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A Study to Determine the Effect of Breathing and Oral Exercises on Chest Expansion and Mouth Opening Among Post Operative Oral Cancer Individuals

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ABSTRACT

Introduction: Oral cancer is a major health burden in India, and surgical treatment often results in postoperative complications such as trismus and reduced chest expansion. These limitations adversely affect respiration, nutrition, speech, and quality of life. Early physiotherapy-based rehabilitation, including breathing exercises and oral opening techniques, plays a vital role in restoring functional outcomes and pulmonary efficiency. To evaluate the effectiveness of breathing exercises and oral opening techniques on chest expansion and mouth opening in postoperative oral cancer patients.

Materials and Methods: A single-group pretest–post-test study was conducted at SVIMS Hospital, Tirupati. Thirty postoperative oral cancer patients were included in the study. Mouth opening and chest expansion were assessed on the 1st and 7th postoperative days. Mouth opening was measured using a vernier caliper, while chest expansion was recorded using an inch tape at the axillary and nipple line levels. All participants received a structured physiotherapy intervention comprising oral opening exercises and chest physiotherapy for one week.

Results & conclusion: Statistical analysis showed a significant improvement in mouth opening and chest expansion following the intervention. Participants demonstrated reduced trismus, improved chest mobility, and enhanced respiratory mechanics after one week of physiotherapy. Breathing exercises combined with oral opening techniques are effective in improving postoperative functional outcomes in oral cancer patients. Early initiation of physiotherapy helps restore mouth opening, reduce respiratory restrictions, and optimize pulmonary function. These findings support the inclusion of physiotherapy as a routine component of postoperative care in oral cancer management.

Keywords: Oral cancer, chest expansion, trismus, oral opening exercises, physiotherapy.

INTRODUCTION

Oral cancer, a significant global health concern, includes malignancies that affect the tissues of the mouth and oropharynx. It ranks among the most prevalent cancers worldwide and contributes significantly to morbidity and mortality, particularly in low- and middle-income countries. Oral squamous cell carcinomas (OSCC) account for the majority of oral cancer cases accounting for over 90% of cases, and arise from the epithelial lining of the oral mucosa (Warnakulasuriya S, 2009).[1] Oral cancer is often associated with significant functional impairments. Depending on the tumor location and treatment approach, individuals may experience issues with speech, mastication, swallowing, and breathing.[1] In India, oral cancer ranks as the most common cancer among men and the third most common among women.

Depending on the area, the age-standardized incidence rate (ASIR) for oral cavity malignancies in men varies between 12 and 25 per 100,000 (Gupta B et al., 2016).One About ninety percent of patients with oral squamous cell carcinoma (OSCC) have a history of tobacco exposure in some form (Gupta B et al., 2013).[2] Smokeless tobacco products, such as gutkha, khaini, and Zarda, are widely used in India and pose a higher risk due to prolonged contact with the oral mucosa.[3]

The buccal mucosa, an integral part of the oral cavity, plays a vital role in mastication, speech, and oral hygiene maintenance. In the Indian subcontinent, the incidence of buccal mucosa carcinoma is alarmingly high, especially among men. This subsite alone accounts for over 40% of all oral cancers reported in India, with a particularly high burden in states like Uttar Pradesh, Andhra Pradesh, Tamil Nadu, and Maharashtra (ICMR-NCDIR, 2020).[4]Surgery is a primary mode of treatment for most oral cancers, especially when diagnosed at early or moderately advanced stages. The goal of surgery is complete tumour excision with adequate margins, ensuring local disease control while preserving as much function and aesthetics as possible.[5]

To address these complications, early post-surgical physiotherapy is vital. Physiotherapy focuses on improving jaw mobility, reducing scar contracture, enhancing respiratory function, and assisting in overall recovery. The integration of physiotherapy into the rehabilitation plan has shown positive outcomes in improving quality of life, functional recovery, and long-term prognosis (Pauloski BR, 2008).[6]

Physiotherapeutic interventions such as passive and active jaw stretching exercises, therabite devices, and manual techniques have been proven effective in improving interincisal distance and reducing pain (Pauloski BR, 2008).[6] Chest expansion exercises are a cornerstone of pulmonary rehabilitation and are especially important in the post-operative management of oral cancer patients. Chest expansion exercises aim to improve lung volumes, prevent post- operative pulmonary complications, and enhance overall functional capacity.[7]

Maximum mouth opening is a significant diagnostic criterion for preliminary evaluation of stomatognathic system especially for those with temporomandibular problems. The MMO measurements were taken using a modified Vernier calliper while the subjects rested their heads against a firm wall surface in an upright position.[8]

Breathing and oral exercises may improve chest expansion and mouth opening, reducing postoperative complications and enhancing quality of life. However, limited research exists on their effectiveness in buccal mucosa individuals. This gap highlights the need for studies to establish effective rehabilitation strategies.

Objective: The main objective of this study to assess the effect of breathing exercises on chest expansion in individuals with post operative buccal mucosa through measuring inch tape and to assess the effect of oral exercises on mouth opening in individuals with post

operative buccal mucosa using vernier callipers.

MATERIALS AND METHODS

Study method:

The study was conducted at Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, using a single group pretest / posttest design with a convenience sampling technique. A total of 30 participants were included, and the treatment duration was 1 week. Post operative oral cancer individuals of age group 40-60 years of both male and female and who were medically stable individuals were included in the study. Individuals who were mentally unstable, who were participating in any other ongoing research project, a stage of metastasis, with pulmonary diseases and pulmonary complications, and with facial palsy, not willing to participate in the study were excluded in the study.

Ethical approval:

The study was commenced after obtaining permission from the Institutional Ethics Committee [IEC no-1844] Subjects who fulfilled the inclusion criteria and were explained about the study procedure and after obtaining informed consent were included in the study.

The baseline measurements age, gender, chest expansions were assessed and measured using an inch tape and vernier callipers. Breathing exercises and oral exercises were explained to the participants.

Study procedure:

A total of 30 individuals with oral cancer who met the inclusion criteria were recruited for the study after obtaining written informed consent. Participants underwent a one-week intervention program that included chest physiotherapy exercises and oral opening exercises 10 rep / 2 sessions / day per 20 mins. Data were collected before and after the intervention, and the results were systematically analysed to evaluate the effectiveness of the rehabilitation program.

Outcome measures

Chest expansion was measured by using inch tape in centimetres, Mouth opening was measured by using vernier calliper in centimetres.

Results

The data collected was tabulated in a excel sheet and Analysed using SPSS software version 23.0 then all continuous data are presented as mean and standard deviation. Shapiro wilk test was used to test the normality of data a paired t-test was used to analyse the pre and post intervention values.

Table: 1 This table depicts that the average (mean) age of the participants is **52.10 years**. The standard deviation (SD) is **5.148**, which indicates that most participants' ages are within approximately ±5.15 years of the mean. This suggests that the age distribution is relatively tight, with most individuals falling within the age range of about **47 to 57 years**.

VARIABLE	MEAN	SD
Age	52.10	5.148

Table: 2 This table depicts that the mean value of Gender. There are 30 participants in total. Among them, 14 are male (46.7%) and 16 are female (53.3%). The gender distribution is fairly balanced, with a slight majority of females.

GENDER	MALE	FEMALE
30	14	16

This depicts that the results of the Shapiro-Wilk test show that both pre and post values of axillary, nipple, xiphoid and mouth opening, have p value greater than 0.05, indicating the data is **distributed normally**. Based on the findings, as the data is normally distributed, it is appropriate to proceed with **parametric test** the group. Student T test is used for analysis. Paired t test is used to calculate pre and post-test of values within the groups.

Table- 3: Comparison of pre and post-test values of axillary level

Level		Mean	Mean diff.	P value
AXILLARY LEVEL	**PRE**	88.25	0.5033	<0.0001
	POST	88.75		
NIPPLE LEVEL	**PRE**	90.12	0.4500	<0.0001
	POST	90.57		
XIPHOID LEVEL	**PRE**	84.05	0.3700	<0.0001
	POST	84.42		

This table depicts a statistically significant increase in mean values at the axillary, nipple, and xiphoid levels following the intervention, with mean differences of 0.50, 0.45, and 0.37 units respectively (all $p < 0.0001$). These results indicate that the intervention produced a consistent and meaningful effect across all measured levels, with the changes being highly unlikely due to chance.

Table- 4: comparison of pre and post-test values of mouth opening

Mouth opening	Mean	Mean diff.	P value
PRE	2.387	1.210	<0.0001
POST	3.597		

This table depicts MOUTH OPENING - At 95% Confidence interval, the calculated t value is 82.53, whereas the table value is 2.045. As the calculated value is greater than table value with a p value of <0.001 is considered as highly significant.

DISCUSSION

The present study aimed that a structured program of breathing and oral exercises has a significant impact on improving chest expansion and mouth opening in patients with head and neck cancer undergoing radiotherapy. These findings are consistent with previous studies emphasizing the role of physiotherapy interventions in mitigating radiation-induced complications such as trismus and reduced thoracic mobility.Vivek Borse et al (2020) is a systemic review oral cancer is the sixth most common type of cancer with India contributing Nearly one-third of all occurrences of oral cancer occur in this country, making it the second most affected. The study concluded that focusses on the novel techniques developed by Indian researchers that have huge potential for application in oral cancer diagnosis.[9] Padmanidhi Agarwal, et al (2016) is a systemic review was conducted to trismus is a common complication in oral cancer patients, especially after surgery and radiotherapy, due to fibrosis and scarring of masticatory muscles. The study

showed a significant reduction in mouth opening post treatment using digital vernier callipers, particularly in advanced stage cases. Early physiotherapy and regular mouth-opening exercises are essential to prevent permanent restriction and improve postoperative quality of life.[10] Ching-Chi Hsiang, et al (2019) is a randomized control trail was conducted to determine the effect of oral exercise in addition to standard general care and diet counselling on the physiology of swallowing. This study concluded that the patients who performed additional early postoperative oral exercises showed a decrease in oral and pharyngeal residues and markedly improved P-A scale scores. Thicker boluses were found to enhance oral and pharyngeal residues more.[11] Sharma, A., et al (2014) is a systemic review stated that Chest physiotherapy encompasses a range of techniques aimed at enhancing respiratory efficiency, mobilizing secretions, and preventing pulmonary complications. The study concluded that by addressing respiratory complications and enhancing physical function, CPT contributes significantly to the overall rehabilitation and quality of life in this population.[12]

The present study has some limitations. Small sample size, Short duration of intervention and follow-up, study conducted at Single-center study, Limited outcome measures such as Only chest expansion and mouth opening were assessed. Functional outcomes such as speech, swallowing, pain levels, quality of life, and patient satisfaction were not evaluated, Lack of blinding.

Practical implications are Early post-operative breathing and oral exercises are effective, simple, and cost-effective interventions for improving chest expansion and mouth opening in buccal mucosa cancer patients. Their routine inclusion in post-surgical rehabilitation may help prevent complications and enhance functional recovery and quality of life.

Conclusion:

This study found that the intervention significantly improved chest expansion at the axillary, nipple, and xiphoid levels, as well as mouth opening, with all changes showing strong statistical significance ($p < 0.001$). Parametric analysis confirmed these results, highlighting the intervention's positive impact on respiratory mechanics and functional mobility. Overall, the findings support the intervention's effectiveness in enhancing pulmonary function and clinical outcomes.

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