

AN ACOUSTIC STUDY OF SUSTAINED VOWELS PRODUCED BY PATIENTS WITH OR WITHOUT RECURRENT LARYNGEAL NERVE PARALYSIS AFTER THYROID SURGERY

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Oncologique



BACKGROUND

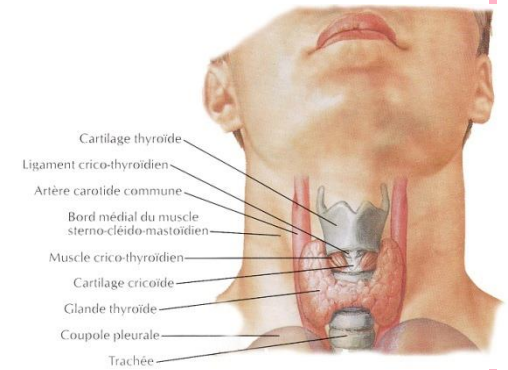
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BACKGROUND

Centre Paul Strauss – Strasbourg (France)

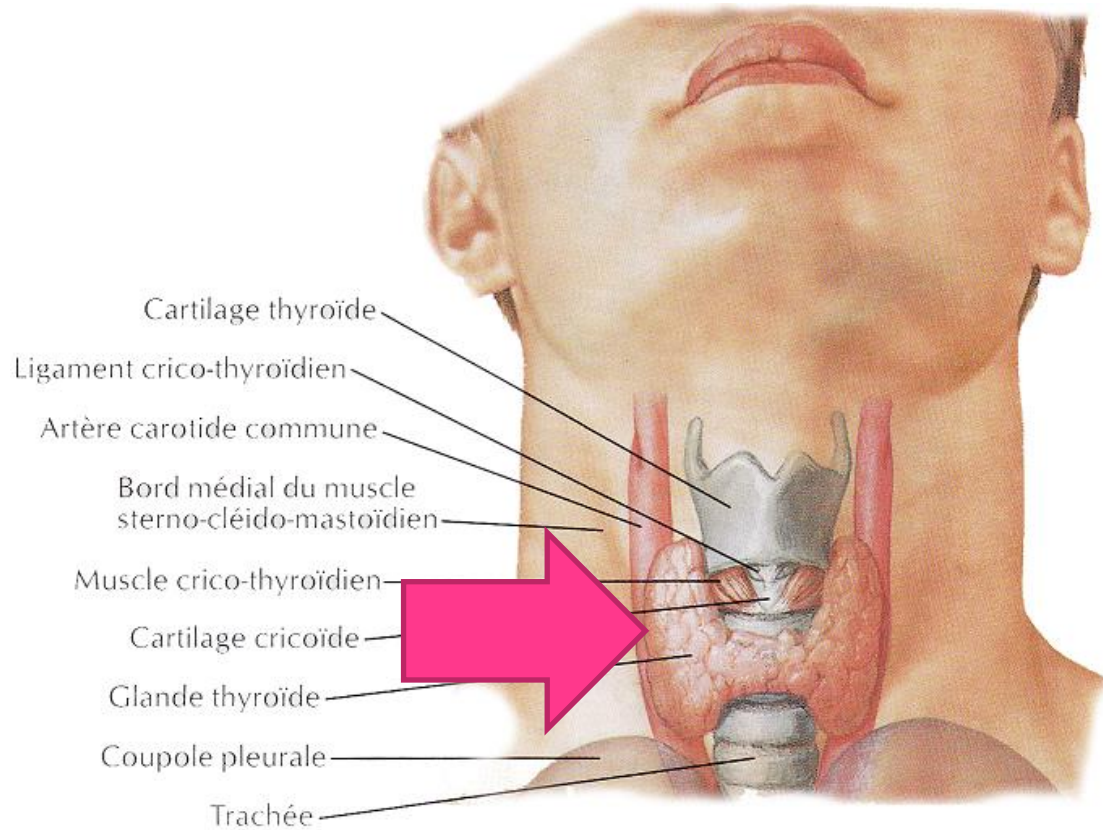


THYROID GLAND



- ❖ Located at the base of the neck
- ❖ Is responsible for secretion of hormones indispensable for important functions of the organism (cardiac rhythm, body temperature...)

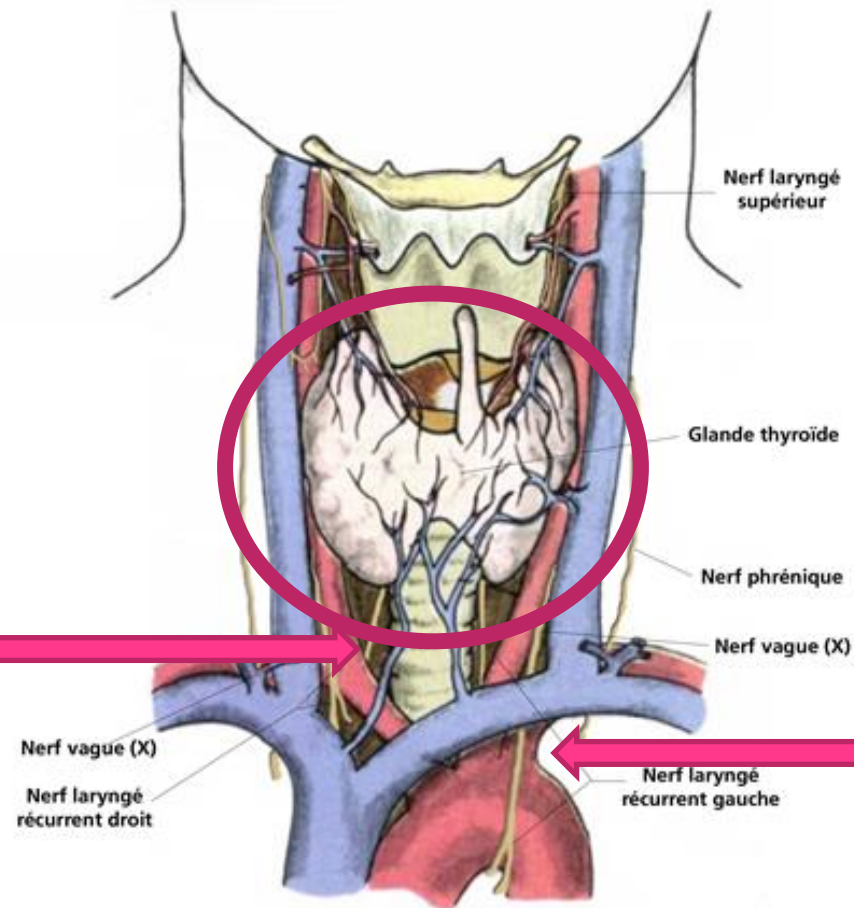
ANATOMY (1)



CONSEQUENCES OF SURGERY

- ❖ Two recurrent nerves, responsible for the vocal folds' mobility
- ❖ However, after surgery, at the laryngeal level, the patient's voice and speech may be altered

ANATOMY (2)



A decorative graphic on a dark grey background. It features several vertical lines of varying widths and colors, ranging from dark grey to light pink. On the left side, there are several pink circles of different sizes. One large circle is at the top left, and several smaller ones are scattered below it. The word "AIMS" is written in a white, serif font to the right of the circles.

AIMS

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AIMS

- ❖ Assess the consequences of thyroid surgery on the patient's voice
- ❖ Identify various vocal perturbations caused by this surgery
- ❖ Uncover the possible compensatory strategies or adjustments the patient may implement either by himself or thanks to the speech therapy (longitudinal study)



METHOD

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PATIENTS

Two groups of speakers:

- ❖ 7 patients without unilateral paralysis (2 men and 5 women)

NPP group
(No Paralysis Patient)

- ❖ 7 patients with unilateral paralysis (2 men and 5 women)

UPP group
(Unilateral Paralysis Patient)

RECORDINGS – METHOD

NPP

Recording phases:

- Preop: the day before surgery
→ Reference voice
- Post-op 1: the day after surgery
→ Voice is altered in variable degrees
- Post-op 2 : 15 days after surgery
→ Measure possible recovery

NPP GROUP

Speakers	Gender	Date of birth	Sugery
NPPGER	Féminin	1947	T Totale
NPPHOE	Féminin	1953	T Totale
NPPHOF	Féminin	1945	T Totale
NPPKRE	Féminin	1961	T Totale
NPPLN	Féminin	1948	T Totale
NPPENS	Masculin	1958	T Totale
NPPKAU	Masculin	1954	T Totale

UPP GROUP

Speakers	Gender	Date of birth	Sugery	Post-op diagnoses
UPPBAS	Féminin	1947	T Totale	C droite en abduction
UPPHEI	Féminin	1946	T Totale	C droite immobile
UPPHUB	Féminin	1953	T Totale	C gauche immobile
UPPWAL	Féminin	1977	T Totale	C gauche immobile paramédiane
UPPWAN	Féminin	1949	T Totale	C gauche immobile
UPPLAT	Masculin	1944	T Totale	C gauche adduction
UPPPAI	Masculin	1945	T Totale	C gauche adduction

A decorative graphic on the left side of the page. It features a vertical gradient bar on the far left, transitioning from dark grey to light pink. To its right are several vertical lines of varying thickness and color, including a prominent light pink line. Scattered around these lines are several pink circles of different sizes. One large circle is positioned near the top left, and a smaller circle below it contains the number '16'.

CORPUS

16

CORPUS

- ❖ 3 cardinal vowels /i, a, u/
 - ❖ Repeated 10 times
 - ❖ Sustained 5 seconds

SOUNDS



Female Speaker
Vowels
Without paralysis



Male Speaker
Vowels
With paralysis



MEASUREMENTS

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MEASUREMENTS

- ❖ Fundamental frequency (F0)
- ❖ Harmonics-to-Noise Ratio (HNR)
- ❖ Vowel Space Area



HYPOTHESES

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HYPOTHESES

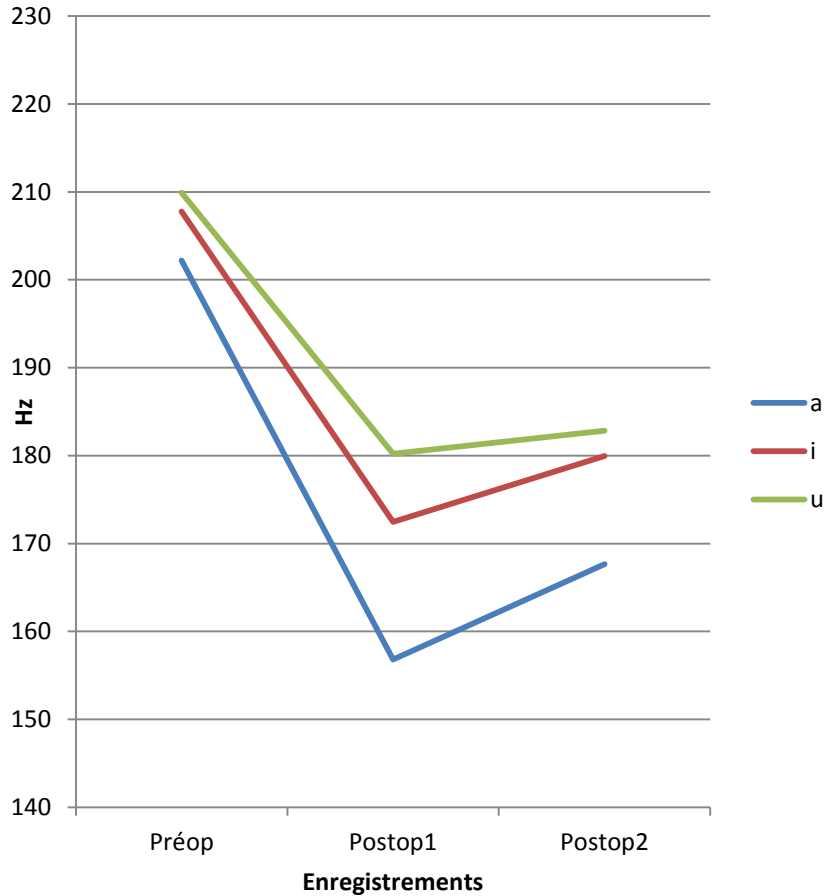
- 1) Difficulty in controlling voicing would expectedly affect F0 values
- 2) Altered laryngeal activity could modify coupling between the larynx and the vocal tract, thus affecting usual target HNR values
- 3) Perturbation of voicing at the source may affect the size and shape of vowel spaces
- 4) With speech therapy or time, the abovementioned parameters would be less modified could be meliorated



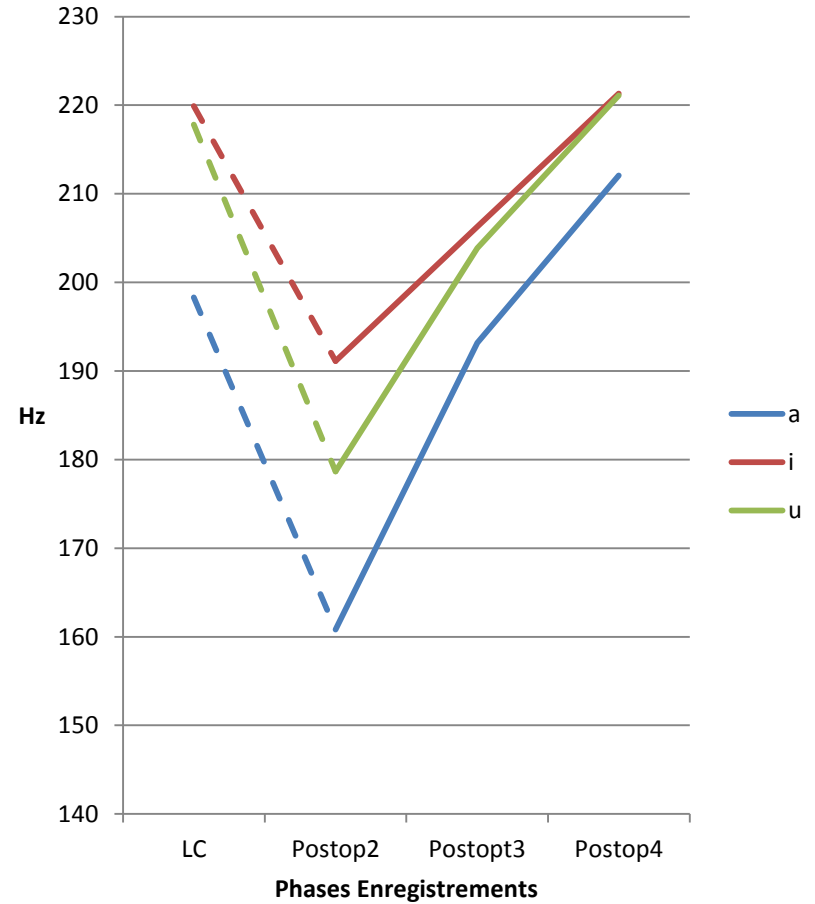
RESULTS

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Fondamental Frequency

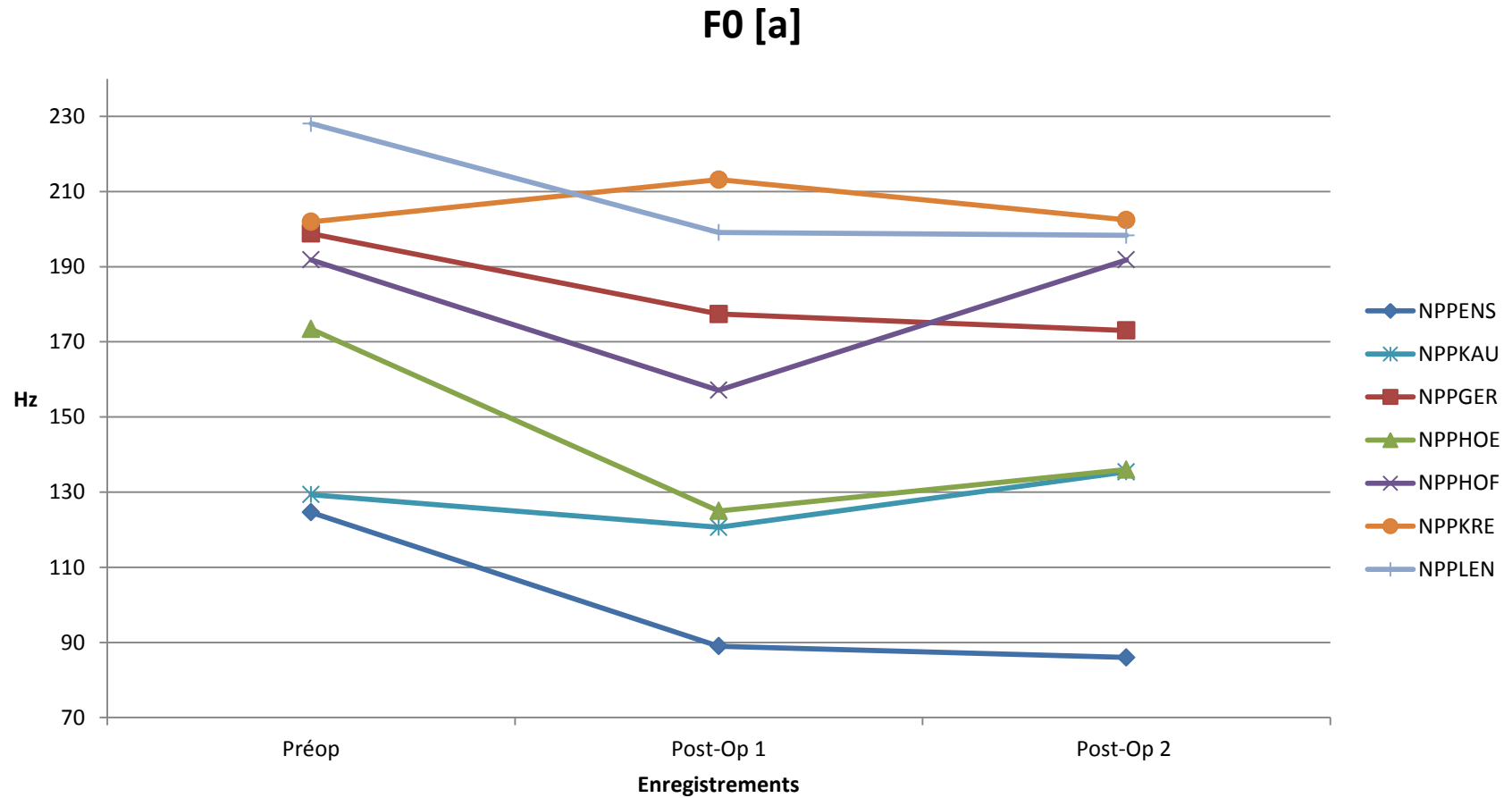


Mean values of F0 (Hz) – Female speaker NPP

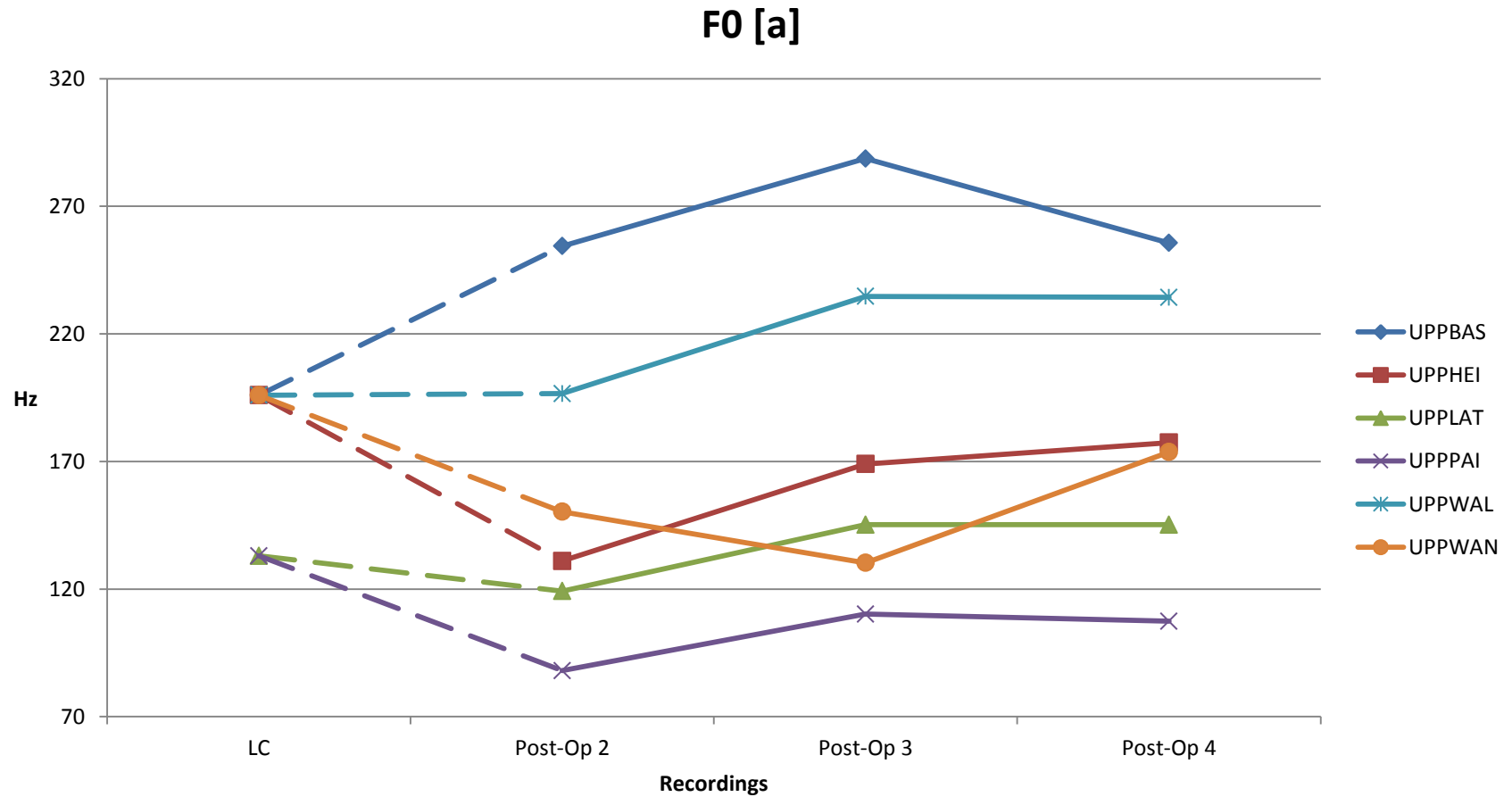


Mean values of F0 (Hz) – Female speaker UPP

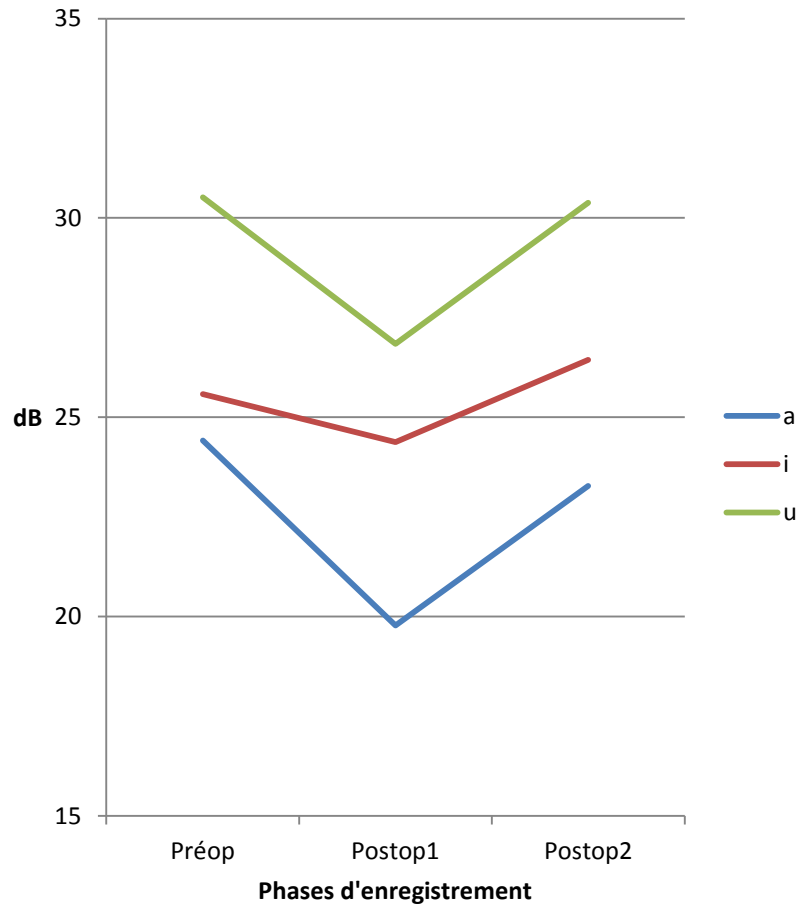
Mean values of F0 (Hz) – NPP speakers



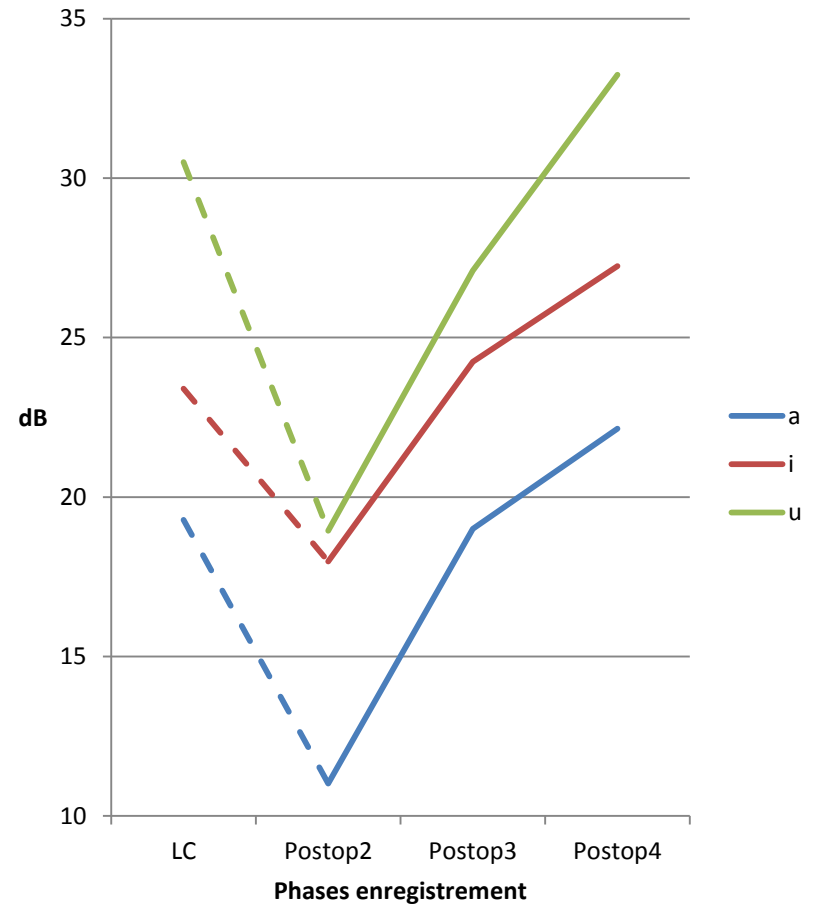
Mean values of F0 (Hz) - UPP speakers



Harmonics-to-Noise-Ratio (HNR)

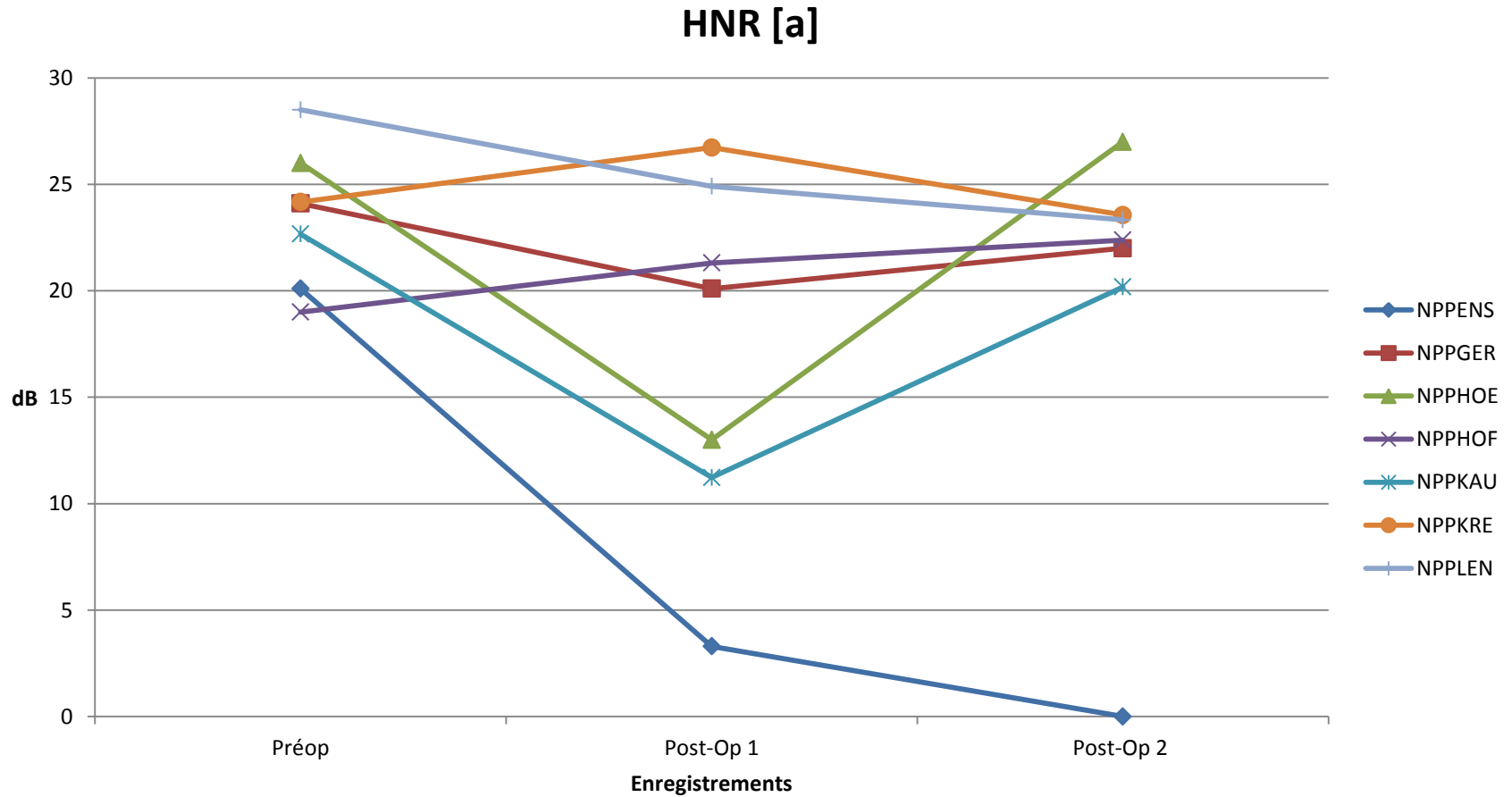


HNR (dB) mean values – Female speaker
NPP

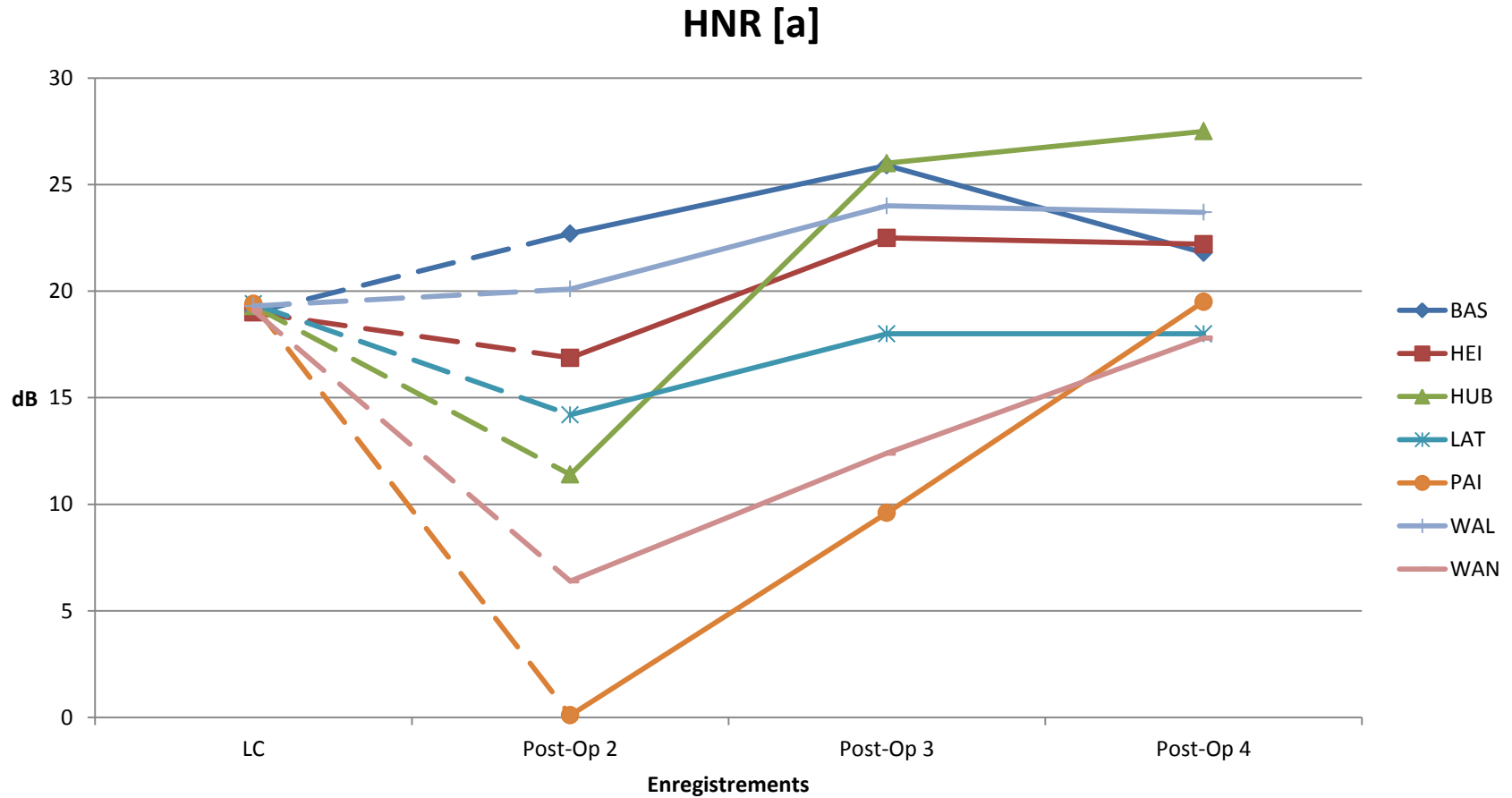


HNR (dB) mean values – Female speaker
UPP

HNR (dB) mean values – NPP speakers



HNR (dB) mean values –UPP speakers



Vowel Space Area

Preop	Postop1	Postop2
0,34kHz ²	0,21kHz ²	0,28kHz ²

Mean Values of VSA – NPP speakers

CS	Postop2	Postop3	Postop4
0,36kHz ²	0,25kHz ²	0,28kHz ²	0,35kHz ²

Mean Values of VSA – UPP speakers

VSA calculated using the Heron's formula

Vowel Space Area

kHz ²	Préop	Post-Op 1	Post-Op 2
NPPENS	0,29	0,31	0,17
NPPGER	0,46	0,15	0,34
NPPHOE	0,22	0,03	0,16
NPPHOF	0,42	0,34	0,38
NPPKAU	0,20	0,07	0,17
NPPKRE	0,33	0,22	0,37
NPPLEN	0,38	0,40	0,33

Mean Values of VSA – NPP speakers

	LC	Post-Op 2	Post-Op 3	Post-Op 4
UPPBAS	0,42	0,40	0,37	0,19
UPPHEI	0,36	0,11	0,33	0,34
UPPHUB	0,42	0,54	0,35	0,29
UPPLAT	0,18	0,30	0,30	0,30
UPPPAI	0,21	0,23	0,18	0,23
UPPWAL	0,41	0,31	0,39	0,34
UPPWAN	0,49	0,19	0,44	0,49

Mean Values of VSA – UPP speakers



CONCLUSIONS

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CONCLUSIONS (1)

Patient's voice would be altered either because of vocal fold paralysis OR simply because of the surgery:

- ❖ Difficulty in controlling voicing would expectedly affect F0 values



CONCLUSIONS (2)

Patient's voice would be altered either because of vocal fold paralysis OR simply because of the surgery:

❖ Altered laryngeal activity could modify coupling between the larynx and the vocal tract, thus affecting usual HNR target values



CONCLUSIONS (3)

Patient's voice would be altered either because of vocal fold paralysis OR simply because of the surgery:

❖ Impact on supraglottal resonances, may affect the size and shape of vowel spaces



CONCLUSIONS (4)

Patient's voice would be altered either because of vocal fold paralysis OR simply because of the surgery:

❖ The precedent parameters may be meliorated with time or by the speech therapy



CONCLUSIONS (5)

According to the literature and our data :

- ❖ Voice quality can be modified even without laryngeal immobility
- ❖ Timing recuperation is delayed for patients with diagnosed laryngeal immobility
- ❖ Patients should be informed about voice quality

LIMITS – FURTHER RESEARCH

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TO BE CONTINUED...

- More speakers
- Articulatory data
- Work on VCV sequences
- Read speech
- Perception Tests

THANK YOU

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