ASPECTS OF RESONANCE: COMPARISON OF HIGH SPEED FILMS AND OVERTONE MEASUREMENTS

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Introduction

- There are new apparatures on the market - based on voice research - where the patient can benefit from advanced diagnostics of overtones.
- A clinical routine with high speed films includes kymography, electroglottography and quantitative measures of the movement of the left and right vocal fold. – It showed that irregularity of the two vocal folds against each other hardly ever was the case.
- Therefore new approaches had to be made, especially not related to airflow.
- Documentation of overtones measures up to 20.000Hz (or more) with a stable and well established overtone analyzer leeds to new clinical experiences –
- since it is made in a clinic friendly easy way – even cheep.
- What is next is to optimize larynx functions understanding into a position to be part of among others Optical coherence tomography to understand the mucosal function,
- which in most cases seems to be the probem..

Software for high speed films

- With high speed films combined with electroglottography, kymography, and overtones, nuanced evaluation of the voice is possible and to some extend evidence based.

- The software of high speed films includes quantitative measures of the closure of the vocal folds as well as stiffness, a calculation of maximal amplitude versus maximal speed of the vocal folds

- - in all 345 measurements of the voice can be made with the software that is on the market -"Glottal analyses tools" from Erlangen Germany.

- Acoustical analysis as well as glottal area waveforms calculations are made online on high speed films.

All measures in "Glottis Analysis Tools"

- **Source: Audio**
- APF(%)
- APQ-11(%)
- APQ-3(%)
- APQ-5(%)
- AVI
- CHNR-v1(dB)
- CHNR-v2(dB)
- CPP(dB)
- Cycle-duration(ms)
- EPF(%)
- EPQ-11(%)
- EPQ-3(%)
- EPQ-5(%)
- Fundamental-Freq(Hz)
- GNE
- Harmonics-Intensity(%)
- HNR(dB)
- Jitt(%)
- Jitt-Factor
- Jitt-Ratio
- max-Harmonic(Hz)
- max-WMC
- mean-Jitt(ms)
- mean-Shim(dB)
- mean-WMC
- min-Subharmonic(Hz)
- NNE(dB)
- PPF(%)
- PPQ-11(%)
- PPQ-3(%)
- PPQ-5(%)
- PVI
- RAP-v1
- RAP-v2
- Shim(%)
- SNR-v1(dB)
- SNR-v2(dB)
- Spectral-Flatness(SFM)

- **Source: GAW**
- Amplitude-Length-Ratio
- Amplitude-Periodicity
- Amplitude-Quotient
- Amplitude-Symmetry*
- Amplitude-Symmetry-Index
- APF(%)
- APQ-11(%)
- APQ-3(%)
- APQ-5(%)
- Asymmetrie-Quotient
- AVI
- CHNR-v1(dB)
- CHNR-v2(dB)
- Closing-Quotient(ClQ)
- CPP(dB)
- Cycle-duration(ms)
- DynamicRange-Symmetry*
- DynamicRange-Symmetry-Index
- EPF(%)
- EPQ-11(%)
- EPQ-3(%)
- EPQ-5(%)
- Fundamental-Freq(Hz)
- Glottal-Area-Index(AC/OQ)
- Glottis-Gap-Index(GGI)
- GNE
- Harmonics-Intensity(%)
- HNR(dB)
- Jitt(%)
- Jitt-Factor
- Jitt-Ratio
- max-Harmonic(Hz)
- Maximum-Area-Declination-Rate
- max-WMC
- mean-Jitt(ms)
- mean-Shim(dB)
- mean-WMC
- min-Subharmonic(Hz)
- NNE(dB)
- Open-Quotient(OQ)
- Peak-Acceleration
- Peak-Closing-Velocity
- Phase-Asymmetry*
- Phase-Asymmetry-Index
- Plateau-Quotient(PQ)
- PPF(%)
- PPQ-11(%)
- PPQ-3(%)
- PPQ-5(%)
- PVI
- RAP-v1
- RAP-v2
- Rate-Quotient(RQ)
- Shim(%)
- SNR-v1(dB)
- SNR-v2(dB)
- Spatial-Symmetry*
- Spatial-Symmetry-Index
- Spectral-Flatness(SFM)
- Speed-Index(SI)
- Speed-Quotient(SQ)
- Stiffness
- Time-Periodicity
- Waveform-Symmetry-Index

- **Souce: Phonovibrogram (PVG)**
- ContourAngles-Symmetry*
- ContourAngles-Symmetry-Index
- Contour-Angle(DEG)

- **Source: Trajectories 50%**
- Amplitude-Symmetry*
- Amplitude-Symmetry-Index
- DynamicRange-Symmetry*
- DynamicRange-Symmetry-Index
- Phase-Asymmetry*
- Phase-Asymmetry-Index
- Waveform-Symmetry-Index
- Amplitude-Length-Ratio
- Amplitude-Periodicity
- Amplitude-Quotient
- APF(%)
- APQ-11(%)
- APQ-3(%)
- APQ-5(%)
- Asymmetrie-Quotient
- AVI
- CHNR-v1(dB)
- CHNR-v2(dB)
- Closing-Quotient(ClQ)
- CPP(dB)
- Cycle-duration(ms)
- EPF(%)
- EPQ-11(%)
- EPQ-3(%)
- EPQ-5(%)
- Fundamental-Freq(Hz)
- Glottal-Area-Index(AC/OQ)
- Glottis-Gap-Index(GGI)
- GNE
- Harmonics-Intensity(%)
- HNR(dB)
- Jitt(%)
- Jitt-Factor
- Jitt-Ratio
- max-Harmonic(Hz)
- Maximum-Area-Declination-Rate
- max-WMC
- mean-Jitt(ms)
- mean-Shim(dB)
- mean-WMC
- min-Subharmonic(Hz)
- NNE(dB)
- Open-Quotient(OQ)
- Peak-Acceleration
- Peak-Closing-Velocity
- Plateau-Quotient(PQ)
- PPF(%)
- PPQ-11(%)
- PPQ-3(%)
- PPQ-5(%)
- PVI
- RAP-v1
- RAP-v2
- Rate-Quotient(RQ)
- Shim(%)
- SNR-v1(dB)
- SNR-v2(dB)
- Spectral-Flatness(SFM)
- Speed-Index(SI)
- Speed-Quotient(SQ)
- Stiffness
- Time-Periodicity

- The software by ”Sygyt Ltd” seems to be clinically feasible to measure harmonic overtones exact and quickly, to be used together with high speed films.

- The literature has been reviewed extensively for clinical aspects of resonance/ overtones/harmonics:
- A British Library search in London two months ago of resonance of the human voice included search words : ”voice AND resonance” for the latest two years (Medline and Embase) found 1610 references out of which some interesting results have been found especially in the book by Donald Miller.

- His study includes overtonesmeasurements to be used to

1) Resonance adjustments
2) Visual feedback
3) Modern and classical singing, musical examples, registers
4) Discussion of nomenclature
5) Acoustical feedback, local formants (hotspots) of resonance.
6) Demystifying voice registration
7) The voice source (vibrating vocal folds), interactivity with the filter (vocal tract),
8) formant tuning.
9) Belting and heavy metal.
10) Using the technology to support voice education.
11) Risks and the role of the voice teacher.

- The book provides examples of how science can meet the voice studio which goes to 5000Hz.

- The program ”VoceVista-Pro” is a vocal analysis software.
- It demonstrates how to learn resonance strategies to achieve optimal sound.
  - How to locate formants
  - To analyse vibrating vocal folds
  - Interact with vocal tract
  - Acoustic feedback and appropiate vowel modifications
  - Measures op to 5.000 Hz

Reference: Donald Gray Miller, PhD. (2008) Resonance in singing. Voicevista.. Inside View Press.

- We have compared the ”Voce Vista” with the newer software ”Sygyt Ltd.” which is easy to use and we have found them comparable.

- In pathology there are no answers of: this singer is better than that singer. Many demonstrations have been made of averaged formant analyses during singing of melodies – sentences - by perfect singers (Pavarotti etc.)

- The question is, with one good overtone measuring method, to answer the patient complaints of various kinds of hoarseness, in an evidence based way in the clinic.

- We tried to compare the methods of overtone/harmonics analysis of ”Voce Vista” with ”Sygyt Ltd.” to find out if the two methods were comparable so that result could be used with both analyses.

- At least twelve subjects are needed statistically- to describe the distribution of a normal material - this was also the case of the analysis of the overtones of the human voice.

- In the litterature the fundamental frequency (F0) was seldom defined in the formant analyses of singers - in a scientifically usable way in pathology.

- Therefore we decided to compare the fundamental frequencies (F0) of voice as used in speech and harmonic overtones hereof, just to have a value for pathology. And we compared the sound analysis of the overtones of the human voice based on the fundamental frequency in speech comparing ”Voce Vista” with the more flexible ”Sygyt Ltd”.

Voce Vista

Spectrograms

- Up to 5000 Hz

Fundamental frequency of speech was chosen to measure overtones:

- Males: 110 Hz
- Females: 220 Hz

Formants:

- A formant was defined as a bundle of harmonic overtones, which combined represented a maximum due to the resonance area of humans.
- The harmonic overtone with the highest point in dB, reflected in the formant, was selected for calculation.
- The amplitude of the selected harmonic overtones was read from the lowest to the highest point.
- The first three formants over 1000Hz were analysed with associated dB for each. Some formants under 1000Hz were noted in parentheses even if they are articulation related.

B: Sygyt (Ltd)

Spectrogram:

- Up to 20000 Hz

Fundamental frequency of speech as chosen for measures to be used in pathology

- Male: 110 Hz
- Female: 220 Hz

Formants:

- We have defined one formant as bundle of harmonic scale which combined represent the formant.
- The harmonic overtone with the highest point in dB reflected in the formant will be selected.
- The amplitude of the selected harmonic overtones will be read from the lowest to the highest point.
- The first three formants over 1000Hz were measured and the asso-
- ciated dB for each formant noted.

Methods

- We have compared 12 normal voices of persons without complaints with measures of ”VoceVista” and ”Sygyt Ltd” results of sound analysis of the overtones =, harmonics.
- 12 persons were statictically enough in a prospective cohort study to characterize a normal material and it was used to identify major differences between the two systems.

- As the voices of the patients are very different in nature, it is a problem to identify the vocal problems.
- In order to identify the pathological problem in the clinic, a sensitive and specific measurement is needed.
- In the litterature formant measurements over several seconds have been analysed of famous singers without discription of F0.
- If you have a clinical situation singing will vary extreemly much, and results can be understood in many ways.
- So to begin with, a clinical approach of the mean fundamental frequency in speech (F0) and the formants hereof as defined with ”VoceVista” which measures to 5000 Hz compared with ”Sygyt Ltd.” that measures to 20.000 Hz was made, over 1000 Hz to exclude articulation related variations.

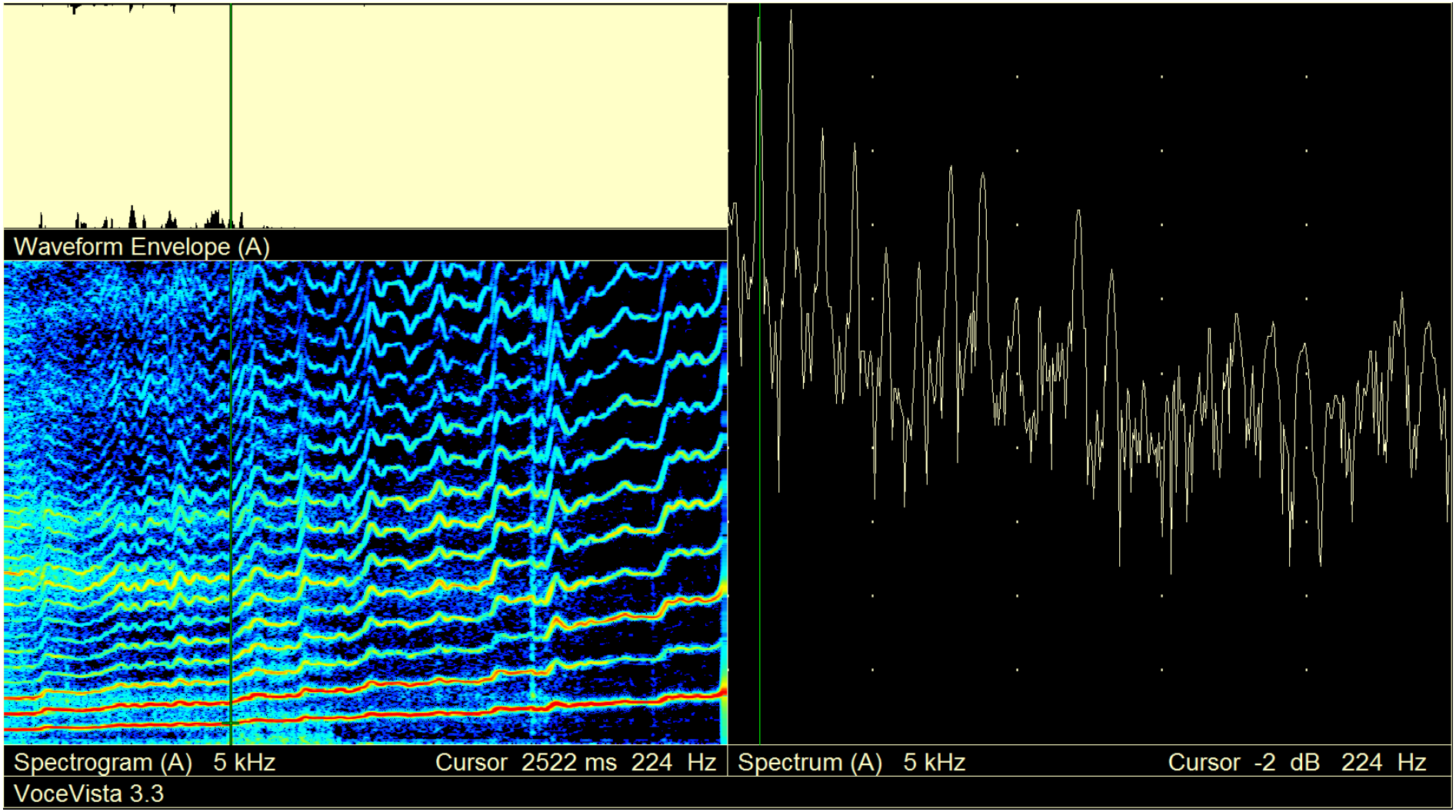
Methods

- Normal persons
- 6 males and 6 females were analysed.
- The fundamental frequency of speech (F0) during intonation of ”ah” was defined.

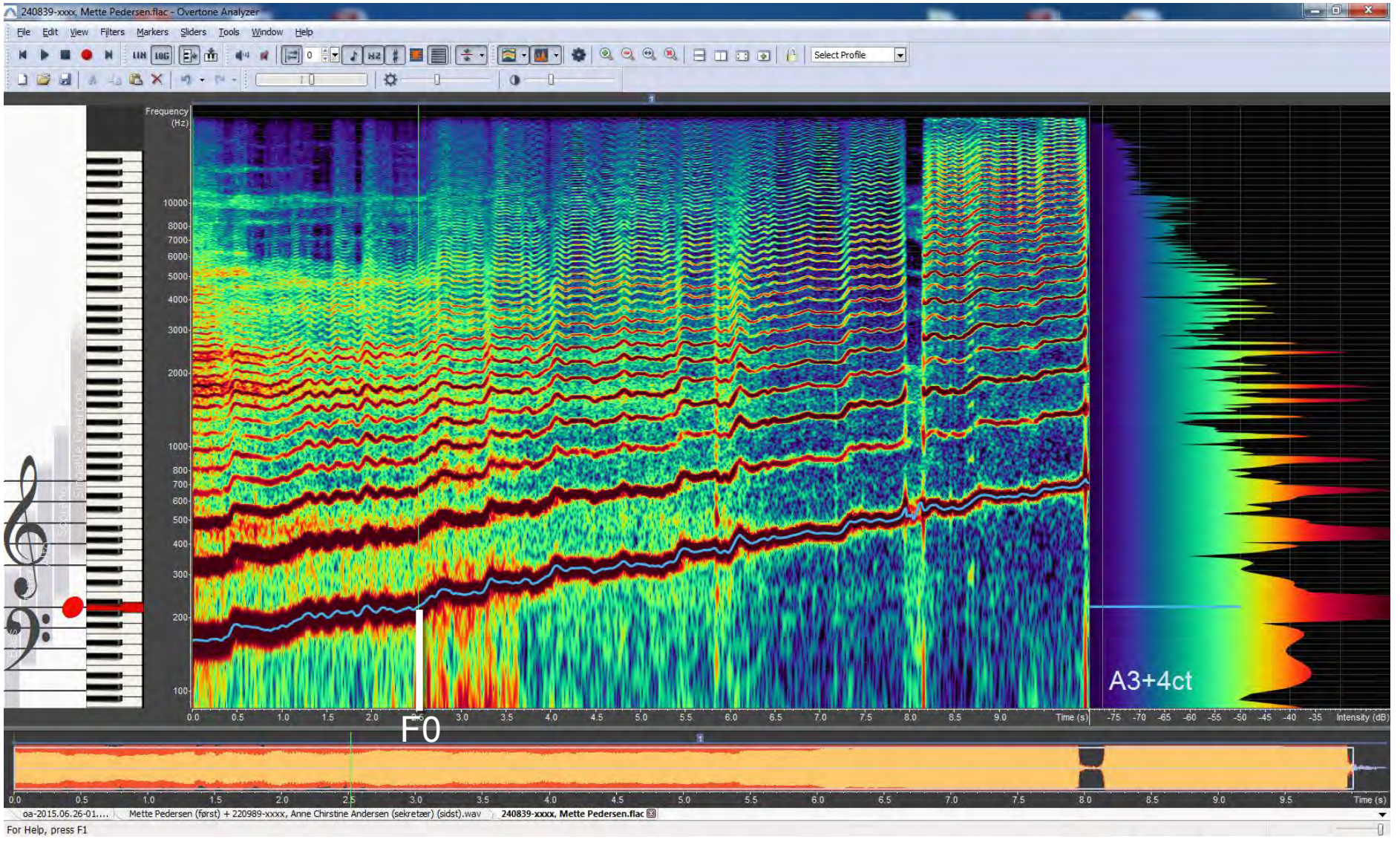
- We have made a prospective cohort study of the formant placements of F0 with ”VoceVista” up to 5000 Hz and ”Sygyt Ltd.” up to 20.000 Hz and there seems to be correspondence.

- From a statistical point of view the same ms (milisecond) measurements to compare the formants - was neccesary in a test of intonation as suggested by our statistician.

“Sygyt Ltd.” 5000 Hz “Voce Vista”



“Sygyt Ltd.” Overtone analyzer to 20000 Hz



”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

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

”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.

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

Comparing ”Sygyt Ltd.” - ”VoceVista”

Nr.	Name	Gender	Age	F0 (Hz)	F0 (dB)	(Fa) (Hz)	(Fa) (dB)	Fx (Hz)	Fx (dB)	Fy (Hz)	Fy (dB)	Fz (Hz)	Fz (dB)
1	MP-B	K	75	220	3			-19	-4	-21	2	862	-10
2	ACA-B	K	25	220	-20			-75	-11	74	10	-90	-7
3	LTC-B	K	40	220	-7			-29	-8	-884	-5	-1323	-9
4	KJH-B	K	47	220	-2			-73	9	-326	-17	-136	-9
5	SM-B	K	24	220	1			-88	-9	-115	-5	188	-5
6	NBL-B	K	25	220	1			-271	-1	-1228	1	-143	8
7	AJ-B	M	24	110	13			-42	-6	909	-7	932	2
8	MSM-B	M	23	110	8			-348	-4	-1001	5	-1152	-3
9	BHA-B	M	22	110	-6			-11	-5	-801	-3	-898	-8
10	MO-B	M	28	110	6			-610	2	-1244	1	-1523	-6
11	AH-B	M	16	110	3			-851	0	-592	5	141	3
12	JJ-B	M	33	110	-18			-3	-12	-4	-2	28	-3
mean								1513.5	27.5	2548.9	24.33	3834.3	18.417
sd								273.796	5.9461	639.65	6.995	803.97	5.6159
cv								18.0903	21.622	25.095	28.75	20.968	30.493

The same sound recording was analysed for the two different softwares.

The comparison is based on varying time points of F0 for the ”Sygyt Ltd.” and the ”VoceVista”. Notice that the coefficient of variation is 20-30%.

The fundamental frequency changes over time during the sound recording, as seen on the next slide it was essential that the results of the ”Sygyt Ltd.” and ”VoceVista” was evaluated at the exact same millisecond for the sound recording.

Comparing ”Sygyt Ltd.” - ”VoceVista”

Nr.	Name	Gender	Age	F0 (Hz)	F0 (dB)	(Fa) (Hz)	(Fa) (dB)	Fx (Hz)	Fx (dB)	Fy (Hz)	Fy (dB)	Fz (Hz)	Fz (dB)	Fz (dB)
1	MP-B	K	75	220	-4			-1	-7	3	-1	862	0	-3
2	ACA-B	K	25	220	-3			-3	-4	-32	9	-90	-5	-3
3	LTC-B	K	40	220	0			1	2	0	-5	-1323	1	-2
4	KJH-B	K	47	220	-2			-13	-6	-19	-9	-136	-4	-6
5	SM-B	K	24	220	-4			3	-5	5	-1	188	-17	-2
6	NBL-B	K	25	220	5			3	0	-1	-3	-143	-5	1
7	AJ-B	M	24	110	0			13	3	0	8	932	0	5
8	MSM-B	M	23	110	-2			1	-1	40	-5	-1152	3	-11
9	BHA-B	M	22	110	6			-5	-3	-31	2	-898	11	-3
10	MO-B	M	28	110	-4			4	-8	-20	3	-1523	5	2
11	AH-B	M	16	110	6			3	0	-73	-2	141	-3	-2
12	JJ-B	M	33	110	-4			3	-4	2	-3	28	28	-3
mean								1513.5	27.5	2548.42	24.5833	3834.33	3834.83	18.8333
sd								6.18098	3.54516	27.6192	5.29937	803.968	10.8195	3.98006
cv								0.40839	12.8915	1.08378	21.5568	20.9676	0.28214	21.1331
								0.75	-2.75	-10.5	-0.58333	-259.5	1.16667	-2.25
Difference in percent of mean								0%	-10%	0%	-2%	-7%	0%	-12%

The same sound recording was analysed for the two different softwares. As the fundamental frequency (F0) changes over time during the sound recording, it was essential that the results of the ”Sygyt Ltd.” and ”VoceVista” were evaluated at the exact same millisecond for the sound recording.

The table shows the difference in formants of F0 between the ”Sygyt Ltd.” and the ”VoceVista” sound analysis software over 1000Hz. As can be seen for the Fx, Fy and Fz, the mean Hz were 1513, 2548 and 3834, respectively with a difference between the softwares of 0.75, -10.5 and -259.5 Hz.

The difference in percentage of mean shows that the difference is 0, 0 and -7%, corresponding to almost identical assessment of the formants around 1500 Hz and 2550 Hz.

”Sygyt Ltd.” results over 5000 Hz are extremely interesting – here we show the overtones/harmonics and intensity variable around 10000 Hz in the 12 normal persons

				Register Change and formant around 10000 Hz in 12 normal persons		↓	
Nr.	Name	Gender	Age	RC (Hz)	RC (dB)	F 10k (Hz)	F 10k (dB)
1	MP-B	F	75	363	58	10125	14
2	ACA-B	F	25	365	52	10615	27
3	LTC-B	F	40	523	71	10325	21
4	KJH-B	F	47	457	41	10142	16
5	SM-B	F	24	415	49	9727	11
6	NBL-B	F	25	410	63	11138	24
7	AJ-B	M	24	205	63	10750	14
8	MSM-B	M	23	201	46	10448	15
9	BHA-B	M	22	224	49	10136	11
10	MO-B	M	28	231	48	9576	21
11	AH-B	M	16	180	14	10571	17
12	JJ-B	M	33	206	49	9969	15

F 10k = Sum of harmonics and formants around 10000 Hz at the fundamental frequency, F0, measured up till 20000 Hz to show the possibility of this new software.

As ”Sygyt Ltd.” results of up to 20.000 Hz can be measured, we tried to study the normal persons for a start - for variation of the formants near 10.000 Hz. The variation was 4,3% with SAS program 9,4 Spearman Rank correlation coefficient test.

Nr.	Name	Gender	Age	RC (Hz)	RC (dB)	F 10k (Hz)	F 10k (dB)
1	MP-B	F	75	363	58	10125	14
2	ACA-B	F	25	365	52	10615	27
3	LTC-B	F	40	523	71	10325	21
4	KJH-B	F	47	457	41	10142	16
5	SM-B	F	24	415	49	9727	11
6	NBL-B	F	25	410	63	11138	24
7	AJ-B	M	24	205	63	10750	14
8	MSM-B	M	23	201	46	10448	15
9	BHA-B	M	22	224	49	10136	11
10	MO-B	M	28	231	48	9576	21
11	AH-B	M	16	180	14	10571	17
12	JJ-B	M	33	206	49	9969	15
					STD	441.4833	
					MEAN	10293.5	
					Coefficient of Variation (CV)	4.3%	

Fundamental Frequency, F0, and intensity variations measured with the acoustic set up of high speed films of the 12 normal persons, using Wolf Ltd. High speed films apparature

Nr.	Name	Gender	Age	Fundamental Frequency (Hz)	Max dB	Min dB
1	MP-A	F	75	327	95	89
2	ACA-A	F	25	251	80	73
3	LTC-A	F	40	329	85	74
4	KJH-A	F	47	142	84	84
5	SM-A	F	24	100	80	70
6	NBL-A	F	25	377	82	78
7	AJ-A	M	24	216	88	81
8	MSM-A	M	23	158	82	80
9	BHA-A	M	22	266	81	80
10	MO-A	M	28	211	93	85
11	AH-A	M	16	139	74	68
12	JJ-B	M	33	178	86	86

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.

Variation of 3 formants 1000-5000Hz from high speed films

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%	

High speed films softwares, "VoceVista" and "Sygyt Ltd." compared: (SAS 9,4, Spearman rank correlation coefficients)

- A statistical difference of the following parameters was seen in a prospective cohort study between 12 healthy and 12 hoarse patients both left and right Glottal Area Wave form included:

Cepstral Harmonics- to-Noise Ratio-v2(dB) **Cepstral Peak Prominence(dB)** **Harmonics-Intensity(%)**	**Normalized Noise Energy (dB)** **Period Pertubation Quotient-11(%)** **Signal-to-Noise Ratio-v1(dB)**	**Spectral-Flatness(SFM)** **min-Subharmonic(Hz)**

- out of 345 parameters in 12 healthy and 12 hoarse persons only
- Strong statistically significant ($p<0.01$) correlation could be seen between:

Parameter	Source	Type	Method	Sound analysis parameter
Cepstral Harmonics-to-Noise Ratio version 2(dB)	[GAW]	[Right]	VoceVista	Fz (Hz)
Harmonics-Intensity(%)	[GAW]		VoceVista	Fz (dB)
Harmonics-Intensity(%)	[GAW]	[Right]	VoceVista	Fz (dB)
Spectral-Flatness(SFM)	[GAW]		VoceVista	Fx (dB)
Spectral-Flatness(SFM)	[GAW]	[Right]	VoceVista	Fx (dB)
min-Subharmonic(Hz)	[GAW]		sygyt	Fx (dB)
min-Subharmonic(Hz)	[GAW]	[Right]	VoceVista	F0 (Hz)
min-Subharmonic(Hz)	[GAW]	[Right]	sygyt	F0 (Hz)

”Sygyt Ltd.” parameters with statistcal significant correlations to the high speed film parameters - with p values down to 0,05. were **not related to the acoustical parameters but to the high speed films glottal area waveforms.**
(SAS 9.4, Spearman Rank Correlation Coefficient).

Parameter_label	Source	Type	Item	klang	Parameter_klang	Variable	spearman	Pmean
Harmonics-Intensity(%)	[GAW]	[Right]		Sygyt	Fz (dB)	value	0.62215	0.0308
Period Perturbation Quotient-11(%)	[GAW]	[Left]		Sygyt	Fz (dB)	value	-0.64026	0.0461
Signal-to-Noise Ratio-v1(dB)	[GAW]	[Right]		Sygyt	Fy (dB)	value	0.63621	0.0261
Spectral-Flatness(SFM)	[GAW]			Sygyt	Fx (dB)	value	0.61404	0.0337
Spectral-Flatness(SFM)	[GAW]	[Left]		Sygyt	Fx (dB)	value	0.65245	0.0409
Spectral-Flatness(SFM)	[GAW]	[Right]		Sygyt	Fx (dB)	value	0.70527	0.0104
min-Subharmonic(Hz)	[GAW]			Sygyt	F0 (Hz)	value	0.62765	0.0289
min-Subharmonic(Hz)	[GAW]			Sygyt	Fx (dB)	value	0.7579	0.0043
min-Subharmonic(Hz)	[GAW]	[Left]		Sygyt	F0 (Hz)	value	0.73113	0.0163
min-Subharmonic(Hz)	[GAW]	[Right]		Sygyt	F0 (Hz)	value	0.77249	0.0032
min-Subharmonic(Hz)	[GAW]	[Right]		Sygyt	Fx (dB)	value	0.67018	0.0171

Discussion

Surgical versus non-surgical interventions for vocal cord nodules

- **Background:** This is an update of a Cochrane review first published in *The Cochrane Library* in Issue 2, 2001 and previously updated in 2007 and 2009.
- Vocal cord nodules are bilateral, benign, callous-like growths of themid-portion of themembranous vocal folds. They are of variable size and are characterised histologically by thickening of the epithelium with a variable degree of inflammation in the underlying superficial lamina propria. They characteristically produce **hoarseness**, discomfort and an unstable voice when speaking or singing.
- **Objectives:** To assess the effectiveness of surgery versus non-surgical interventions for vocal cord nodules.
- **Search methods:** We searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register; the Cochrane Central Register of Controlled Trials (CENTRAL); PubMed; EMBASE; CINAHL; Web of Science; BIOSIS Previews; Cambridge Scientific Abstracts; ISRCTN and additional sources for published and unpublished trials. The date of the most recent search was 9 April 2012.
- **Selection criteria:** Randomized and quasi-randomized trials comparing any surgical intervention for vocal cord nodules with non-surgical treatment or no treatment.-including acoustical measures.
- **Data collection and analysis:** No suitable trials were identified.
- **Main results:** No studies fulfilled the inclusion criteria.
- **Authors' conclusions:** There is a need for high-quality **randomised controlled trials** to evaluate the effectiveness of surgical and non-surgical treatment of vocal cord nodules.

Pedersen M, McGlashan J (2012) Surgical versus non-surgical interventions for vocal cord nodules (Review) *The Cochrane Library. pp. 1-13*

Discussion

Reliability of Objective Voice Measures of Normal Speaking Voices

- **Objective: to determine the reliability of objective voice measures used commonly in clinical practice**.
- 18 healthy volunteers (nine males and nine females)
- Measures of laryngeal efficiency, and pertubation measures of fundamental frequency (F0) for both genders.
- For female **cepstral peak prominence(CPP)** had moderate reliability, wheres for males, the smooth CPP was reliable.
- **Noise-to-harmonic ratios (NHRs)** has the lowest consistency of all measures over the course.
- **Additional research is needed to investigate which factors within the testing protocol and/or changes to the measurement instruments may lead to more consistent test results.**

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

Discussion

Evidence-based Clinical Voice Assessment: A Systematic Review

- Objective: to determine what research evidence exsists to support the **use of voice measures in the clinical assessment of patients with voice disorders.**
- **Litterature study** provides evidence for selected **acoustic, laryngeal imaging-based, auditory-perceptual, functional, and aerodynamic measures** to be used as effective components in a clinical voice evaluation.
- There is clearly a pressing need for high-quality research that is specially designed to expand the evidence base for - clinical voice assessment.

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 Journak of Speech-Language pathology. Vol. 22. pp. 212-226.

What we presented was an attempt to

- Measure high speed films combined with overtones/harmonics with “Voce Vista” and “Sygit Ltd”.
- Show that “Sygyt Ltd” can be used in clinical praxis for formant analysis.
- Prove that the approach in clinical praxis must be simple - as using F0 as a basis for formant analysis for comparison of treatment effect in pathology together with high speed films.
- To evaluate if a patient gets better after treatment comparison at the same mili second is probably necessary.

Find the slides on: http://www.mpedersen.org

Thank you for your attention!