EFFECT OF INSTANT EAR DOMES ON REAL EAR GAIN

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INTRODUCTION

Open-fit hearing aids have become a fast growing and popular phenomenon in recent years due to their attractive and comfortable design. Recent technology has seen the development of RIC aids in which the receiver is located in the ear canal at the end of the tubing rather than in the body of the aid and the most commonly used fittings are pre-molded canal fitting (dome) which are available in standard sizes and shapes which may include vents. These instant ear domes are preferred due to their time efficiency and increased comfort as they reduce the perceived occlusion effect.

The subjective occlusion effect can be described as the change in perception of one's own voice when wearing the hearing aid due to retention of transmitted vibrations during vocalization in the external auditory canal by the closed ear molds.

One of the strategies to overcome occlusion effect is venting, So occlusion effect is considered a function of vent characteristics and not a function of the hearing aid style.

Accordingly, this study was designed to assess the acoustics of different types of instant ear domes by estimating the insertion loss of each using Real ear measurements to make the right fitting choice.

RIC : Receiver in the canal

AIM OF THE WORK

The aim of the present study was to find out and compare the effect of instant ear domes of the RIC hearing aid on the real ear gain, specifically measuring the insertion loss of different types of domes and to compare between them according to subjective occlusion rating.

SUBJECTS AND METHODS

The study included 30 normal hearing individuals (60 ears), 17 females and 13 males, aging from 18 to 50 years without any facial anomalies or history of previous ear surgeries.

RIC with 5 types of domes were used: Open, Tulip, Bass-1-vent, Bass-2-vent and Double dome and the REM procedures were carried **on Affinity 2.0 Interacoustics, Denmark.**

Subjective occlusion rating was obtained as participants were asked to utter the names of the months of the year wearing the hearing aid turned off and rate the perceived occlusion based on the sound of their own voice on a scale ranging from 0 (no occlusion) to 10 (complete occlusion). This was repeated for each ear dome .

Insertion Loss was calculated for each dome : (Insertion loss = REOG – REUG)

Real ear unaided gain (REUG) was measured using 65 dBSPL pink noise stimulus without hearing aid while Real ear occluded gain (REOG) was measured using the same stimulus while hearing aid in place but turned off.

The variability of measured insertion loss among subjects was deduced by obtaining the coefficient of variation (COV) to confirm the reliability of this measurement.

RESULTS

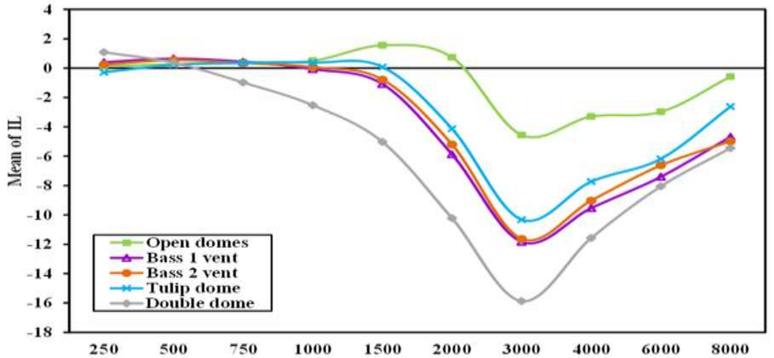

Figure: Distribution of the studied cases according to IL in each dome (n = 60)

Table 1 : Coefficient of variation for Insertion loss

IL	Open domes	Bass 1 vent	Bass 2 vent	Tulip dome	Double dome
250	4.62	3.30	4.64	6.93	2.04
500	3.59	1.74	1.44	8.73	4.51
750	2.93	4.72	6.09	5.69	3.19
1000	2.04	38.71	41.43	5.39	1.67
1500	0.90	3.96	5.03	39.0	0.94
2000	3.71	0.99	1.23	1.25	0.59
3000	0.58	0.41	0.44	0.42	0.31
4000	0.93	0.42	0.46	0.46	0.36
6000	0.93	0.58	0.71	0.77	0.59
8000	7.26	0.95	0.96	1.59	0.86

COV: Coefficient of variation

Table 2:Comparison between the different domes according to subjective occlusion scale (n = 60)

	#Subj. occlusion of impression	Subjective occlusion scale					Fr	p
		Open domes	Bass 1 vent	Bass 2 vent	Tulip dome	Double dome		
Min. – Max.	7.0 – 10.0	0.0 – 5.0	2.0 – 7.0	1.0 – 7.0	0.0 – 7.0	3.0 – 10.0	185.84*	<0.001*
Mean ± SD.	9.32 ± 0.79	1.02 ± 1.21	4.28 ± 1.33	3.65 ± 1.52	2.53 ± 1.65	6.65 ± 1.49		
Median (IQR)	9.50 (9.0 – 10.0)	1.0 (0.0 – 2.0)	4.0 (3.50 – 5.0)	3.0 (2.0 – 5.0)	2.0 (1.0 – 4.0)	7.0 (6.0 – 8.0)		
p0			<0.001*	<0.001*	<0.001*	<0.001*		
p1				0.073	<0.001*	<0.001*		
Pairwise				p2=0.024*,p3<0.001*,p4<0.001*				

#:Excluded from comparison IQR: Inter quartile range SD: Standard deviation
Fr: Friedman test, Sig. bet. periods was done using Post Hoc Test (Dunn's)
p: p value for comparing between the different domes
p0: p value for comparing between Open domes and each other domes
p1: p value for comparing between Bass 1 vent and each other domes
p2: p value for comparing between Bass 2 vent and Tulip dome
p3: p value for comparing between Bass 2 vent and Double dome
p4: p value for comparing between Tulip dome and Double dome
*: Statistically significant at p ≤ 0.05

CONCLUSION

- According to the established results in this study, the instant ear domes are arranged from least to most occluding as follows:

1-Open dome has the least insertion loss and lowest subjective occlusion rating which is best used for down sloping HL pattern

2- Tulip dome

3- Bass group which showed no significant difference between 1 and 2 vents whether in subjective rating or measured insertion loss

4- Double dome has the highest insertion loss which expressed itself at lower frequencies and the highest subjective occlusion rating but still not completely occluding as custom ear molds.

- Except for open and double domes, Results showed high variability at mid frequencies so individualized real ear measurement should be considered for best fitting outcome.