

Phonetic analysis of functional disorders of vocal articulation in cases of intra-oral carcinoma – a pre- and postoperative long-term study

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ABSTRACT

This study explores pre- and postoperative speech motor abilities in cases of patients suffering from cancer in the oral cavity affecting the tongue or the floor of the mouth. Depending on the course of therapy (surgical treatment vs. radio-chemotherapeutical treatment vs. combination of surgery and postoperative radio-chemotherapy) intra-oral carcinoma leads to varied forms of functional articulation disorders. The results reveal that radio-chemotherapy is the most important factor concerning the impairment of speech motor abilities, whereas the localization of the cancer seems to be less important.

1. INTRODUCTION

The main objective in medical therapy of malignant tumors is the complete resection of the carcinoma. Besides the effort to achieve the survival of the patient, it could be observed over the last decades that therapy focused more and more on the endeavour to maintain simultaneously the quality of life of tumor patients. For patients suffering from intra-oral cancer this implies the maintainance of speech motor abilities, in addition to minimizing the post-therapeutic impairments of mastication and swallowing [1, 2, 3, 4]. The present study forms part of a long-term study which was carried out in order to illuminate the effects of different medical therapies on the speech production of 11 patients suffering from cancer. The principles of treatment depended on localization, state and histologic type of malignoma, therefore the different applied procedures will be explained, and subsequently the observed changes in articulation will be presented. Main objective was the evaluation of vowel articulation.

2. METHOD

2.1 Patients

In five cases the cancer affected the floor of the mouth (fm), in six cases the tongue (t). The histologic analyses confirmed in ten cases a keratinizing squamous cell carcinoma (PECA) and in one case a semi-malignant ameloblastoma (AB). Concerning the treatment, generally the tumor was

removed (res), mostly the resulting defect was closed with tissue flaps (rec). Radiotherapy (ra) and chemotherapy (ch) were applied as postoperative as well as primary therapy (Tab. 1). Nine patients who underwent surgical treatment participated in four speech recording sessions: one preoperative recording (recording session 1) and three postoperative recordings after two, twelve and 24 weeks (recording session 2, 3, 4). Two patients were treated solely by radio-chemotherapy and participated in one pre-therapeutic and one post-therapeutic recording session (recording session 1 and 2).

patient	age	group	diagnosis	locus	ch	ra	res	rec
fm1	45	I	PECA	fm	-	-	x	x
fm2	48	I	PECA	fm	x	x	x	-
fm3	41	I	PECA	fm	-	-	x	x
fm4	59	I	PECA	fm	x	x	x	x
fm5	73	I	AB	fm	-	-	x	x
t1	37	II	PECA	t	x	x	x	x
t2	60	II	PECA	t	-	-	x	x
t3	49	II	PECA	t	-	-	x	x
t4	34	II	PECA	t	-	x	x	x
t5	54	III	PECA	t	x	x	-	-
t6	56	III	PECA	t	x	x	-	-

Table 1: Study population

2.2 Material

For the acoustic analysis a selection of isolated sustained German vowels (i, e, ε, ø, y, a, o, u) and vowels (i, e, a, o, u) in initial position followed by a voiceless stop (p, t, k) in VCV-sequences was taken from the data obtained by the speech recordings.

Besides the pre- and postoperative speech recordings a standardized investigation protocol was applied to register pre- and postoperative functional abilities of the intra-oral muscles. Simultaneously, patients evaluated introspectively the functional disorders of articulation, mastication and swallowing by means of a rating scale from one (very good) to five (very bad).

2.3 Data

Speech recordings were carried out either in the hospital with a DAT-Walkman (Sony TCD-D8) or by means of a DAT-Recorder (TASCAM DA-20MKII) in the phonetics lab studio. Subsequently the acoustic data were transferred

therapy is the most important for the observed impairment of speech motor abilities, whereas the localization and the size of the cancer seem to be less important.

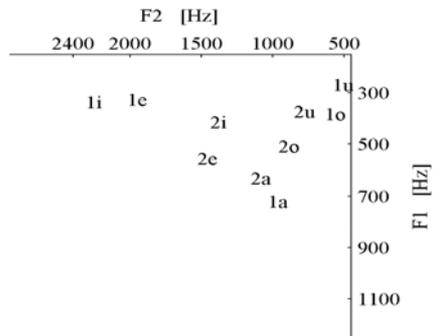


Figure 10: Centralization of F1 and F2 before and after primary radio-chemotherapy (t5)

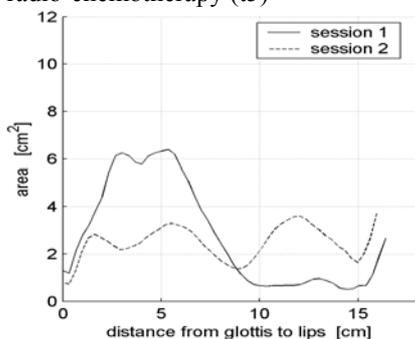


Figure 11: Reconstructed area function of the isolated sustained vowel /e/ (t5)

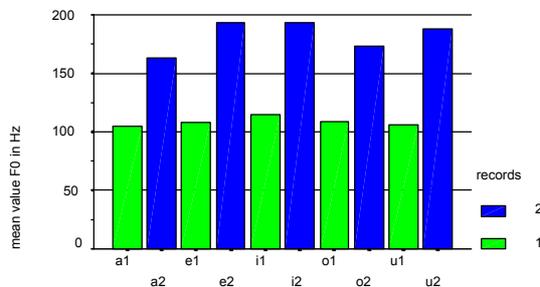


Figure 12: F0 before (recording session 1) and after (recording session 2) primary radio-chemotherapy (t5)

4. CONCLUSIONS

Although today one of the main therapeutic objectives is to maintain functional abilities of patients suffering from intra-oral cancer, only a few investigators have yet tried to clarify the specific effects of different medical treatments on speech production. This fact could be explained on the one hand by the difficulty in obtaining homogeneous groups of patients with regard to tumor localization and tumor size and the different surgical procedures. On the other hand the available number of comparable patients is too small to lead to statistically relevant statements with regard to specific effects of a therapeutic procedure on functional articulation abilities. Despite these difficulties and restrictions, studies of small populations or merely single case studies do lead to a better understanding of the

post-therapeutic effects on speech production, even if only tendencies can be discussed. The findings of the present study show clearly that patients suffering from cancer of the floor of the mouth tend to a centralization concerning the vowel articulation, while patients suffering from a malignant tumor of the tongue show a variety of changes of functional speech motor abilities, essentially depending on the localization of the tumor. In all cases radio-chemotherapy seems to be the most important factor concerning the impairment of speech motor abilities.

5. ACKNOWLEDGMENTS

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