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PERTURBATION MEASURES? – A PRELIMINARY STUDY POST CHEMOTHERAPY

Audiology

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ABSTRACT

BACKGROUND: The purpose of this study was to investigate perturbation measures - jitter and shimmer in participants undergoing concurrent chemoradiotherapy for non-laryngeal head and neck cancer. An insight into their voice measures is necessary for the identification and management of these individuals and also to have clarity on the recovery of voice if present.

METHOD: Recordings were carried out on 26 non laryngeal head and neck cancer participants on two time basis, once prior to the treatment regimen and another on post treatment using Multidimensional Voice Profile Software (Model 4150: Kay Elemetrics Corp).

RESULTS: Both the parameters showed higher values on post treatment measures with statistical significant differences (P< .005).

Conclusion: Chemoradiotherapy for non-laryngeal head and neck cancer significantly affects perturbation measures of voice.

KEYWORDS

Chemoradiotherapy; Perturbation; Jitter; Shimmer

INTRODUCTION

Cancer is the growth of cells which proliferate in an uncontrolled way due to changes in gene expression leading to deregulated balance of cell proliferation and cell death, ultimately evolving into group of cells which invade tissues and are able to metastasize, causing morbidity (Ruddon, 2007). Cancer which arises in the head or neck region is referred to as head and neck cancer. Parkin (2005) opined that head and neck cancer is the sixth most common type of cancer, representing about 6% of most of all cases and accounts for an estimated 650,000 new cases each year. In the current Indian scenario, head and neck cancer are the commonest cancer which occupies about one-third of all cancers in the world. From the reports of the Indian Council of Medical Research, it is estimated that, approximately 0.2 to 0.25 million new head and neck cancer patients are diagnosed each year (Takiar, Nadayil & Nandakumar, 2010). The major sites of head and neck cancer include paranasal sinuses, nasal cavity, lips, oral cavity, salivary glands, larynx, pharynx - nasopharynx, oropharynx, hypopharynx, and lymph nodes in the upper part of the neck.

Concurrent chemoradiotherapy has found its way as a dominant treatment modality to improve control of head and neck cancer (Paleri etal., 2011),in spite of concerns pertaining to treatment related morbidity. Chemoradiotherapy is often associated with acute and late toxicities due to its radio sensitization effects which results as various side effects. These can have a significant impact on the patient's quality of life (Surkin, Schwartz, Markiewicz, 2013). Acute toxic effects are relatively common, which range from minor to severe complications. The overall acute and late toxicities reported in literature include seizures, tingling of the extremities, numbness, loss of tendon reflexes, weakness of limb, cardiac issues like tachycardia, tachypnea, ventricular dilation, pulmonary, venous congestion, poor perfusion and pleural effusion, dermatitis and myelosuppression, difficulties with swallowing, chewing, speech, taste, saliva, and pain. (Kvolik, etal, 2003; Maracic, Van, Beach, 2007), Along with these side effects, literature reveals of deviant voice quality in these individuals post treatment. The purpose of this study was to perform a comprehensive evaluation of voice in survivors of non-laryngeal head and neck cancer who had undergone chemoradiotherapy as treatment. The parameters taken in the study to understand the voice quality in these patients include jitter and shimmer. These perturbation measures help to find out the deviancies in the voice related characteristics and also to help the professionals understand the change in voice and plan subsequent change sin treatment and rehabilitation.

METHOD

The study recruited 26 participants within the age range of 18 to 74 years, diagnosed with squamous cell carcinoma of head and neck beyond stage III of cancer, planned for concurrent chemoradiotherapy. Voice recordings, using Multi-Dimensional Voice Program (MDVP) software were made twice namely; before the initiation of the treatment and soon after the treatment in each participant. These recordings were carried out using a condenser microphone attached to computerized speech lab with MDVP module, at a distance of about 10cm away from the mouth of the participant for a sustained phonation of /a/ at the most comfortable pitch and loudness in the soundproof room. Perturbation measures such as jitter and shimmer were taken into consideration and statistical analysis was performed using paired t test at 5% probability level. Participants with previous history of voice and related disorders were not included in the study.

STATISTICAL ANALYSIS

Statistical analysis was performed using paired t test for comparison between the pre treatment values and post treatment measures.

RESULTS

This study aimed to assess the perturbation measures of voice in patients undergoing concurrent chemoradiotherapy. Statistical paired t test was done to compare the pretreatment and post treatment values for jitter and shimmer. The values were subjected to mean and standard deviation measures. The results indicated significant mean difference between pretreatment and post treatment values for jitter and shimmer. Also, higher post treatment mean values were noted for both.

Parameters	**Mean**	**SD**	
Parameters	**Mean**	**STD**	
Jitter	Pre Treatment	1.967	1.697
	Post Treatment	3.893	3.573
Shimmer	Pre Treatment	4.221	2.445
	Post Treatment	7.98	6.753

Table 1: Jitter and Shimmer values for pre and post treatment

***SD – Standard Deviation**

Table 1 depicts pre and post treatment values for these participants. Significant difference between pretreatment jitter (M=1.96, SD=1.697), post treatment jitter (M=3.893, SD=3.573) condition; t (26) = -4.681, p=.005 and pretreatment shimmer (M=4.221, SD=2.445) and post treatment shimmer (M=7.98, SD=6.753) condition; t(26)= -3.397,p=.005 were delineated. These results suggest that, there is significant change in the perturbation measures post chemoradiotherapy indicating, effect of chemoradiotherapy on participants' voice acoustics.

DISCUSSION

Lazarus opined that effects of chemoradiotherapy on voice have been identified in terms of acoustic measures of perturbation such as for jitter and shimmer (Smith, 2003). The current findings revealed that, the jitter and shimmer values were higher on post treatment evaluation when compared with the pretreatment values. These findings are significant as most of the head and neck cancer patients exhibit voice changes after chemoradiotherapy. Paleri et. al study reported that chemoradiotherapy for nonlaryngeal head and neck cancer significantly affects patients self-reported voice quality which is concordance with present study. Also, Jacobi,etal (2010) stated that voice and speech measures do not show normal values either before or after chemoradiotherapy for advanced head and neck cancer. Another study by Honocodeevar-Boltežar & Žargi (2000) revealed that, irradiated subjects demonstrated significantly higher values for jitter and shimmer compared with those of normal group which again

coincides with the study findings of Kazi etal (2008). Lehman, Bless & Brandenberg (1986) reported abnormal post-radiation voices in head and neck cancer patients in line with this They demonstrated increased jitter, shimmer values and suggested that these increased perturbation characteristics are due to poor vocal fold activity following radiotherapy. This could be attributed to the effect of the treatment on vocal areas such as reduced lubrication and hydration of the cords, irregularities of the vocal fold vibration and even weakening of the vocal cords. This may also be a resultant of stiffness of the vibratory source and inadequate compensatory maneuvers in phonation owing to the chemotherapy treatment. Sjögren, Rossum, & Langeveld (2008) opined that abnormal acoustic measures were attributed to impairment of vocal fold vibration, as observed stroboscopically, with incomplete closure and reduced mucosal wave, as well as ventricular activity which indicate hyper function of vocal cords. This can also be attributed to effects of radiation such as fibrosis of soft tissue which limit the normal range of muscle motion. The above literatures are in line with the current findings of our study. Therefore, it's necessary to probe into extend of voice deviancy in these participants and their recovery pattern. The future research could point to the areas of different drugs used in chemotherapy and the dosage of radiation with site of carcinoma. This study indicates that, chemoradiotherapy has a significant effect on the voice acoustics even though larynx is spared from carcinoma and its subsequent treatment. The post treatment values of jitter and shimmer suggests that voice-related measures are severely affected in these participants; and can hence have a negative impact on overall quality of life. Rehabilitation on this aspect can improve the quality of life in survivors. Thus, it is necessary that, treatment should extend beyond the issues of oncological cure alone, addressing voice and related quality of life post treatment for success of oncological management. Therefore, the authors try to answer the questions of concerns raised during pre-treatment counseling by majority of patients in spite of laryngeal area being spared during course of treatment. Yes, indeed the patient would certainly feel change in voice acoustics; but they are fortunate enough to have proper guidance from a speech therapist to help them.

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