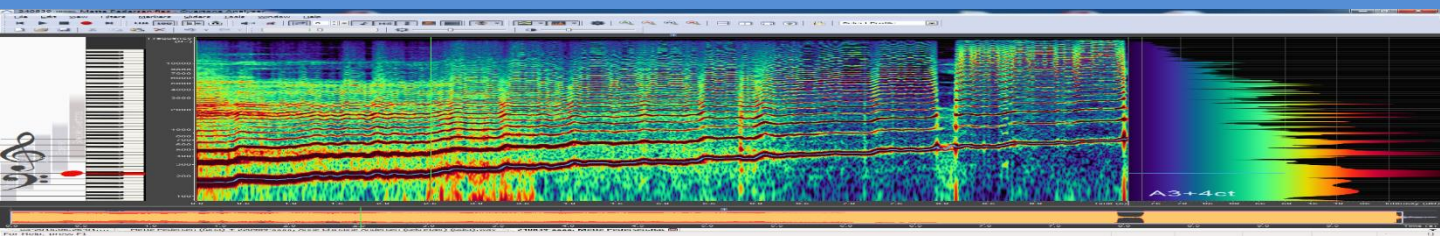
Overtone measures in the clinic

Mette Pedersen MD. Students: Anders Jønsson, Sanila Mahmood, Bilal Hussain Akram, Mohammad Shezad Mahmood, Anne Alexius Agersted
Voice Unit, Medical Centre, Oestergade 18, 1, 1100 Copenhagen, Denmark
m.f.pedersen@dadlnet.dk



Introduction: So far voice analysis has not produced any sufficient evidence based clinical diagnostics effect (1, 2, 3) and many voice measures have little significance to pathology. Voice measures are difficult to quantify but overtone analysis software seem promising. The goal of this presentation is to evaluate the possibilities of overtone analysis in pathology (4).

Methods: Twelve normal persons had overtone analysis carried out with ”Sygyt Ltd.” on the market and the older ”Vocevista” (2008). These methods were compared with the acustical measures of high speed films by ”Glottis Analysis Tools”, (Videos made with Wolf Endocam 5562 Setup from Erlangen, Germany). A problem in pathology was solved in the way that the fundamental frequency F0 was systematically used for overtone measures.

Results: A normal material for use in our clinic has been made. Comparable results were found with the three methods for formants from 1000-5000 Hz, up to 25% variation. Interestingly when ”Sygyt Ltd.” was compared to ”Vocevista” in the same milisecond the variation shrinked to 0% and 7%, which suggests use of the same formulas, (figure 1, 2). Acoustical analysis software measures of the vocal fold movements does not seem to correlate well with the overtone measures.

A: "VoceVista" Results

Nr.	Name	Gender	Age	ms	F0 (Hz)	F0 (dB)	(Fa) (Hz)	Fa(dB)	Fx (Hz)	Fx (dB)	Fy(Hz)	Fy (dB)	Fz (dB)	Fz (dB)
1	MP-A	K	75	2522	224	62			1546	38	2430	36	4662	23
2	ACA-A	K	25	14154	224	46			1558	28	2906	24	3886	16
3	LTC-A	K	40	2335	224	43			1113	38	2304	25	3525	18
4	KJH-A	K	47	2668	224	60			1552	48	2220	35	3766	25
5	SM-A	K	24	308	224	49			1762	30	2864	23	4350	14
6	NBL-A	K	25	616	224	46			1762	29	2202	24	3929	24
7	AJ-A	M	24	2551	107	48			1768	19	3321	15	4247	17
8	MSM-A	M	23	567	107	40			1624	22	2430	30	3243	30
9	BHA-A	M	22	883	107	38			1576	28	2286	20	3122	20
10	MO-A	M	28	1063	107	52			1546	35	2151	18	3327	20
11	AH-A	M	16	2320	107	42			1251	20	2290	26	3868	22
12	JJ-B	M	33	847	107	46			1095	28	3303	26	4079	24

Fig.1. ”VoceVista” results of formants from 1000 up to 5000 Hz in a prospective cohort study of 12 normal persons with the F0 nearest to 220 and 110 Hz.

B: "Sygyt" Results

Nr.	Name	Gender	Age	ms	F0 (Hz)	F0 (dB)	(Fa) (Hz)	(Fa) (dB)	Fx (Hz)	Fx (dB)	Fy (Hz)	Fy (dB)	Fz (Hz)	Fz (dB)	Total Range in Hz	
															Lowest	highest
1	MP-B	K	75	2520	220	58	436	55	1545	31	2433	35	4662	20	231	1126
2	ACA-B	K	25	14150	220	43	436	52	1555	24	2874	33	3881	13	174	610
3	LTC-B	K	40	2330	220	43	403	48	1114	40	2304	20	3526	16	190	874
4	KJH-B	K	47	2665	220	58	441	55	1539	42	2201	26	3762	19	151	760
5	SM-B	K	24	310	220	45	441	56	1765	25	2869	22	4333	12	211	491
6	NBL-B	K	25	620	220	51	441	49	1765	29	2201	21	3924	25	196	703
7	AJ-B	M	24	2560	110	48	333	47	1781	22	3321	23	4247	22	88	714
8	MSM-B	M	23	570	110	38	344	41	1625	21	2470	25	3246	19	98	615
9	BHA-B	M	22	880	110	44	452	59	1571	25	2255	22	3133	17	99	853
10	MO-B	M	28	1060	110	48	333	44	1550	27	2131	21	3332	22	102	538
11	AH-B	M	16	2320	110	48	333	38	1254	20	2217	24	3865	20	110	365
12	JJ-B	M	33	850	110	42	549	45	1098	24	3305	23	4107	21	107	683

Fig.2. ”Sygyt Ltd.” results of sound formants from over 1000 Hz up to 5000 Hz with 110 and 220 Hz as basis of overtone measures in the same normal persons.

Variation of 3 formants 1000-5000 Hz from high speed films, (figure 3):

Nr.	Name	Gender	Age	ms	F0 (Hz)	F0 (dB)	(Fa) (Hz)	(Fa) (dB)	Fx (Hz)	Fx (dB)	Fy (Hz)	Fy (dB)	Fz (Hz)	Fz (dB)
1	MP-A	K	75	520	327	64			1320	35	2312	34	3271	18
2	ACA-A	K	25	70	251	48			1261	33	2241	30	4025	28
3	LTC-A	K	40	1130	329	45			1401	28	2295	20	3357	9
4	KJH-A	K	47	850	142	15			1293	39	2328	24	3028	27
5	SM-A	K	24	900	307	38			1606	38	3206	25	4004	26
6	NBL-A	K	25	640	377	64			1131	23	2258	22	3411	14
7	AJ-A	M	24	120	216	56			1293	48	2371	40	3449	40
8	MSM-A	M	23	1060	158	38			1115	38	2549	29	3341	21
9	BHA-A	M	22	1210	266	47			1320	51	2904	30	4230	20
10	MO-A	M	28	440	211	49			1077	42	2373	28	4694	19
11	AH-A	M	16	430	139	42			1385	23	2500	28	3336	16
12	JJ-B	M	33	160	196	20			1040	12	1697	12	2204	19
Difference to sygyt sound analysis of 12 normal persons														
Coefficient of variation (cv)				mean					1513.5		2548.4		3834.8	
				change mean					243.3		128.9		305.7	
				std					270.0		632.7		923.4	
				cv					18%		25%		24%	

Fig.3 High speed films on line, the acoustical measures here from, analyzed with “Sygyt Ltd.” of a prospective cohort study of 12 normal persons, the results of formant variation are on the same level as “VoceVista” due to the variation of F0.

Conclusions: Overtone analysis softwares proved to be comparable for ”Vocevista”, ”Sygyt Ltd.” and acoute measures on High speed films with Glottal Analysis Tools. Further video analysis measures might be needed to yield better results. The implication in pathology of the results and future has many perspectives. Evidence based diagnostics of the human voice are needed. Overtones might be useable combined with High speed films.

References

1. Pedersen M, McGlashan J. 2012. Surgical versus non-surgical interventions for vocal cord nodules (Review) The Cochrane Library. pp. 1-13.
2. Leong, K. Hawkshaw, M. Dentchev, D. Gupta, R. Lurie, D. Sataloff, R. Reliability of Objective Voice Measures of Normal Speaking Voices. 2013. Journal of Voice. Vol. 27, No.2. pp. 170-176.
3. Roy, N. Barkmeier-Kraemer, J. Eadie, T. Sivasankar, M. Mehta, D. Paul, D. Hillman, R. Evidence-Based Clinical Voice Assessment: A systematic Review. 2012. American Journal of Speech-Language pathology. Vol. 22. pp. 212-226.
4. Pedersen M. 2015. Aspects of resonance: Comparison of high speed films and overtone measurements, Journal of Health Education Research & Development, 3:3 pp. 145.