

# Improving OAE Screening Practices in Primary Healthcare Settings Using Combination OAE /Tympanometry

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# Goals for Periodic OAE Screening

## *Birth to Three*

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1. Address loss to follow up
  - No follow-up after birth screen
  - Missed in the hospital
  - Born outside of AZ border
  - Late onset and progressives
2. Conduct routine screenings as part of the well child check
3. Identify Chronic OM
4. Address parental and PCP concerns
  - Hearing loss
  - Child not talking
  - Child not meeting developmental milestones

# Implementation of OAE Screening Practices

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- In 2005, conducted a pilot project with 3 pediatric healthcare practices to investigate the feasibility and practicality of including OAE screening as part of their daily well and sick child check routines.

Examined:

- Protocols
  - Periodicity
    - How often should screenings be conducted
  - Screening
    - Follow-up plan for kids that don't pass
- Training
- Outcomes

# Cumulative Refer Rates on Initial Screens 10/04-9/05

	Mountain Park	Dr. Golner	Clinica Adelante
<b>Total # kids screened</b>	<b>534</b>	<b>509</b>	<b>199</b>
<b>Passed</b>	<b>415 (78%)</b>	<b>238 (47%)</b>	<b>164 (82%)</b>
<b>Referred</b>	<b>44 (8%)</b>	<b>102 (21%)</b>	<b>30 (15%)</b>
<b>CNT</b>	<b>45 (8%)</b>	<b>87 (17%)</b>	<b>3 (1.5%)</b>
<b>Inconclusive (pass or refer one ear/CNT other ear)</b>	<b>15 (3%)</b>	<b>34 (7%)</b>	<b>3 (1.5%)</b>
<b>Tymps Pass</b>		<b>47 (46%)</b>	
<b>Tymps refer</b>		<b>37 (36%)</b>	

# OAE Refers

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- Possible reasons for an OAE refer
  - False positive
    - Poor probe fit
    - Noisy child (internal or external)
    - Noisy environment
    - Equipment malfunction (battery or blocked probe)
  - Middle ear dysfunction (not always detectable)
  - Hearing Loss

# Benefits of Adding Tympanometry Screening

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Provides more information about the OAE “refer”

- False Positives
- Improved ability to detect effusion
- Eliminates un-necessary visits to audiologist

# Barriers or Challenges with Tympanometry Screening

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- Logistics of equipment
  - Lack of training (turnover)
    - Non-compliant child
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= TIME

# Effectiveness of Identifying ME Effusion: Visual Otoscopy

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A review of the literature shows that:

- Static otoscopy **often is not capable of identifying a non-infected middle ear effusion or TM retraction.** Pediatricians commonly use **static otoscopy** which **has “limited”** ability to aid in diagnosis (Nelson, 1988; Sassen, Van Aarem, & Grote, 1993).
- KC, Guragain, & Sinha, 2007 found a **Sensitivity of 78.7% and Specificity of 22.2%** in N=121 ears



# Pneumatic Otoscopy

- The current standard for diagnosing otitis media is pneumatic otoscopy (Alper, Bluestone, Casselbrant, Dohar, & Mandel, 2004).
- The diagnostic accuracy is affected by the anatomy of the infant's ear, the medical professional's training, and the equipment used to visualize the tympanic membrane.
- The average accuracy score for general practitioners was 45%. The score for pediatricians was 50%. For otolaryngologists, the score was 73%. Primary care doctors reported an average of 58% certainty in their diagnosis of AOM in infants under a year of age (Froom, Culpepper, Grob, Bartelds, Bowers, Bridges-Webb, Grava-Gubins, Green, Lion, Somaini, Stroobant, West, and Yodfat, 1990).
- Pneumatic otoscopy has been found to have good sensitivity but only fair specificity for the diagnosis of OM (Nozza, Bluestone, Kardatzke, & Bachman., 1994).
  - KC, Guragain, & Sinha, 2007 found a Sensitivity of 90.40 % and Specificity of 33.3 % in N=121 ears.

# Tympanometry 226 Hz Probe Tone > 6 months

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- *Nozza et al*, reported **sensitivity of 83% and specificity of 87% at best**
  - When **combining** tympanometry and pneumatic otoscopy, sensitivity increases to **90–98% and specificity to 80–93%**.
- Among children  $\geq 6$  months of age, **effusion was diagnosed in 80.2% of ears with flat tympanograms**, *Smith et al, Pediatrics 2006*.

# Tympanometry 1000 Hz Probe Tone < 6 months

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- Swanepoel, 2007: did a study of (0-4 weeks of age) neonatal ears, comparing 1000 Hz probe tone tympanometry and DPOAE screening and concluded that **initial reports demonstrate that high frequency immittance measurements using a 1000 Hz probe tone assist in clarifying false positive screening results** due to middle ear pathology or transient middle ear effusion.
- Concluded that correct identification of middle ear status in the neonatal period could direct timely and correct referrals to medical and audiological personnel that may lead to improved efficacy of neonatal hearing screening programmes.

# Research Questions

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- Is the addition of a tympanometry screen helpful in validating failed OAE results?
- Are the results of the 2 screens consistent?
- Is the information provided by the combination screen useful to the physician?
- How well does the equipment perform on young children?

# Study 101 Ears

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- Tested 53 kids in a high volume community health clinic and pediatrician's office
  - Both well and sick kids
  - Screenings conducted by medical assistants
  - Both offices previously screened with OAE's
  - Conducted both OAEs and Tympanometry (226 and 1000 HZ)

# Pass / Fail Criteria

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## DPOAE

Number of frequencies: 4

F2 frequencies (as presented):

5, 4, 3, 2 kHz

P1/P2: 65/55

Avg Time: 2 seconds per  
frequency

SNR for a passing frequency:  
6 dB

# of passing frequencies for  
overall PASS: 3 of 4

Ratio: 1.20

Minimum DP Amplitude: -5 dB

## Tympanometry:

226 Hz Probe Tone

Ear Canal Volume: 0.2 – 2.0 ml

Compliance Peak: 0.2 – 1.4 ml

Peak Pressure: -150 - +100

## Tympanometry:

1000 Hz Probe Tone

Kei, et al (2003):

.39 mmhos (peak to  
positive tail)



## EroScan Pro Data

**Phoenix Pediatrics: 40 Ears: OAE Pass = 28 / OAE fail=12**  
**Average Test Time: 5.5 minutes**

OAE Refer/ Tymp Refer	Pneumatic Otoscopy
<b>11</b>	<b>10 with effusion</b>

OAE Pass/ Tymp Pass	OAE Pass/ Tymp Refer	OAE Refer/ Tymp Pass
<b>26</b>	<b>2</b>	<b>1</b>

**MPCHC: 61 Ears: OAE Pass = 44 / OAE Fail=17**  
**Average Test Time: 5.2 minutes**

OAE Refer/ Tymp Refer	Visual Otoscopy
<b>12</b>	<b>5 with effusion</b>

OAE Pass/ Tymp Pass	OAE Pass/ Tymp Refer	OAE Refer/ Tymp Pass
<b>39</b>	<b>5</b>	<b>4</b>

**OAE / 1000 Hz Probe Tone Results: Combined Sites**

OAE Pass/ Tymp Pass	OAE Refer / Tymp Refer	OAE Pass/ Tymp Refer
<b>10</b>	<b>6</b>	<b>1</b>



# Practical Considerations

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- Enhancement and validation of OAE refer
- Helps to expedite the course of treatment
- Improves patient flow in the office
- Practical enough to incorporate into a busy practice

# Case Study: SJ

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- Full Term, Passed Newborn Hearing Screen
- 1<sup>st</sup> Week: Administered antibiotics due to a kidney infection
- First 2 Year well child checks: normal developmental milestones
- 2 Year Check: Parental concerns, sitting too close to TV
- Failed OAE, Passed Tympanometry
- Visit to Audiologist: Bilateral, Moderate to Severe SNHL
  - Hearing Aids, AU