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Metodi Alternativi per lo Screening Neonatale

ASSR, AABR e CochleaScan

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Terminologia

- **NHS** : Neonatal Hearing Screening
 - Targeted (ie NICU)
 - Non-targeted (well-babies)
- **UNHS**: Universal Neonatal Hearing Screening - Screening Neonatale Universale
- **UNHS = EHDI** (Early Hearing Detection and Intervention) Identificazione ed Intervento Precoce

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Gli strumenti che abbiamo per i programmi EHDI

Fase di Identificazione (Detection)

- OAEs
- AABR, ASSR (?????)

Fase del Intervento

- ABR, EchoG,
- ASSR, Cochleascan

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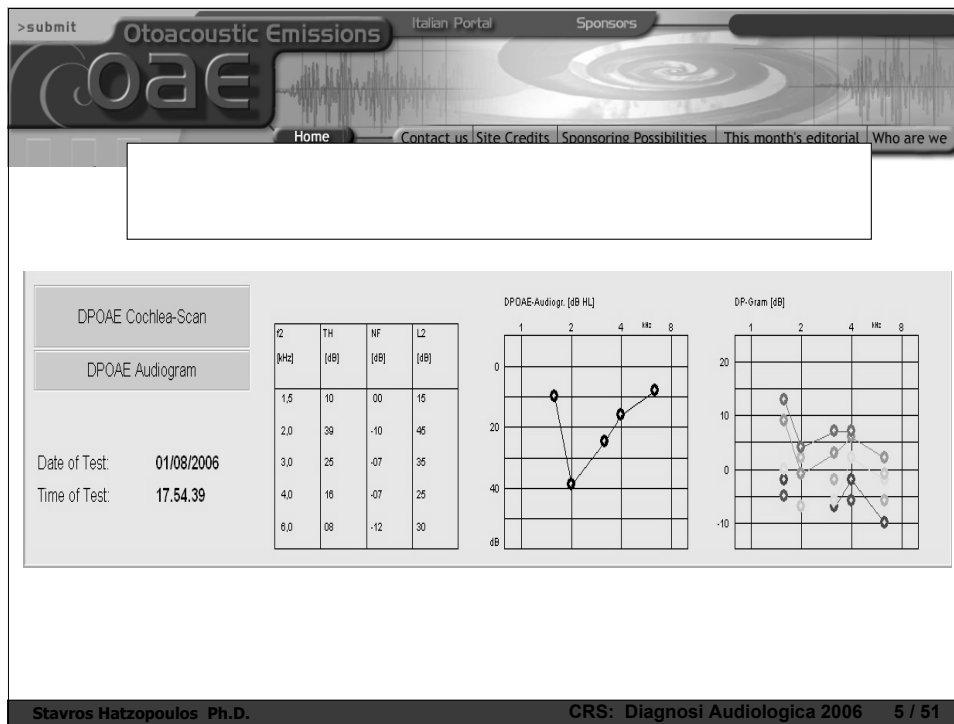
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CochleaScan

- Using the scissor paradigm where $L1 = 0.4L2 + 39$ dB a logarithmic dependency of the DPOAE pressure level L_{dp} on the sound pressure level $L2$ of the f_2 primary tone can be found (Boege and Janssen, 2002)

L1	L2
65	65
63	60
61	55
59	50
57	45
55	40
53	35
51	30
49	25
47	20

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Che cosa è la risposta ASSR

- Il potenziale Steady - State si genera dalla modulazione, di un tono carrier , in frequenza o ampiezza.
- La intensità del segnale può arrivare a 120 dB HL.
- La frequenza del potenziale ASSR si identifica con procedure statistiche .

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2000 Hz tone modulated at rate of 100 Hz

Modulated carrier

amplitude

msec

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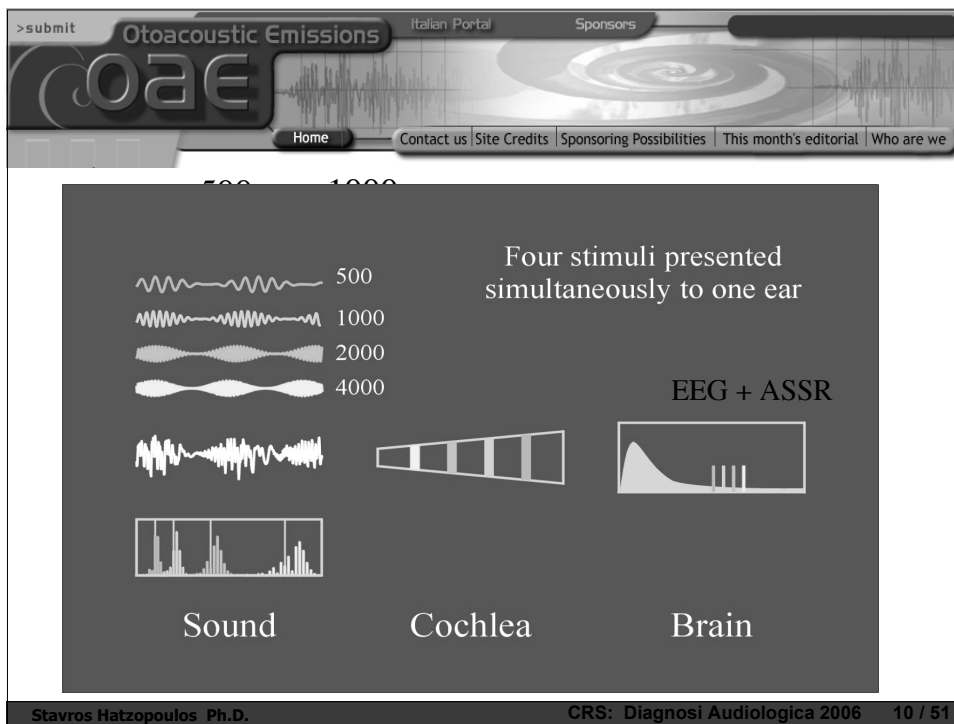
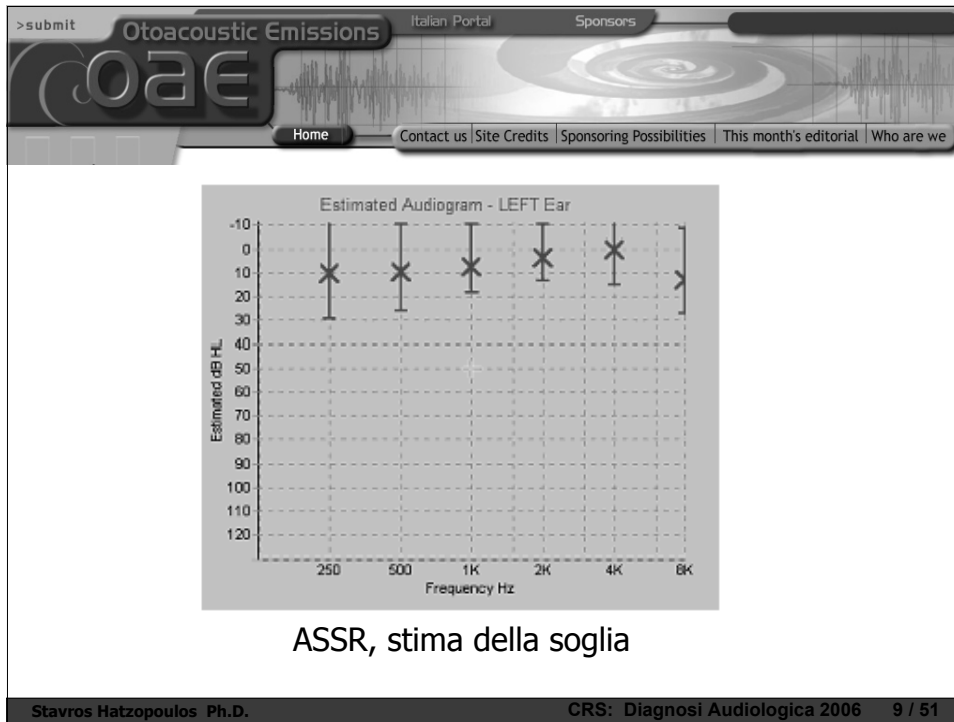
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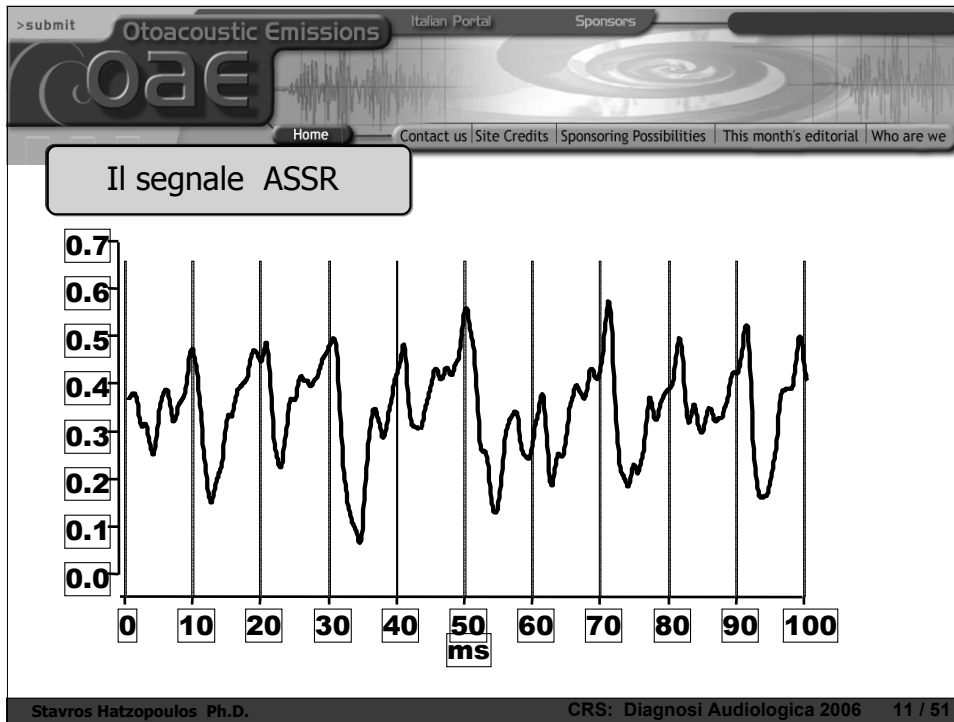
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ASSR

- ▶ Auditory Steady State Responses-ASSR
Risposte /Potenziali dello stato stazionario
(Componenti periferici, centrali, corticali).
- ▶ Molto utile per la stima della soglia uditiva per
le applicazioni post-screening (ie protesi).
- ▶ E possibile considerare futuri applicazioni nel
settore di screening .

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- GSI VIASYS
 - Audera (Rickards, Gary Rance, Barbara Cone-Wesson, et al)
 - Bio-Logic Systems Inc.
 - MASTER (Terry Picton et al)
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DPOAE Cochlea-Scan

DPOAE Audiogram

Date of Test: 01/08/2006
Time of Test: 17.54.39

f2 [Hz]	TN [dB]	NF [dB]	L2 [dB]
1.5	10	00	15
2.0	39	-10	46
3.0	25	-07	95
4.0	16	-07	25
6.0	08	-12	30

DPOAE-Audiogr. [dB HL]

DP-Ogram [dB]

Cochleascan VS ASSR

Estimated Audiogram - Left Ear

Estimated Audiogram - Right Ear

L/R
 R/L
 Overlaid
 ASSR Report
 Inhib Done
 ASSR Thresholds
 Est. Audiogram
 Results Summary

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THE UNIVERSITY OF MELBOURNE

Towards a ASSR Screening Test for Neonates

Barbara Cone-Wesson, John Parker,
Field Rickards, Ellen Ma and
Graeme Clark
JAAA, 2002

Methods

- Newborns were tested as part of a larger study of universal newborn hearing screening technologies (Identification of Neonatal Hearing Impairment, NIDCD #DCO1958).
- 87 neonates (majority NICU grads) who had passed AABR, TEOAE and DPOAE tests.
- 4 frequencies and two levels tested in random order.

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Discussion

- ASSR results at 2 kHz compare favorably with other established hearing screening measures.
- Need to establish test performance using a sample that also includes infants with hearing loss.
- Need for rigorous study of ASSR threshold in newborns and older infants.

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**PARTE 2:
Automated
Auditory Brainstem Responses
(AABR)**

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Da ricordare gli strumenti che abbiamo alla nostra disposizione

<p>Fase: Identificazione</p>	<p>Fase: Intervento</p>
<ul style="list-style-type: none">• Tecnologie Acustiche OAEs• Tecnologie EM AABR, ASSR (?????)	<ul style="list-style-type: none">• Tecnologie EM ABR, EchoG, ASSR

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Quarta Generazione (ABR +OAEs)



VIASYS Audio-screener
www.euromedicalaudio.com



Labat Echolab-plus
www.labat.it



Accu-Screen
www.gnresound.it

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- Ci sono anche gli apparecchi dedicati ad AABR come il portatile Algo 3i di Natus.



ALGO[®] portable
Newborn Hearing Screener



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- Il protocollo di Automated ABR (AABR) ha come obiettivo la identificazione della onda V, a livelli di stimolazione = 35 -45 dB nHL.
- Il hardware filtra le informazioni non relative alla onda V.
- La ricerca della informazione relativa, si fa in un intervallo di latenza preciso (ie 6 - 10 ms). Questo risolve l'uso di diversi template per neonati NIDO e NICU.

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- La corretta identificazione della onda V, viene valutata tramite una serie di procedure statistiche.
- Gli apparecchi forniscono un esito PASS quando I criteri dell'algoritmo statistico sono superiori a un certo limite probabilistico.
- Per la esperienza clinica un PASS è associato con una corretta probabilità di identificazione $p > 0.98$.

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- I dispositivi ABR usano preamplificatori di bassissimo livello di rumore, e per questo hanno problemi con impedenze elevate ($> 10K$) degli elettrodi.
- E' possibile fare un'esame con $Z_{in} > 15 K$ ma le tracce saranno "diverse", e l'esame durerà molto tempo.

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AccuScreen

```
~~~~~ Impedance test ~~~~~  
Please attach  
the electrodes!  
White: 15500Ω poor  
Red: 16100Ω poor  
Balance: 600Ω good!  
~~~~~ STOP ~~~~~
```

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- E' molto importante di creare una database di valutazione per qualsiasi dispositivo AABR.
- Da ricordare che questi dati (database) sono molto utili in caso che abbiamo certi dubbi sull'esito della valutazione AABR (ie caso NATUS).

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**Accuracy of Automated ABR
Summary of 4 Studies
(1187 ears)**

		Conventional ABR	
		Refer	Pass
ALGO I	Refer	101	38
	Pass	2	1046

Sensitivity = 96%
Specificity = 98%

Herrmann B S, Thornton A R, & Joseph J M (1995) Automated infant hearing screening using the ABR. Development and validation. American Journal of Audiology, 4(2) 6-14.

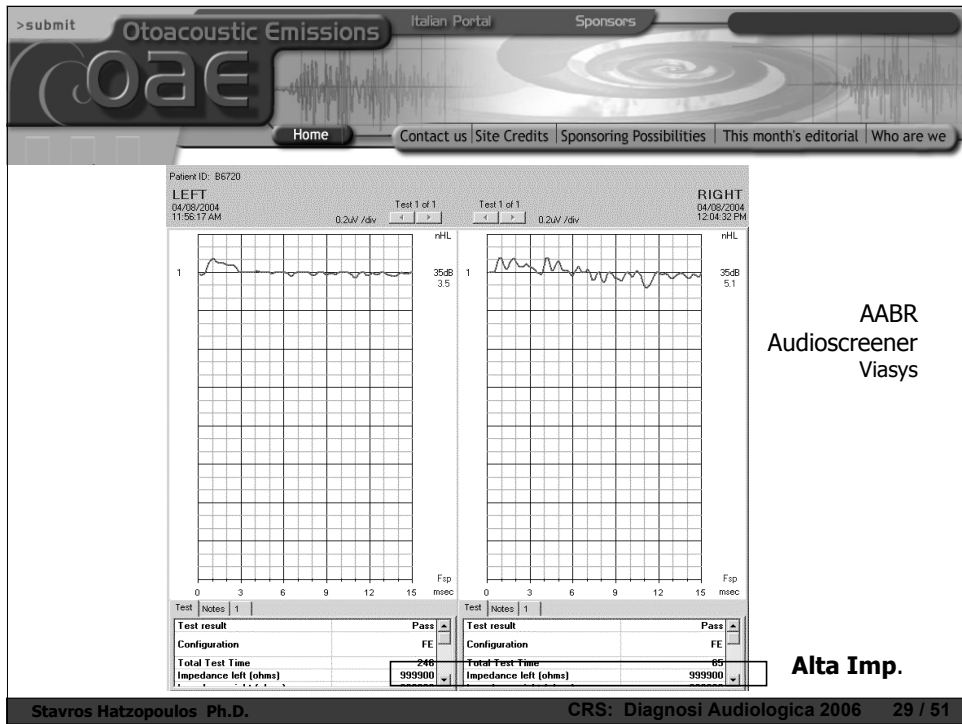
2

1

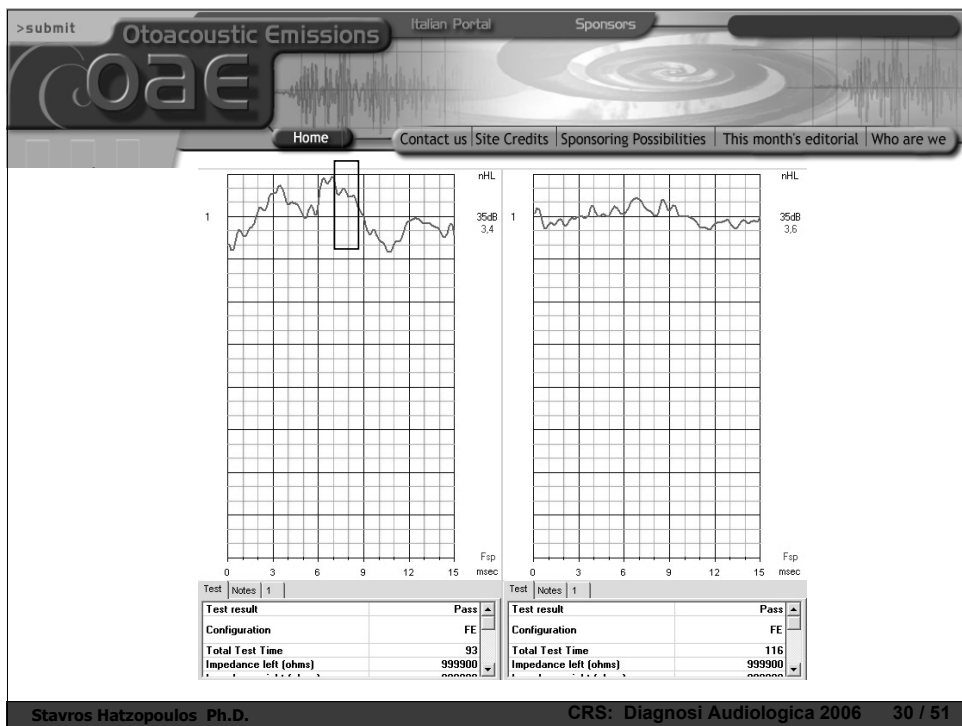
Automated and conventional ABR screening techniques in high-risk infants.
J Am Acad Audiol. 1990 Oct;1(4):187-95
Jacobson JT, Jacobson CA, Spahr RC.

(224 neonates)
Sensitivity and specificity measures for the ALGO-1 unit were 100 and 96 percent, respectively.
Permanent hearing loss was demonstrated in 5 percent of the newborns screened in this study.

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AABR
Audioscreener
Viasys



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DOB: 21/11/2003 Patient ID: P0421
 Examiner:
ABR - Refer

Right Ear: 27/11/2003 14.21.56
 Test Time:
 ABR:
 EEG:

Wt: 6100 Ohm
 Rd: 7000 Ohm

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DOB: 00/00/0000 Patient ID: P0465
 Examiner:
ABR - Pass

Right Ear: 04/02/2004 11.58.49
 Test Time:
 ABR:
 EEG:

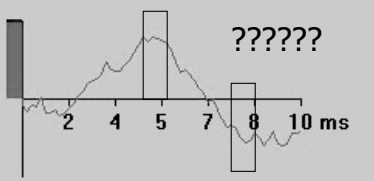
Wt: 3500 Ohm
 Rd: 3900 Ohm

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DOB: 00/00/0000 Patient ID: P0476
 Examiner:
ABR - Pass
 Left Ear: 10/02/2004 15.46.45
 Test Time:
 ABR:
 EEG:



Wt: 2900 Ohm
 Rd: 2900 Ohm

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PART 4:
La Realtà Clinica

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Dispositivi ABR

- L'uso degli dispositivi ABR può risolvere il problema della Neuropatia Uditiva nella popolazione di NICU.
- Sfortunatamente l'ambiente di NICU /NIDO è molto rumoroso e ostile per le registrazioni ABR. Quindi è molto facile di affrontare tempi di registrazioni relativamente lunghi (> 10 min)

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Dispositivi ABR

- L'uso dei protocolli ABR ha costi nettamente superiori di quelli associati con I protocolli OAE. Una valutazione globale di tutti I nati (UNHS) è fuori le possibilità economiche di tanti programmi di screening.

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AABR vs ASSR


- Gli dispositivi ASSR presentano una miglior performance a 500 e 1000 Hz, quindi è possibile che in un prossimo futuro la metodica di ASSR sostituerà l'AABR.!!!

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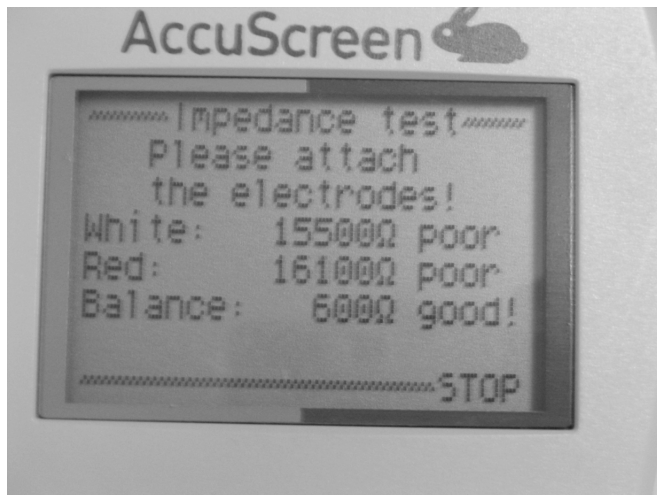
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That's all Folks !!