Std. Deviation**	**t**	**p-value**
Group A	Pair 1	Mouth Opening 5th POD - Mouth Opening 15th POD	-1.20000E1	4.47214	-10.392	0.000
	Pair 2	Side to Side Rt 5th POD - Side to Side Rt 15th POD	-1.33333	1.23443	-4.183	0.001
	Pair 3	Side to Side Lt 5th POD - Side to Side Lt 15th POD	-1.06667	0.70373	-5.870	0.000
	Pair 4	PROTRUSION 5th POD - PROTRUSION 15th POD	-0.60000	0.73679	-3.154	0.007
	Pair 5	Pain 5th POD - Pain 15th POD	2.26667	0.88372	9.934	0.000
Group B	Pair 1	Mouth Opening 5th POD - Mouth Opening 15th POD	-4.93333	2.57645	-7.416	0.000
	Pair 2	Side to Side Rt 5th POD - Side to Side Rt 15th POD	-0.73333	0.96115	-2.955	0.010
	Pair 3	Side to Side Lt 5th POD - Side to Side Lt 15th POD	-0.53333	0.63994	-3.228	0.006
	Pair 4	PROTRUSION 5th POD - PROTRUSION 15th POD	-0.33333	0.48795	-2.646	0.019
	Pair 5	Pain 5th POD - Pain 15th POD	1.26667	0.45774	10.717	0.000

Table 2 shows p value for intragroup comparison for different measures

Vol.9, No. 02; 2025

ISSN: 2581-3366

Table 3 Group Statistics

	Group	N	Mean	Std. Deviation	p-value
MO_Diff	Group A	15	12.0000	4.47214	0.000
	Group B	15	4.9333	2.57645	
STS_Rt_Diff	Group A	15	1.3333	1.23443	0.149
	Group B	15	0.7333	0.96115	
STS_Lt_Diff	Group A	15	1.0667	0.70373	0.039
	Group B	15	0.5333	0.63994	
Pro_Diff	Group A	15	0.6000	0.73679	0.252
	Group B	15	0.3333	0.48795	
Pain_Diff	Group A	15	-2.2667	0.88372	0.001
	Group B	15	-1.2667	0.45774	

TABLE 3 shows the comparison between the post-test measurements of two groups of different measures and p values

Discussion

According to Dreizen et al. the exercise program should be intensified and, if necessary, combined with physiotherapy to regain the lost inter-arch distance [43] Therefore it necessitates that postoperative exercises are essential to prevent reduction in mouth opening, as exercise maintains the muscle elasticity, contractility and thereby improve the range of motion and muscle length.

In this study while comparing between two groups after intervention with regards to mouth opening (p=0.006) and side to side right (p=0.075) values improved significantly. The results may be attributed to the active exercise. Active exercises were performed by the participants by their own muscular efforts without the assistance or resistance of any external force, other than that of gravity. Active exercises promote relaxation by the alternating and reciprocal contraction and relaxation of the opposing muscle groups maintain joint mobility, physiologic elasticity and contractility of the participating muscles, muscle power and tone in response to tension created in them, neuromuscular co-ordination, increase circulation and give confidence to the patient. [44] The combined effects active exercises led to significant improvement in the values of mouth opening and side to side right in both the groups.

Values of side to side left (p=0.143), protrusion (p=0.718) were not statistically significant though there was a difference their mean values. In the present study, it was observed that the numbers of patients were having incisional scar over right side of the mouth. Lateral pterygoid muscle is the prime structure for side to side movement of the lower jaw. If only one lateral pterygoid contracts, lower jaw moves to opposite side. During the surgery insertion site of right

Vol.9, No. 02; 2025

ISSN: 2581-3366

lateral pterygoid could be damaged so participants found difficulty in moving the lower jaw to the left side. Another reason may be due to stretching of scar and pain thus produced. Apprehension may also be one of the reasons.

The normal value for protrusion is 6-9 mm. [45] In this particular study on pre-intervention assessment mean value for protrusion for experimental group and control group was (5.86±1.12) and (6.33±1.11) respectively which showed that protrusion was not much affected before intervention. After intervention mean value for the same was (6.46±1.64) and (6.66±1.34) respectively. So it could be inferred that the protrusion values were not affected before the intervention so no significant difference was found.

However, the mouth opening (p=0.000) and pain (p=0.001) values were much more significantly improved in experimental group compared to control group. This result may be attributed to the passive stretching and contract-relax maneuvers delivered in the experimental group. It added the benefit in the form that slow steady stretch produces a relaxation and lengthening of the muscle and overcomes the resistance of the shortened ligaments, fascia and fibrous sheaths of muscles. [46] Hold-relax technique effectively increases flexibility and range of motion of particular joint. [47] The idea behind these stretch and strength exercises is to prevent none-use atrophy of the musculature involved in mouth-opening. Furthermore, a simple fact that a physiotherapist was actually doing something (contract-relax and manual stretching) about restricted mouth opening may induce an increase in mouth opening.

A study reported by Karoline Camargo Bragante et al 2020 stating that that the exercise protocols performed in this study were not more effective than the usual guidance to prevent reduction in MO in patients undergoing radiotherapy for head and neck cancer.[48] In contrast to this, in the particular study comparing within group before and after intervention for mouth opening in experimental group (p value=0.000) and in control group (p value=0.000) showed highly significant improvements.

Rose et al 2009 reported that simple jaw exercises can be a useful aid to help prevent side effects of trismus due to treatment. [49] Ana Paula Dall´Anese et al 2010 suggested that mouth opening increased significantly after physical therapy in patients with trismus, and these results were sustained after therapy had been concluded. [50] Ling Yang et al 2025 concluded in their study that beginning mouth opening exercises during the second week after surgery (prior to radiotherapy) can greatly enhance mouth opening, lessen pain, and improve the quality of life for postoperative radiotherapy patients with oral cancer. [51]

In this particular study it was found that an important aspect of rehabilitation was the application of hand-assisted stretching forces and the hold-relax technique for manual stretching may also have contributed to the results. The fact that mouth opening showed immediate results with the use of the proposed techniques favored patient adherence to practicing exercises in the control group also.

Vol.9, No. 02; 2025

ISSN: 2581-3366

The study group comprised small number of participants due to limited availability of patients and long term effects of exercises for mouth opening were not considered. Future study can be done with long term follow up in larger sample and see the effects of physiotherapy.

Conclusion

The study showed definite positive effect of physiotherapy intervention for mouth opening in surgically treated patients for oral cancers.

Acknowledgement

I am glad to give a vote of special thanks to my husband, Dr. Utkarsh and family for having faith in me and for the constant encouragement and help. With profound gratitude I thank Dr. Nirav Vaghela and Dr. R. Harihara Prakash for support and guidance. Their intelligence and simplicity has always encouraged me.

Financial support & Sponsorship: No

Conflicts of interest: No

References

World Health Organization. The Global Burden of Disease: 2004 Update. Geneva: World Health Organization; 2008.

Werning, John W. Oral cancer: diagnosis, management and rehabilitation. *Oral cancer*.2007;32(2):45-51.

Sankaranarayanan, R., et al., Head and neck cancer: a global perspective on Epidemiology and prognosis. Anticancer Res, 1998. 18(6B): p. 4779-86.

Warnakukulasuriya S. Causes of oral cancer-an appraisal of controversies. Br Dent J 2009; 207:471-5.

Nair MK, Sankaranarayanan R. Epidemiologic leads to cancer control in India. Cancer Causes Control. 1991 July, 2(4):263-5.

Shenoi R et al. Demographic and clinical profile of oral squamous cell carcinoma patients: A retrospective study. Indian journal of cancer 2012; 49:1:22.

Charles L. MacGarvey PTIII. Clinics in physical therapy. Physical therapy for the cancer patient. New York: Churchill Livingstone 1990; 1-47,137.

Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics 2002. *CA Cancer J Clin.* 2005; 55:74–108.

Copper MP, Tan IB, Oppelaar H, Ruevekamp MC, Stewart FA. Meta-tetra (hydroxyphenyl) chlorin photodynamic therapyin early-stage squamous cell carcinoma of the head and neck. *Arch Otolaryngol Head Neck Surg*. 2003; 129:709-711.

Ward EC, van As-Brooks CJ. Head and neck cancer, treatment, rehabilitation and outcomes. *Plural Publishing*. 2007.

Mittal BB, Pauloski BR, Haraf DJ, Pelzer HJ, Argiris A, Vokes EE, Rademaker A, Logemann JA . Swallowing dysfunction—preventative and rehabilitation strategies in patients with

head-and-neck cancers treated with surgery, radiotherapy, and chemotherapy: a critical review. *Int J Radiat Oncol Biol Phys*. 2003; 57:1219–1230.

Lee WT, Akst LM, Adelstein DJ, Saxton JP, Wood BG, Strome M, Butler RS, Esclamado RM . Risk factors for hypo pharyngeal/upper esophageal stricture formation after concurrent chemoradiotherapy. *Head Neck* .2006; 28:808–812.

Urba S, Wolf G, Eisbruch A, Worden F, Lee J, Bradford C, Teknos T, Chepeha D, Prince M, Hogikyan N, Taylor J. Single-cycle induction chemotherapy selects patients with advanced laryngeal cancer for combined chemoradiotherapy: a new treatment paradigm. *Clin Oncol*.2006; 24:593–598.

Allal AS, Nicoucar K, Mach N, Dulguerov P. Quality of life in patients with oropharynx carcinomas: assessment after accelerated radiotherapy with or without chemotherapy versus radical surgery and postoperative radiotherapy. *Head Neck* .2003; 25:833–839.

Smith RV, Kotz T, Beitler JJ, Wadler S. Long-term swallowing problems after organ preservation therapy with concomitant radiotherapy and intravenous hydroxyurea: initial results. *Arch Otolaryngol Head Neck Surg*. 2000; 126:384–389.

Kotz T, Abraham S, Beitler JJ, Wadler S, Smith RV. Pharyngeal transport dysfunction consequent to an organ-sparing protocol. *Arch Otolaryngol Head Neck Surg* .1999; 125:410-413.

Murry T, Madasu R, Martin A, Robbins KT. Acute and chronic changes in swallowing and quality of life following intraarterial chemoradiotherapy for organ preservation in patients with advanced head and neck cancer. *Head Neck*.1998; 20:31-37.

Kotz T, Costello R, Li Y, Posner MR. Swallowing dysfunction after chemoradiotherapy for advanced squamous cell carcinoma of the head and neck. *Head Neck*. 2004; 26:365–372.

Shiley SG, Hargunani CA, Skoner JM, Holland JM, Wax MK. Swallowing function after chemoradiotherapy for advanced stage oropharyngeal cancer. *Head Neck Surg*. 2006; 134:455–459.

Malignant tumor. Last reviewed September 2012. In Pubmed Health, Section- Disease and Conditions- Cancer. U.S. National Library of Medicine- The World's Largest Medical Library available from: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002267.

Chambers MS, Garden AS, Kies MS, Martin JW. Radiation-induced xerostomia in patients with head and neck cancer: pathogenesis, impact on quality of life, and management. *Head Neck*.2004; 26:796–807.

Finlay PM, Dawson F, Robertson AG, Soutar DS. An evaluation of functional outcome after surgery and radiotherapy for intraoral cancer. *British Journal Oral Maxillofacial Surgery*.1992; 30:14-17.

Vissink A, Jansma J, Burlage FR, Coppes RP. Oral sequelae of head and neck radiotherapy. *Critical Review Oral Bio Med*. 2003; 14:199–212.

Ichimura K, Tanaka T. Trismus in patients with malignant tumors in the head and neck. J Laryngol Otol 1993; 107:1017-20.

Dhanrajani PJ, Jonaidel O. Trismus: aetiology, differential diagnosis and treatment. Dent Update 2002; 29:88-94.

Vol.9, No. 02; 2025

ISSN: 2581-3366

Tveteras K, Kristensen S. The aetiology and pathogenesis of trismus. Clin Otolaryngol 1986; 11:383-7.

Kouyoumdjian JH, Chalian VA, Nimmo A. Limited mandibular movement: causes and

Luyk NH, Steinberg B. Aetiology and diagnosis of clinically evident jaw trismus. Aust Dent J 1990; 35:523-9.

Kent ML, Brennan MT, Noll JL, Fox PC, Burri SH, Hunter JC, Lockhart PB. Radiation-induced trismus in head and neck cancer patients. Support Care Cancer 2008; 16:305-9.

Scott B, Butterworth C, Lowe D, Rogers SN. Factors associated with restricted mouth opening and its relationship to health-related quality of life in patients attending a Maxillofacial Oncology clinic. Oral Oncol 2008; 44:430-8.

Dijkstra PU, Kalk WW, Roodenburg JL. Trismus in head and neck oncology: a systematic review. Oral Oncol 2004; 40:879-89.

Leonard M. Trismus: what is it, what causes it, and how to treat it. Dent Today 1999; 18:74-7.

Tveteras K, Kristensen S. The aetiology and pathogenesis of trismus. Clinical Otolaryngology 1986; 11:383-7.

Kouyoumdjian JH, Chalian VA, Nimmo A. Limited mandibular movement: causes and treatment. J Prosthet Dent 1988; 59:330-3.

Dijkstra PU, Sterken MW, Pater R, Spijkervet FK, Roodenburg JL. Exercise therapy for trismus in head and neck cancer. Oral Oncol 2007; 43:389-94.

Barrett NV, Martin JW, Jacob RF, King GE. Physical therapy techniques in the treatment of the head and neck patient. J Prosthet Dent 1988; 59:343-346.

Engelmeier RL, King GE. Complications of head and neck radiation therapy and their management. J Prosthet Dent 1983; 49:514-522.

Vissink A, Burlage FR, Spijkervet FK, Jansma J, Coppes RP. Prevention and treatment of the consequences of head and neck radiotherapy. Crit Rev Oral Biol Med 2003; 14:213-225.

Buchbinder D, Currivan RB, Kaplan AJ, Urken ML. Mobilization regimens for the prevention of jaw hypomobility in the radiated patient: a comparison of three techniques. J Oral Maxillofac Surg 1993; 51:863-867.

Etnyre BR, Abraham LD. Gains in range of ankle dorsiflexion using three popular stretching techniques. Am J Phys Med 1986; 65:189-196.

Cohen EG, Deschler DG, Walsh K, Hayden RE. Early use of a mechanical stretching device to improve mandibular mobility after composite resection: a pilot study. Achieves of Physical Medical Rehabilitation 2005; 86:1416-1419.

Shulman DH, Shipman B, Willis, FB. Treating trismus with dynamic splinting: a cohort, case series. Adv Ther 2008; 25:9-15.

Dreizen SA, Brown LR, Daly TE, Drane JB (1977a). Prevention of xerostomia-related dental caries in irradiated cancer patient. J Dent Res 56:99-104.

M.Dena Gardiner, The principles of exercise therapy, ed-4, page-41-44.

Pamela K. Levangie, Cynthia C. Norkin, Joint structure and function- A comprehensive analysis, ed-4, page-221.

Carolyn Kisner, Lynn Allen Colby: Therapeutic exercise, ed- 5, page 71.

Carolyn Kisner, Lynn Allen Colby: therapeutic exercise, ed- 5, page 85.

Vol.9, No. 02; 2025

ISSN: 2581-3366

Karoline Camargo Bragante, Sandro Groisman, Cristiane Carboni, Jaqueline Munaretto Timm Baiocchi, Neiro Waechter da Motta, Marcelo Faria Silva, Roselie Corcini Pinto, Rodrigo Della Mea Plentz, Patrícia Wienandts, Geraldo Pereira Jotz. Efficacy of exercise therapy during radiotherapy to prevent reduction in mouth opening in patients with head and neck cancer: A randomized controlled trial. Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology. 2020;129(1)27-38.

Rose T, Leco P, Wilson J. The development of simple daily exercises for patients receiving radical head and neck radiotherapy. J Med Im Rad Sc 2009, 40:32-7.

Ana Paula Dall´Anese, Karin Schultz, Karina Braga Ribeiro, Elisabete Carrara-de Angelis. Early and Long-Term Effects of Physiotherapy for Trismus in Patients Treated for Oral and Oropharyngeal Cancer. Applied Cancer Research. 2010; 30(4):335-9.

Ling Yang, Guihua Hao, Wenyu Yang, Lili Hou. The impact of different timing of mouth opening exercises on trismus in postoperative radiotherapy patients with oral cancer. Journal of Stomatology, Oral and Maxillofacial Surgery 2025;126(3),102-104.