



Original Research Article

Does Radiation Therapy swallow up the Swallowing Abilities when Laryngeal Area is spared? A Preliminary Study

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ABSTRACT

Introduction: Certain treatment strategies result in some amount of side effects though their effects on the disease for which they have been recommended is satisfactory. One such treatment option is radiation therapy for cancer individuals. Though it's commonly known that radiation therapy of head and neck cancer would possibly cause swallowing difficulties, extend of its effects and recovery is unknown. Therefore the aim of the study is to determine effects of radiation therapy on swallowing abilities in non-laryngeal head and neck cancer individuals.

Methods and Material: Swallowing measures was carried out using a subjective tool, Manipal Manual of Swallowing assessment (MMSA) which was administered on pre-treatment, immediate post treatment and one month after post treatment on individuals undergoing radiation therapy for non-laryngeal head and neck cancer. Study was carried out in a Multi-speciality disciplinary hospital setup for a duration of two years. The study followed a prospective study design

Statistical analysis: Statistical analysis was done using ANOVA repeated measures and paired t test.

Results: Statistical significant mean difference was seen for all the parameters on three time points of the assessment.

Conclusions: The study reveals that radiation therapy significantly affects swallowing abilities of the individual, and these difficulties are of short term duration with recovery seen after a period of time.

Key-words: Radiation therapy, Head and neck cancer, Swallowing, Manipal Manual of Swallowing Abilities.

INTRODUCTION

Radiation therapy used to eradicate cancer cells abolish chemical bonds in the genetic material of the cells, leading to cell death. Though the radiation beams are targeted to cancer cells, they affect healthy cells too resulting in side effects. Dysphagia is one such commonest effect. Dysphagia can be due to the damage to the mucosa and

soft tissue in structures due to radiation treatment. [1] As only limited studies have quantified the extent of difficulties in swallow, this study aims to understand the effect of radiation therapy on swallowing in non-laryngeal head and neck cancer.

MATERIALS AND METHODS

15 individuals in the age range of 18 to 74 years with mean age of 60.34 years who were newly diagnosed with carcinoma of non-laryngeal head and neck cancer, undergoing radiation therapy were considered for the study. These subjects were treated with radiation therapy alone with no other treatments such as chemotherapy. Among the 15 individuals enrolled for the study, 4 had carcinoma of tongue, 3 had carcinoma of thyroid gland, 2 with brain tumours, 2 with carcinoma of mandible, 2 with nasopharyngeal cancer and 2 with carcinoma of buccal mucosa. These participants did not have any previous history of neurological disorders, swallowing issues, respiratory disorders and any related issues prior to radiation treatment. All participants who had undergone prior treatment with radiation therapy and chemotherapy was excluded from the study. Such that only newly diagnosed individuals in Department of Oncology, later referred to Department of Radiation therapy for treatment regimen was recruited for the study.

These participants were assessed for swallowing functioning on their course of treatment. Swallowing measures were carried out using Manipal Manual of Swallowing Assessment (MMSA) given by Balasubrahmaniam and Bhat, 2012. This tool permits subjective evaluation of the elements of dysphagia which can be quantified. Different items in the tool helps to compute extend of difficulty in these participants undergoing radiation treatment. Each item was scored based on the manual description and totalled for final scores. Manipal manual of swallowing assessment (MMSA), assess 4 main domains which reveal adequate information on dysphagia in participants. Sensory assessment provides information on the sensory aspects of each structures assisting swallow. Light and deep pressure contacts are used to assess this

function. On motor assessment, the oral structures were observed in rest and during movements. These structures were also checked for any structural abnormalities in order to verify interference with swallowing. Assessment of phases of swallow was carried out by observing swallow of participants with different food consistencies. Subjects were asked to carry out dry swallow, thick liquid swallow, thin liquid swallow and solid swallow by using the mentioned consistencies as described in the manual. Tolerance of different consistencies by the participant was also noted on evaluation. The total score was derived by obtaining aggregate of all domains in the tool.

The swallowing assessments were done three times on each of the 15 participants. The time points of assessment were a) pre-treatment (before the commencement of the radiation treatment), b) post treatment (immediately (within 2 days) after the radiation treatment) and lastly c) one month after post treatment (one month after the completion of radiation treatment). The assessments made were scored, tabulated and analysed. Statistical analysis was carried out using the SPSS software package (SPSS, Inc., Chicago, IL) using ANOVA repeated measures and paired t-test to compare the parameters such as sensory assessment, motor assessment, assessment of phases of swallow and total score in MMSA at the 3 different time points namely pre-treatment verses post treatment, post treatment verses one month after post treatment and lastly pre-treatment verses one month after post treatment measures. A p value of less than 0.025 was taken as indicating significant difference.

RESULTS

Post hoc tests using the Bonferroni correction revealed statistical significance of mean scores difference for all time points of the study for Sensory assessment ($F(2,15)=$

7.108, $p=.009$, Motor assessment ($F(2,15)=5.941$, $p=.016$), Assessment of phases of swallow ($F(2,15)=47.148$, $p=.000$) and Total score on MMSA ($F(2,15)=30.250$, $p=.000$).

In order to verify statistical significance between two time points alone, paired t-test was used in the study. The details of the values obtained on MMSA for all parameters such as mean, standard deviation and results of paired t-test are detailed in table I. On paired t-test, significant difference was seen when pre-treatment and post treatment values were compared for sensory, motor, assessment of

phases of swallow, and total score on MMSA. Comparison between post treatment and one month after post treatment showed significant difference for motor assessment, assessment of phases of swallow, and total score, but sensory assessment did not show any significant difference. There was no significant difference seen for any of the parameters namely sensory assessment, motor assessment, assessment of phases of swallow and total score when pre-treatment measures were compared with one month after post treatment values.

Table I: Mean, standard deviation and p value on paired t-test for all the parameters

| Parameter | | Mean | SD** | Pre Vs post treatment | Post Vs one month post treatment | Pre Vs one month after post treatment |
|---------------------------------|--------------------------|---------|--------|-----------------------|----------------------------------|---------------------------------------|
| | | P value | | | | |
| Sensory Assessment | Pre Treatment | 6.714 | 14.30 | .004* | .036 | .030 |
| | Post Treatment | 8.714 | 15.81 | | | |
| | One Month Post Treatment | 5.571 | 13.86 | | | |
| Motor Assessment | Pre Treatment | 18.285 | 17.63 | .000* | .023* | .215 |
| | Post Treatment | 24.571 | 16.79 | | | |
| | One Month Post Treatment | 11.571 | 13.02 | | | |
| Assessment of phases of Swallow | Pre Treatment | 4.714 | 7.84 | 0.0* | 0.00* | .534 |
| | Post Treatment | 25.0 | 5.32 | | | |
| | One Month Post Treatment | 5.142 | 7.267 | | | |
| Total Score | Pre Treatment | 29.714 | 35.668 | .000* | .001* | .203 |
| | Post Treatment | 58.285 | 32.739 | | | |
| | One Month Post Treatment | 22.285 | 33.812 | | | |

** - Standard Deviation, * - Significant Difference ($p<0.025$)

DISCUSSION

Sensory assessment showed significant difference when pre-treatment and post treatment measures were compared. The significance in sensory assessment scores in the current study is in agreement with the findings that, sensory input at oral preparatory and oral pharyngeal phase decreased as an effect of radiation. [2] Paresis of oral structures is yet another factor contributing for altered sensation. [3] Radiation therapy also effects recognition of

taste in mouth. [4] These findings can also be partly considered as an effect of pain in oral structures during assessment process in especially in carcinoma of structures of oral cavity. Motor assessment showed significant difference on pre-treatment Vs post treatment as well as post treatment Vs one month after post treatment measures. The change in the motor assessment scores could be attributed to restricted movements of the articulators, and pain while moving the articulators. Also, decreased base of tongue

to posterior wall contact and reduced pharyngeal contraction affecting bolus transport [5] are contributing factors. In addition, decreased laryngeal elevation and penetration have also been reported. Research evidences has also supported the evidence of the current study by giving a list of abnormalities observed in motor movements related to swallowing in post radiation patients. [2] Radiation therapy can cause difficulties in pharyngeal contraction and laryngeal elevation due to fibrosis developed at the pharyngeal muscles and soft tissues. [6] The change in scores at various phases of swallowing were related to certain aspects such as cough while swallowing, post swallow gurgly voice, multiple swallows, etc. These deficits were probably due to oral phase impairment which would include reduced range of tongue movement, reduced tongue strength, impaired bolus formation, reduction in bolus transport in oral cavity, longer oral transit times, and increased food residue in oral cavity. [7] Impairments such as restricted posterior movement of tongue base, impaired closure of velopharyngeal port, and delayed triggering of the pharyngeal swallow at pharyngeal phase swallow which would affect different phases of swallow. [8] Pain, xerostomia, thickened viscous mucous production, and tissue swelling [9] can contribute to acute dysphagia. Also, increased acute inflammation may increase late effect fibrosis and lymphedema resulting in dysphagia. [2] Reduced inversion of epiglottis, longer time in swallowing, incoordination in timing of propulsion of food, pooling of residue in vallecula and pyriform fossa [10] can be regarded as reasons for dysfunctioning in phases of swallow. The result on month after post treatment versus pre-treatment can be contributed to the recovery taking place in these individuals once the treatment is over. On pre-treatment measures, these participants exhibited near normal or

slightly deviant values than normal healthy individuals whereas on post treatment assessment, they exhibited highly deviant parameters and values compared to their pre-treatment values obtained in Manipal Manual of Swallowing Abilities (MMSA). On one month after completion of radiation therapy, these participants showed better scores compared to their post treatment values indicating that there is some amount of improvement seen during the time when treatment (radiation therapy) is terminated. During this period, a recovery is seen in overall swallowing measures. As a fact, while comparing pre-treatment values with one month after post treatment, they show no significant difference which again emphasizes on the recovery towards baseline. This suggests that the dysphagia they develop is temporary and would recover in due course of time. This study has highlighted the fact that though laryngeal area is spared from radiation in non-laryngeal head and neck cancer individuals, they do exhibit swallowing difficulties due to the treatment regimen followed. These difficulties seen in them are of shorter duration and recovery towards baseline is sure to notice after a period of time.

The current study revealed the significance of a tool to measure swallowing in these participants. Also the tool used in this study showed the importance of assessment and management needed in these participants for their swallowing abilities. Manipal manual of swallowing abilities (MMSA) revealed significant differences at all time frames in all parameters such as sensory assessment, motor assessment, assessment of phases of swallow, and total scores. However, one month after post treatment scores were found to be better than that of post treatment suggesting that there is a pattern of recovery seen which emerges towards the baseline; measures on one month after post treatment compared

with pre-treatment measures confirms this fact.

CONCLUSION

The current study aimed at finding out extends of swallowing difficulty in individuals undergoing radiation therapy for non laryngeal head and neck cancer. Its been very much known that, radiation therapy of laryngeal cancer would possibly cause swallowing difficulties. This study focussed on effects of this treatment regimen when laryngeal area is spared. The findings state that, swallowing abilities can be compromised in the progress of radiation therapy but these difficulties are of temporary concern as they would regain their swallowing abilities. The swallowing specialists need to provide adequate therapy during the course of the treatment in order to fasten up the recovery process and also adequate counselling is needed on this regard to the patient and family. This also creates insight to the swallowing specialists about the course of swallowing deficits and its recovery; further enhancing knowledge in dealing with non laryngeal head and neck cancer individuals.

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