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Health Science

COMPARISON OF VOICE ASPECTS ON RADIOTHERAPY AND CHEMORADIOTHERAPY PATIENTS

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ABSTRACT

Background: Evidence on acoustics of voice of radiotherapy and chemoradiotherapy patients are limited; also comparison of voice quality between the two groups are yet to be explored. The study aims to find the voice abnormality in these patients and also to compare voice parameters based on the treatment (Radiation therapy, chemoradiation ther) regimen used.

Method: 15 participants undergoing radiotherapy (Group 1) and chemoradiotherapy (Group II) for head and neck cancer sparing laryngeal cancer was evaluated using Multidimensional Voice Program on three time frames viz pretreatment, immediate post treatment and one month after post treatment. Statistical analysis was done using ANOVA repeated measures and paired t test.

Results: All acoustic parameters showed significant difference between two groups for pretreatment vs post treatment and for post treatment vs one month after post treatment evaluation. Whereas, significance was seen only for jitter on pretreatment vs one month post treatment evaluation.

Conclusion: Significance in parameters indicate that treatment regime followed have substantial impact on voice parameters. Also no significance in NHR and SPI points to the direction of recovery. The understanding of voice measures in these participants would yield professionals with better knowledge during management.

KEYWORDS : Jitter; Noise to harmonic ratio (NHR); Soft phonation index (SPI).

INTRODUCTION

Radiotherapy and chemoradiotherapy are the frequently used treatment regime for treating patients with cancer. Though these are effective in eliminating cancerous cells, they also affect normal healthy cells and tissues due to which patient exhibit varied forms of side effects. These short and long term effects vary from mild to severe form based on the treatment used. Often these effects are associated with the type of drug, dosage and the schedule of drug (Lefor,1999) . Adelstein & Adams (2003) reported that toxicity was on a higher grade with concurrent chemoradiotherapy than with radiotherapy alone. As these treatment strategies affect most of all the systems of body, a hand full of them points to changes in voice seen in them. Though there are adequate literatures on effects of radiotherapy on voice in patients with nonlaryngeal and laryngeal head and neck cancer, studies suggesting effects chemoradiotherapy on voice are limited. Lazarus (2009) stated increased jitter, shimmer, noise to harmonic ratio and fundamental frequency in individuals undergoing radiotherapy and chemoradio therapy. The voice changes after radiotherapy include reduced vocal intensity, reduced speaking pitch, reduced respiratory support for phonation, vocal hoarseness, roughness, breathiness, and vocal fatigue etc (Morris, Canonico, & Blank, 1994). It is estimated that 87.8% of individuals with irradiated larynx reported of abnormal voice, ranging from slight-to-moderate impairment (Šiupšinskienė et al 2008). Higher values for jitter, shimmer, degree of voiceless elements, noise to harmonic ratio was found in irradiated larynx than in healthy individuals (Irena, 2000). Also irregularities in vocal cord vibration and voice fatigue is reported in them (Bibby, Cotton, Perry, & Corry, 2008). Pretreatment and early post treatment acoustic measures for non-laryngeal head and neck patients state that chemoradiotherapy has a significant effect on the patients' self-reported voice quality in long term (Paleri, 2011).

MATERIAL AND METHOD:

The study followed prospective study design with convenient sampling where 15 participants undergoing radiotherapy (Group I) and chemoradiotherapy(Group II) for non laryngeal head and neck cancer was taken. These participants were included with prior consent and patients with no history of voice or related disorders were recruited for the study. Both the study groups were assessed for acoustic parameters such as jitter, noise to harmonic ratio (NHR) and soft phonation index (SPI) using Multidimensional Voice Program (Computerized Speech Lab Model 4150: Kay Elemetrics corp), a software from Kay-electronics, New Jersey. The participant was seated comfortably in a sound treated voice laboratory and was instructed to produce a sustained phonation of the vowel /a/ preceded by a deep inhalation. These recordings were picked up by a condenser microphone placed at a distance of 10cm approximately from the mouth of the participant. These evaluations were done on both the groups for three time points namely pretreatment, immediate post treatment and one month after post treatment. The findings were analysed using statistical methods of ANOVA repeated measures and paired t test for significance of p value less than 0.025.

RESULTS

ANOVA repeated measures and paired t test was used during statistical analysis to find the significance within the three time frames (pretreatment, post treatment and one month after post treatment) and between two time frames (pretreatment vs post treatment, post treatment vs one month after post treatment and also pretreatment vs one month after post treatment) in both the groups respectively.

As indicated in table 1, Radiotherapy participants (Group I) showed statistical significant main differences between the three time points such as pretreatment, post treatment and one month after post treatment for all of the voice acoustic parameters such as jitter ($F(2,15)= 19.078$, $p= .00$), noise to harmonic ratio ($F(2,15)=10.678$, $p= .002$) and soft phonation index ($F(2,15)= 11.884$, $p= .001$). Significance was seen for all parameters (jitter, NHR, and SPI) when pretreatment and post treatment measures were compared on paired t-test. When post treatment and one month post treatment measures were compared, statistical significant difference was seen only for jitter. Whereas when pretreatment measures were compared with one month after post treatment measures, no statistical significance was observed for noise to harmonic ratio, and soft phonation index, whereas jitter values exhibited significance.

Table 1: Representing means for acoustic parameters of radiotherapy (Group I) and Chemoradiotherapy (Group II) participants.

Acoustic parameters	Groups	Pretreatment	Post treatment	One month after post treatment
Mean jitter (%)	I	2.383	4.730	3.375
	II	2.631	5.012	3.783
Mean NHR	I	0.172	1.228	0.317
	II	0.154	1.017	0.518
Mean SPI	I	22.689	40.968	34.380
	II	25.040	39.336	28.336

In chemoradiotherapy participants (Group II), statistically significant main differences was seen between all the three time points namely pretreatment, post treatment and one month post treatment for all the acoustic parameters such as jitter, noise to harmonic ratio and soft phonation index. Post hoc test using Bonferroni correction revealed significance between pretreatment and post treatment values for jitter ($p= .012$), noise to harmonic ratio ($p=.008$) and soft phonation index ($p=.021$). Likewise, Paired t-test represented similar findings when pretreatment was compared with post treatment measures revealing significance on all parameters. When post treatment and one month post treatment measures were compared, statistical significance was seen for jitter and soft phonation index but not for noise to harmonic ratio. On the other hand, no significant difference was seen for any of the acoustic parameters when pretreatment measures were compared with one month post treatment values.

Comparing radiotherapy (Group I) and chemoradiotherapy (Group II)

participants as shown in table 2, statistical significant difference was seen on all parameters (jitter, NHR and SPI) for pretreatment vs post treatment measures and also for post treatment vs one month after post treatment. However, pretreatment vs one month post treatment values revealed significance only for jitter value.

Table 2: Representing statistical values for acoustic parameters on comparison of radiotherapy (Group I) and Chemoradiotherapy (Group II) participants for the time frames of pretreatment vs post treatment, post treatment vs one month after post treatment and pretreatment vs one month after post treatment.

Parameter	Radiotherapy (Group I) vs Chemoradiotherapy (Group II)		
	Pre vs Post treatment	Post vs one month post treatment	Pre vs one month after post treatment
	p value	p value	p value
Jitter (%)	.000*	.000*	.013*
NHR	.000*	.006*	.122
SPI	.000*	.008*	.053

*Significant difference ($p<0.025$)

DISCUSSION

In the current study, acoustic parameters such as jitter, NHR and SPI were compared between the two treatment groups namely; radiotherapy (Group I) and chemoradiotherapy (Group II). The observations revealed significance in all time points as on pretreatment, post treatment, one month after post treatment and for pretreatment vs post treatment for all parameters in both the groups. Post treatment vs one month after post treatment measures exhibited significance in jitter in group I whereas group II showed significance for jitter and SPI. On pretreatment vs one month after post treatment, significance was seen for jitter in group I while group II had no significance in any of the parameters. On group I vs group II, statistical significance was seen for both pretreatment vs post treatment and for post treatment vs one month after post treatment. On the other hand, only jitter revealed significance in pretreatment vs one month after post treatment measures.

The above findings are in concordance with studies from literature that radiotherapy and chemoradiotherapy has significant effect on person's voice related measures. Patients undergoing chemoradiotherapy had varied voice acoustics based on patients and clinicians' perception (Lazarus, 2009). Change in voice measures post radiotherapy in terms of hoarseness, roughness and breathiness are reported in literature (Morris, Canonico, & Blank, 1994; Stoicheff, 1975; Stoicheff, Ciampi, Passi, & Fredrickson, 1983). The results of our current study can be compared to previous studies which highlighted to the fact that, voice variability and unpredictability to be the common complaints of patients undergoing radiotherapy (Orlikoff, & Kraus, 1996). The difference in voice parameters in both the groups were assumed to be due to laryngeal mucosa dryness, atrophy of laryngeal muscles, erythemia, fibrosis, reduced lubrication of vocal folds as a result of these treatment regimen (Lazarus , 2009). Similar findings for jitter is noted in prior researches too (Bibby, Cotton, Perry, & Corry, 2008; Paleri, Carding, & Chatterjee, 2011).Further improved voice quality is noted as time progresses after post treatment (Irena, 2000). This recovery of voice on these participants as stated by above authors, are in line with the findings of our study. As time advances post treatment, all the acoustic parameters in the current study showed lesser variability, indicating recovery. Though jitter showed significance in pretreatment vs one month after post treatment for radiotherapy (Group I) participants, the variability exhibited in one month post treatment evaluation was reduced compared to that of post treatment value indicating a progress towards improved voice. On contrary, few studies state that voice changes in head and neck cancer survivors never recover to former condition. The findings across the radiotherapy (Group I) and chemoradiotherapy (Group II) participants, suggests that the treatment followed has a significant impact on persons voice parameters. This can be certain from the fact that, toxicity for chemoradiotherapy is of higher degree compared to participants of radiotherapy alone (Adelstein, & Adams, 2003). Further these toxic effects are linked to the type of drug prescribed, its total dose and also the schedule of drug (Lefor, 1999). The current study focused on the change in voice acoustics caused by two different treatment regime for non laryngeal head and neck cancer. Though these treatments spared laryngeal area, their effects on voice parameters were observable. Hence, this study, put forth a confirmatory evidence on change in voice acoustics in participants undergoing radiotherapy and chemoradiotherapy. Congruently, it also indicates that, the type of treatment (radiotherapy or chemoradio therapy) followed in these participants has an effect on voice measures. These valid evidences hones the medical professionals and speech language pathologists with understanding of voice changes and its recovery on nonlaryngeal head and neck cancer patients creating a strong basis for counselling prior to the treatment and also in due course of management of voice in them.

The possible limitation of the study can be inclusion of all head and neck cancer except laryngeal cancer, consideration of participants irrespective of their drug prescription and radiation dosage. This study can be further carried out by narrowing down the participant criterion, drug and radiation dosage as mentioned above.

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