Effects Of Tonsillectomy On Acoustic Parameters

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Abstract

The vocal tractus from the glottis to the lips is considered to be a resonator and any change in its shape may cause voice changes. Since tonsillectomy causes a shape and volum difference in supraglottic area, it is assumed that acoustic characteristics may change postoperatively.
In this study, the effects of tonsillectomy over voice parameters is examined.
20 patients (13 males, 7 females), aged between 21 and 39 were included to the study. They all went tonsillectomy for recurrent episodes of tonsillitis under regional anesthesia. Voice samples to measure F0 (fundamental frequency) and F1, F2 , F3 formants were recorded 1 week before and 3 months after the surgery. These parameters were analyzed on a sustained [a:] using the CSL main program with the Computerized Speech Lab CSL 4300B (Kay Elemetrics Ltd., Lincoln Park, NJ, USA). The patients were also asked, whether they perceived any change in their voices postoperatively.
None of the patient perceived any change in his/her voice postoperatively. F0 did not show any significant change postoperatively. F1 formant has a tendency to decrease, F2 and F3 formant has a tendency to increase after surgery. But this is statistically not significant.
Although changes in formants after surgery is not significant, in cases for vocal performing artists, they should be warned for the possible changes in voice colors after surgery.

INTRODUCTION

Tonsillectomy is a common surgical procedure performed to treat upper respiratory tract infections and/or obstructive disease. This procedure is one of the most performed surgical procedures worldwide.

The vocal tractus from the glottis to the lips is considered to be a resonator and any change in its shape may cause voice changes. Since tonsillectomy causes a shape and volum difference in supraglottic area, it is assumed that acoustic characteristics may change postoperatively. But the question is whether these changes are minimal or they have a crucial effect over voice parameters? The answer to this question is important for the vocal performing artists, since any change in vocal quality may interfere performing their jobs.

In this study, the effects of tonsillectomy over voice parameters is examined.

MATERIAL & METHOD

20 patients (13 males, 7 females), aged between 21 and 39, mean age 29, were included to the study. They all went tonsillectomy for recurrent episodes of tonsillitis under regional anesthesia. Voice samples to measure F0 (fundamental frequency) and F1, F2 , F3 formants were recorded 1 week before and 3 months after the surgery. These parameters were analyzed on a sustained [a:] using the CSL main program with the Computerized Speech Lab CSL 4300B (Kay Elemetrics Ltd., Lincoln Park, NJ, USA). The patients were also asked, whether they perceived any change, negative or positive, in their voices postoperatively. Statistical analysis was carried out using Paired Sample T-Test procedure.

RESULTS

Results were shown in table 1. The means and the standard deviations of the study groups were shown in table 2. Fundamental frequency (F0) did not show any statistically significant change postoperatively. F1 formant has a tendency to decrease, F2 and F3 formants has a tendency to increase after surgery. But this is also statistically not significant. None of the patients perceived any change in his/her voice postoperatively.

Figure 1

Table 1: The vocal analysis results of the patients. Any perceived voice change by the patients themselves is also marked. (N= No), f=female; m=male

Patient No	sex	pre-Fo(Hz)	pre-F1(Hz)	pre-F2(Hz)	pre-F3(Hz)	post-F0(Hz)	post-F1(Hz)	post-F2(Hz)	post-F3(Hz)	perceived voice change
1	f	244	612	1042	2432	238	664	1055	2543	N
2	f	218	778	1432	2890	214	772	1344	2816	N
3	f	196	445	1523	3012	201	442	1218	3218	N
4	f	255	812	1094	3217	248	801	1112	3432	N
5	f	231	566	987	2766	236	559	1002	3961	N
6	f	218	398	1271	3211	218	398	1284	2817	N
7	f	190	412	1439	3490	188	427	1440	2923	N
8	m	140	531	1528	3765	134	525	1551	3012	N
9	m	93	651	1374	2801	102	644	1411	3217	N
10	m	144	801	1639	2310	140	814	1699	3455	N
11	m	135	450	1138	2695	136	442	1143	2988	N
12	m	102	569	1217	2519	112	561	1299	3112	N
13	m	116	367	1410	3097	120	365	1501	3451	N
14	m	91	327	1032	3484	97	322	1030	2967	N
15	m	87	481	975	3401	92	489	992	3522	N
16	m	112	339	902	3248	114	336	1001	2918	N
17	m	105	617	1455	3917	107	611	1462	3331	N
18	m	81	429	1290	2912	92	417	1301	2310	N
19	m	124	311	703	3269	126	299	714	3379	N
20	m	132	723	943	3317	130	711	951	3412	N

Figure 2

Table 2: The means and standart deviations of the study groups.

	Mean (Hz)	Std. Deviation
Pre-op FO	150,70	57,64
Post-opFO	152,25	54,42
Pre-op F1	530,95	161,12
Post-opF1	529,95	162,90
Pre-op F2	1219,70	254,10
Post-opF2	1225,50	246,01
Pre-op F3	3087,65	428,00
Post-opF3	3139,20	377,10

DISCUSSION

The effects of tonsillectomy on the voice have not been studied extensively from the perspective of acoustic changes, other than its effect on nasalance ([1]). A few studies have examined potential changes in vocal quality after tonsillectomy. In general, minimal changes were found ([2,3,4,5]). Tonsillectomy can affect the voice by enlarging the resonating chamber and altering the formant frequencies or by altering the conformation of the tonsillar fossae ([1,3]). Potentially, part of the soft palate musculature can be removed or disturbed. This could theoretically lead to scarring and subsequent limitation of fine motor control or even velopharyngeal closure ([6]).

It is not expected that fundamental frequency (F0) change after tonsillectomy. Because it is an operation that did not directly affect larynx and not influence the rate at which vocal folds open and close during phonation.

With respect to supralaryngeal factors, if extirpation of soft tissue from the oropharynx altered the anatomy of the

supralaryngeal acoustic transmission pathway and possibly the dynamics of physiologic function, the acoustic measures related to vocal tract resonances could be changed ([1]). If viewed from the vowel structures`s point, some vowels may show a change in their structure after tonsillectomy, but since the structures of vowel /a/ remained basically unchanged postoperatively, it may partly explain the statistically indifferent changes in formants in our study ([1]).

Chuma et al. reported that tonsillectomy had only minor quantitative and qualitative effects on various acoustic parameters ([1]). Saida et al. and Hori et al. also reported similar observations in their studies ([2,3]). In general, it was reported that after tonsillectomy, fundamental frequency and F1 and F2 formant frequencies remained unchanged whereas F3 decreases and F4 increases postoperatively ([5]). But some other reports doesn't support this findings ([1,7]).

Patients may ask about the possibility of voice changes after tonsillectomy. Patients' perception of voice is an important treatment outcome measure, especially in the case of benign disease where the greatest impact is on the quality of life ([8]). They should be advised of potential voice changes, especially professional voice users who may be particularly sensitive to changes in resonant characteristics. However, according to Behrman et al., one fifth of the patients perceived their voices to be improved after surgery and none thought that the voice to be worse ([8]). Therefore, it is concluded that patients are unlikely to perceive a change in voice as a result of surgery, but in those cases where a difference is perceived, it is likely to be a positive change.

For children, anectodal accounts of some parents suggest that tonsillectomy changes sometimes voice production within the first few weeks after surgery. These parental concerns may in part reflect short-term acoustic changes associated with hyponasal speech improving to normal, normal speech becoming more hypernasal ([1]). In our study, the subjects were not asked to come just after surgery, since it was expected that during the healing process some voice parameters be changed and limitation in singing or performing be noted ([6]). The focus of our study was to research any permanent voice change after surgery.

In a retrospective study among the performing artists done by Jarboe et al. it was stated that patients' voices were not impaired after tonsillectomy. The majority of the patients also reported that they perceived an improvement in their singing, but this should not be discussed as an indication for surgery, simply a possible coincidental outcome. The expression of improvement in voices after surgery could be related to the reduction of discomfort in throat and to the enlarged resonating chamber.

The gathered information in his study suggests that tonsillectomy can be performed safely in vocal performing artists despite their specialized requirements for pharyngeal function ([6]).

CONCLUSION

Based on our study, tonsillectomy does not have any effect over fundamental frequency. Although changes in formant frequencies after surgery is not significant, in cases for vocal performing artists, they should be warned for the possible subtle changes in voice colors after surgery, though it is presumably positive.

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