SPEECH PRODUCTION AND PERCEPTION ANALYSES AFTER TOTAL OR PARTIAL GLOSSECTOMY CONTRIBUTION OF CINE- AND FUNCTIONAL MRI

ABSTRACT

Introduction This study aims at analyzing speech disorders after partial or total glossectomies. Severe modifications of the vocal tract induce speech intelligibility and vocalic and consonantal production impairments.

Materials and methods: patients who underwent oro-pharyngo-laryngeal surgery including glossectomy are selected. They are current patients at the ENT and Head & Neck Surgery Department of Strasbourg University Hospital. Examination of patients and control subjects during phonation are carried out using cervico-facial cine-MRI, video- and acoustic recordings[5]. The data for each patient are obtained at pre- and postoperative stages (approximately one week before surgery and 1, 6 and 12 months after surgery). Acoustical analyses focussed on the first three formant frequencies for vowels /i, a ,u/, and on the burst spectrum and Klatt's VOT for plosive consonants /t, d ,k, g/ appearing in VCV sequences (V=a). Speech intelligibility during spontaneous conversation is evaluated by an expert jury**.** Data are compared to the data i) of healthy subjects, ii) between pre- and postoperative periods to analyze compensation mechanisms in order to optimize speech therapy strategies[1,3].

Preliminary results: in a complex surgery case of total glossectomy, very early rehabilitation based on articulatory motor targets and initiated before recovery of phonation significantly improved segmental and suprasegmental speech components[3]. Elocution has not shown major deterioration of pitch and speech rate[2]. 5 months after surgical treatment and speech rehabilitation, Klatt's VOT duration values became similar to the Klatt's VOT duration values of control speakers. Timing constraints of consonant productions were perturbed and affected the glottal signal and articulatory coordination: voicing pulses of voiced plosives disappeared. Progressively, F1 and F2 values of /i, a, u/ varied and the acoustic vowel space augmented. F3, with lower values at the first postoperative recording, tended gradually to resemble "standard" values.

Conclusion: these results justify research including i) perceptual measurements, ii) acoustic analyses, iii) cine-MRI, in order to study and correlate data in the case of glossectomy. The combination between functional brain MRI and effects of surgical[1,4,6] and rehabilitative treatments could open new therapeutic perspectives.

References:

1. Abry C., Perrier P. : *Production de la parole en présence de perturbations fonctionnelles, pathologiques ou artificielles, Étude des mécanismes de ré-apprentissage et de récupération,* Rapport de fin de recherche, Institut de la Communication Parlée, Université Stendhal, Grenoble, 2002.
2. Fauvet F., Schultz P., Debry C., Hirsch F., Sock R.: *Intelligibilité de la parole après glossectomie totale et réhabilitation orthophonique précoce,* in Actes des XXVIèmes Journées d'Étude sur la Parole, pp. 451-454, Dinard, 2006.
3. Furia, C., Kowalski, L., Latorre, M., Angelis, E., Martins, N., Barros, A., Ribeiro, K.: *Speech intelligibility after glossectomy and speech rehabilitation,* Archives of Otolaryngology, Head and Neck Surgery, Chicago, 2001; vol.127, (7), pp. 877- 883.
4. Hesselmann V., Sorger B., Lasek K., Guntinas-Lichius O., Krug B., Sturm V. et al.: *Discriminating the Cortical Representation Sites of Tongue and Movement by Functional MRI,* Brain Topography, Volume 16, Number 3, Spring 2004, pp. 159-167.
5. Lebeau J., Savariaux C., Perrier P., Bettega G., Raphaël L. B. : *Évaluation fonctionnelle des reconstructions endobuccales. Un outil intéressant: l'interprétation articulatoire du signal acoustique*, Rev. Stomatol. Chir. Maxillofac., 2000 ; 101, n° 2, pp. 60-64.

6. Mosier C., Liu W.-C;, Behin B., Lee C., Baredes S.: *Cortical Adaptation Following Partial Glossectomy With Primary Closure: implications for Reconstruction of the Oral Tongue,* Annals of Otology, Rhinology & Laryngology, 2005, 114 (9),: 681-687.

Key words : Vocal Tract Surgery - Speech Therapy Program - Precociousness - Articulatory Motor Targets - Speech Intelligibility - Acoustic Analyses - MRI.

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