

Foramen ovale electrodes in presurgical evaluation of TLE

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Temporal lobe epilepsy is the most prevalent type of epileptic syndrome, and also the most frequent type of surgically treatable epilepsy

Foramen ovale electrode is a device developed by Wieser (1984) to explore human temporo-medial interictal and ictal EEG activity during presurgical evaluation

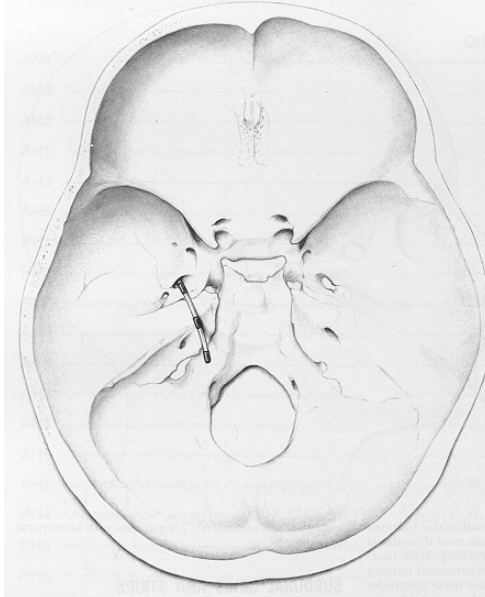
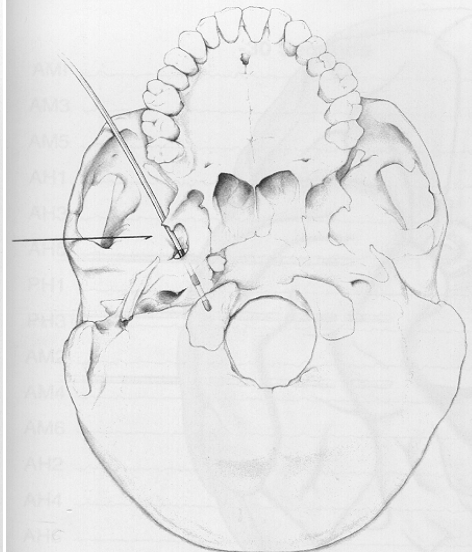
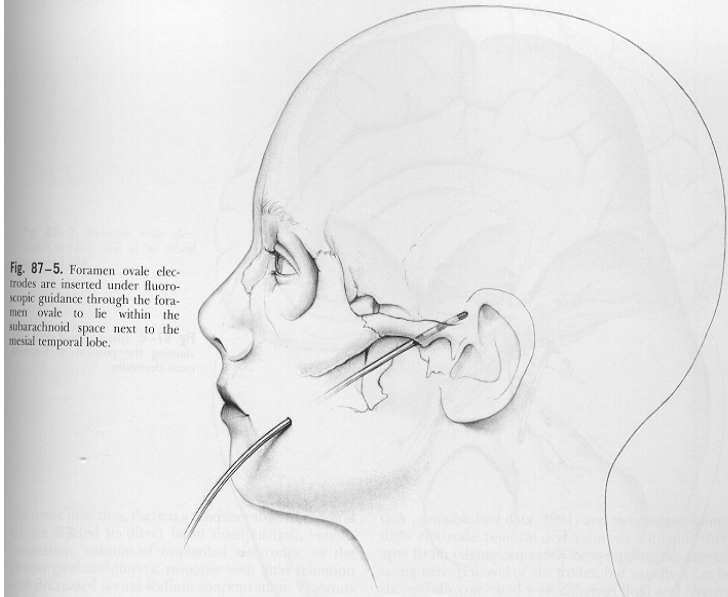
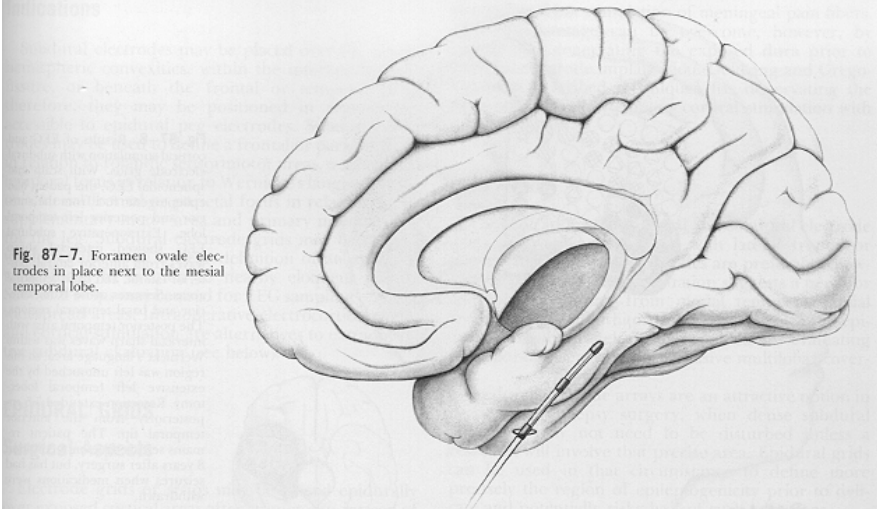
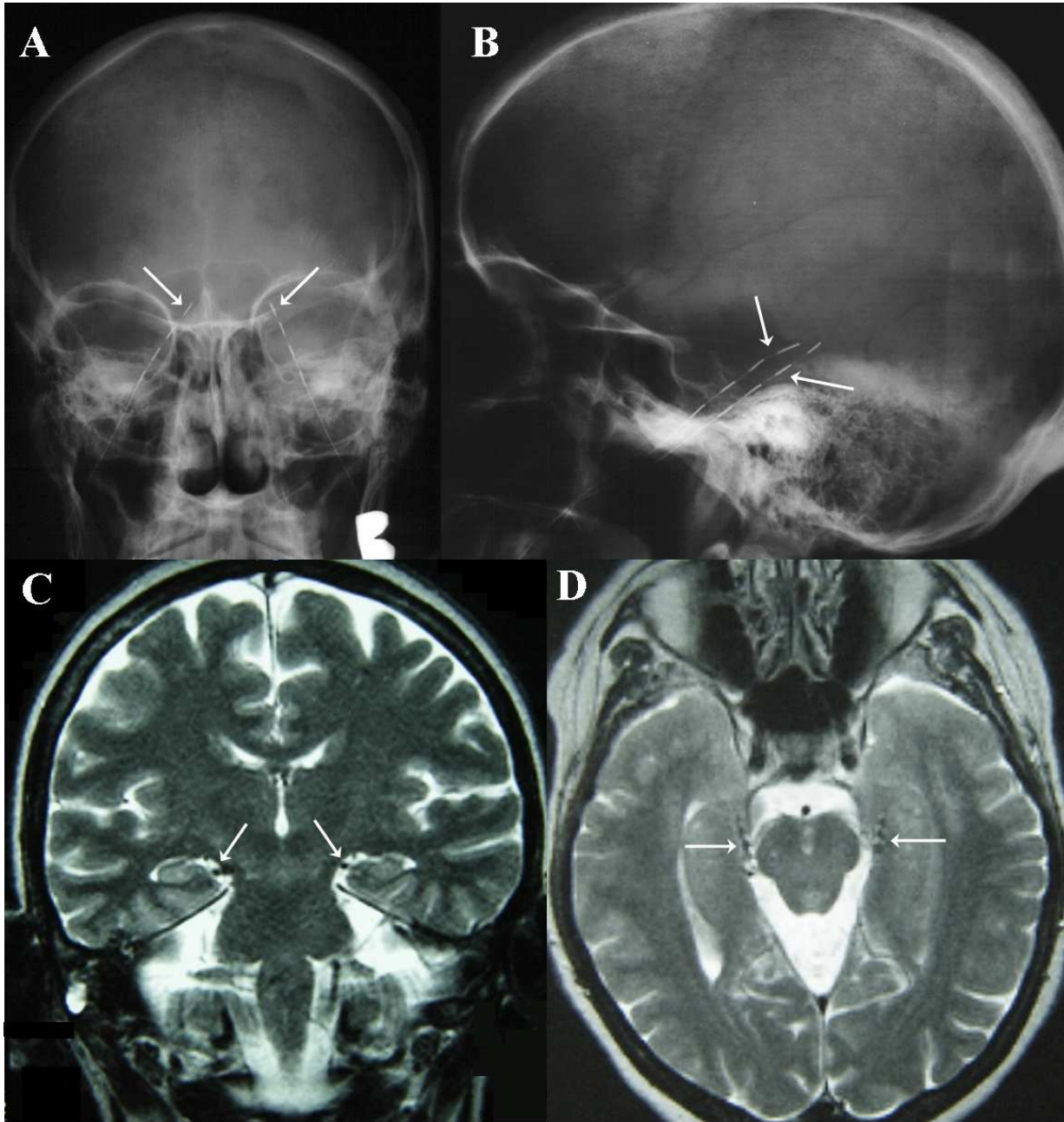


Fig. 87-6. Internal basal skull view showing the position of foramen ovale electrodes.

Foramen ovale electrode - position of the electrode in three dimension

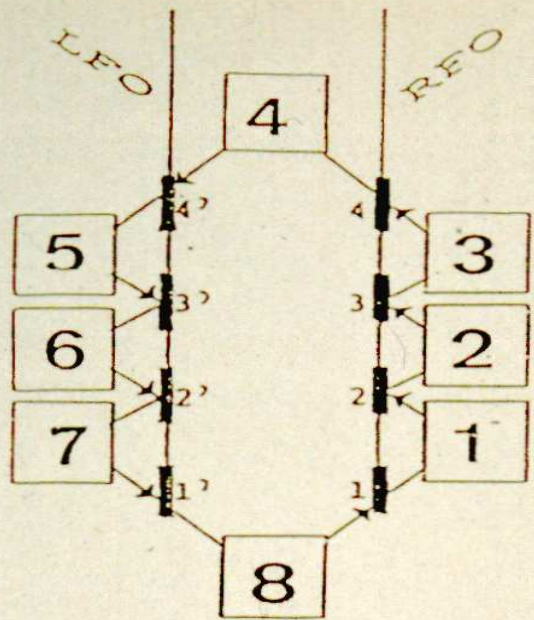




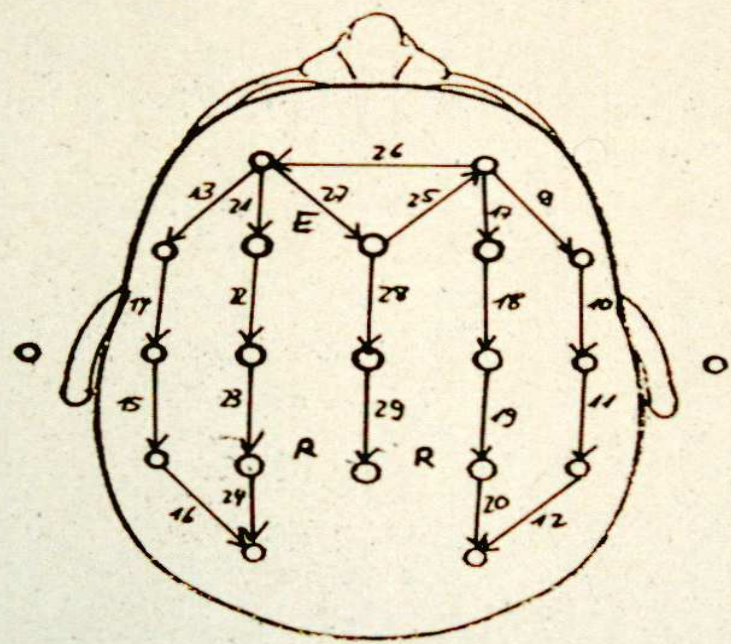
Position of FO
electrodes

In skull X-ray

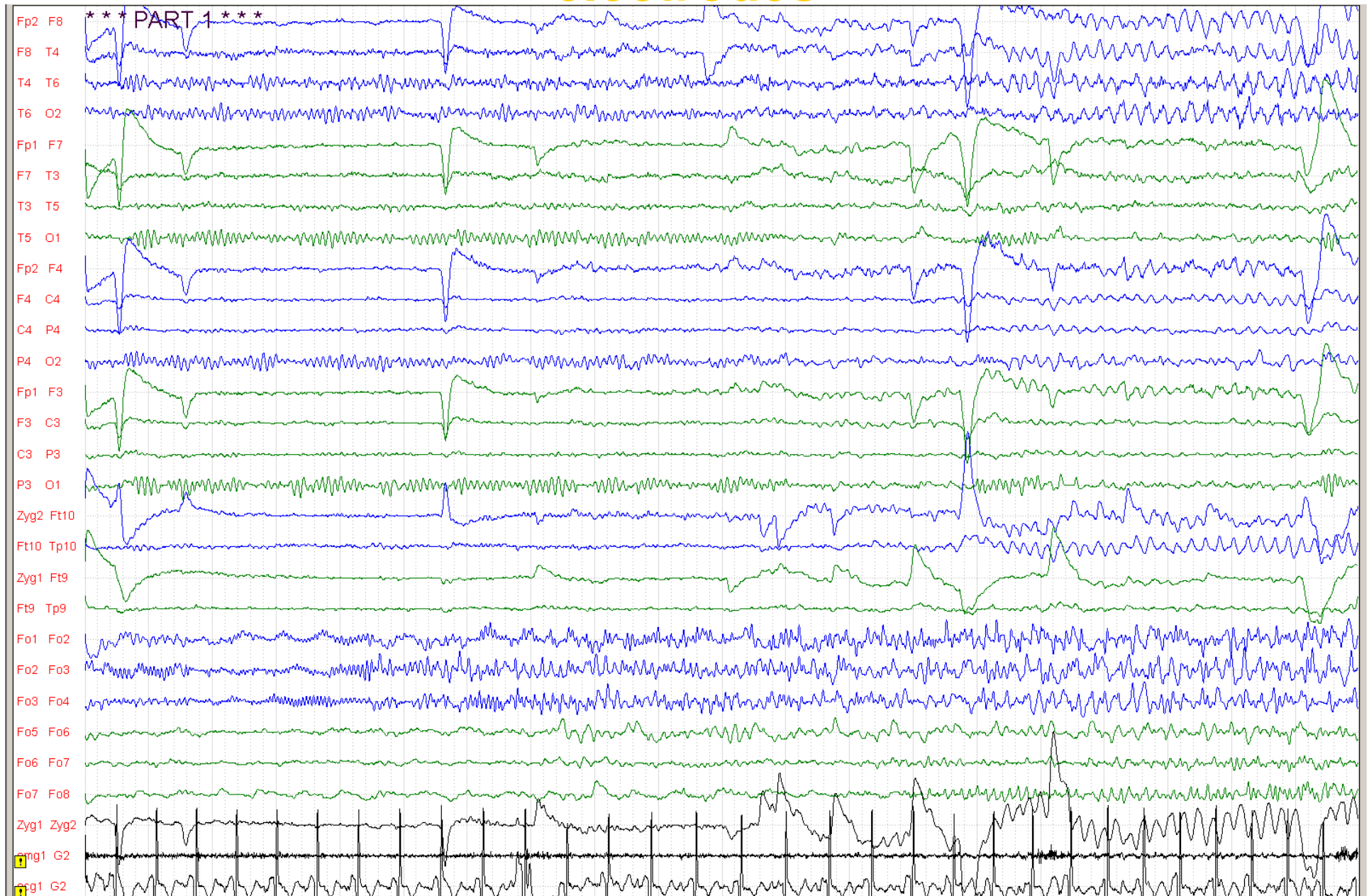
In MRI



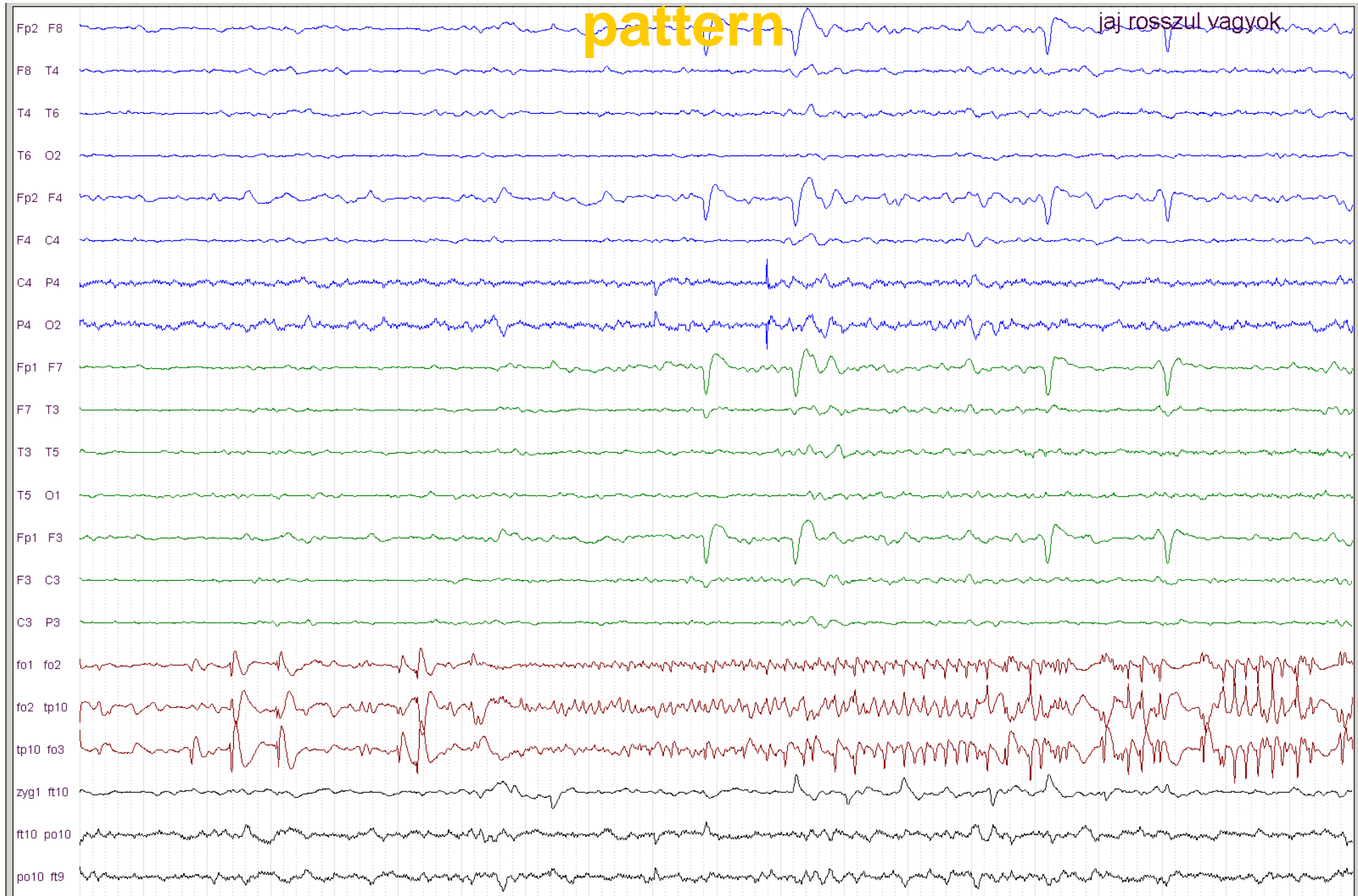
RFO/1 - RFO/2
 RFO/2 - RFO/3
 RFO/3 - RFO/4
 RFO/4 - LFO/4'
 LFO/4' - LFO/3'
 LFO/3' - LFO/2'
 LFO/2' - LFO/1'
 LFO/1' - RFO/1



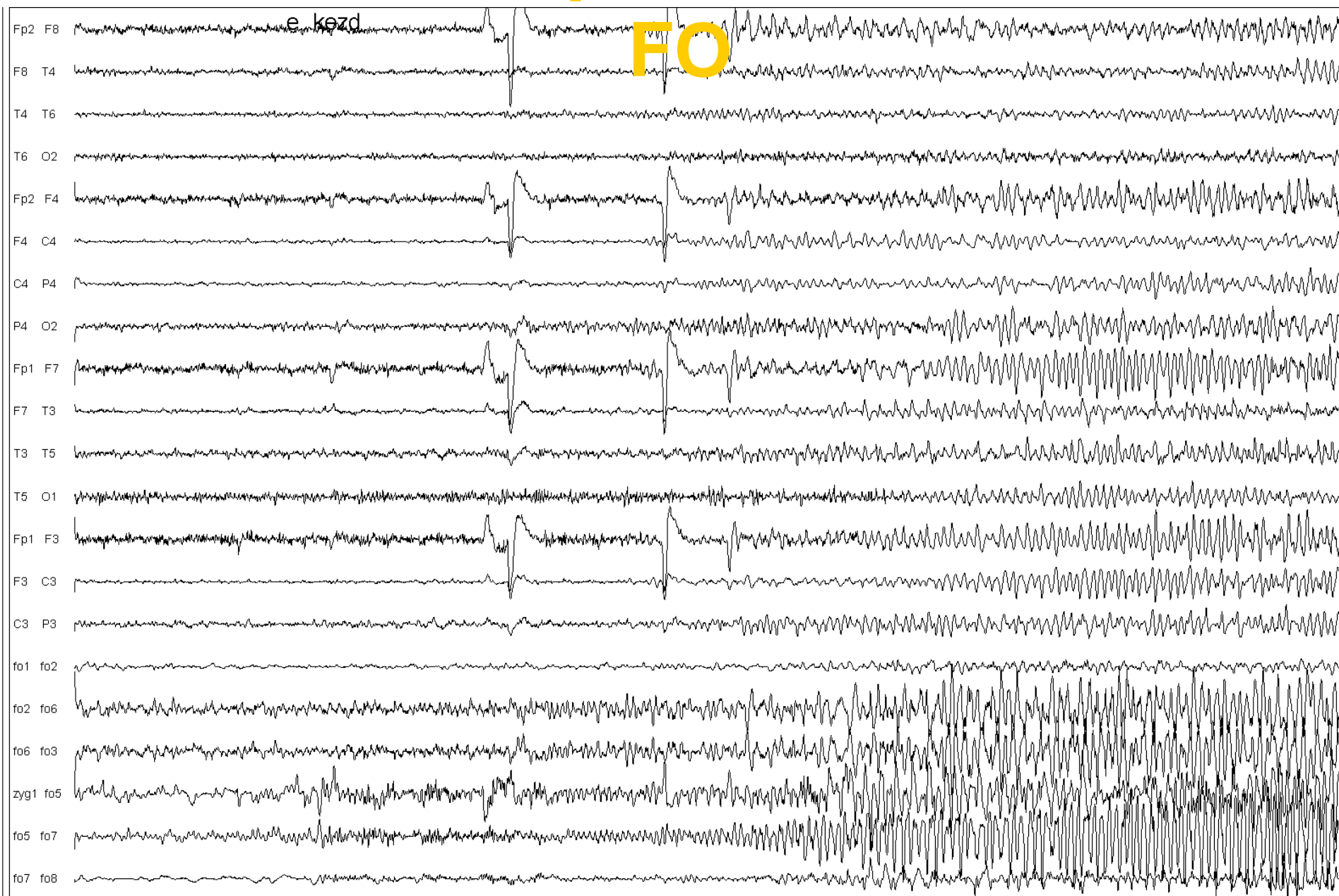
Temporal seizure pattern starting first in the FO electrodes



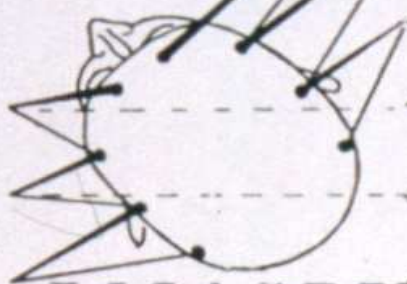
Seizure pattern in FO without surface ictal



MTLE seizure pattern starts first in



SEEG 114
16-04-84



RESP

R.FOR.OV.DC

R.FOR.OV.AC

R.AMYGDALA

R.T2 ant.

R.HIPPOCAMP.

R.T2 med.

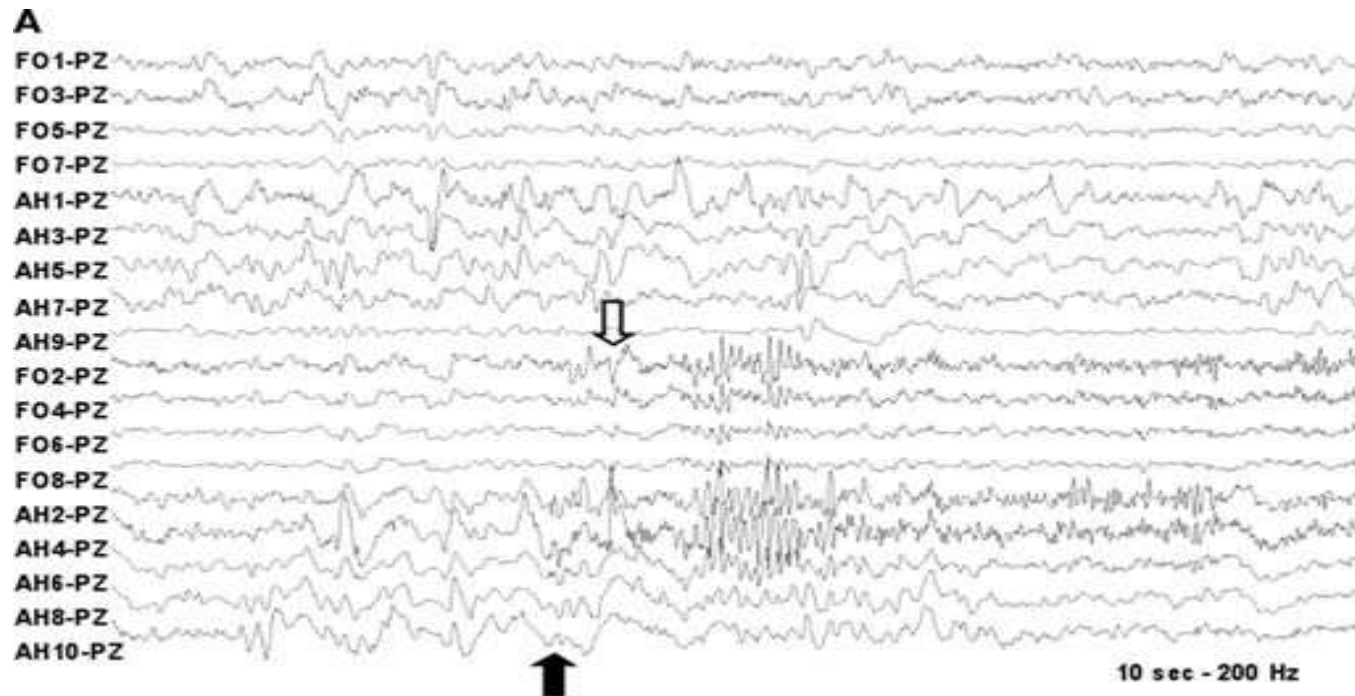
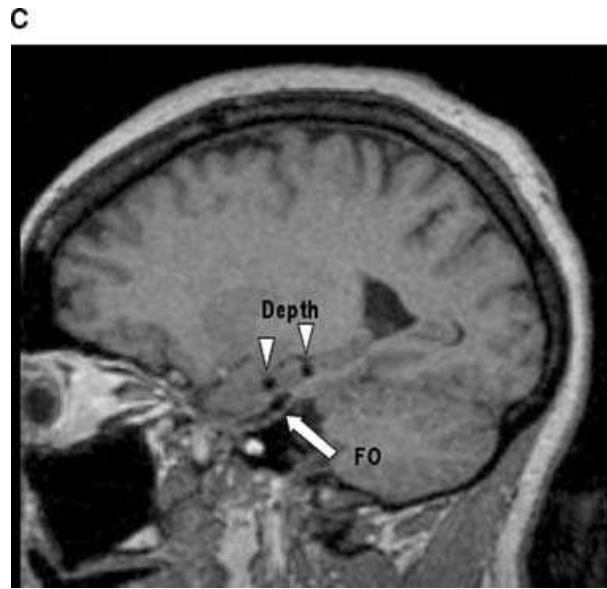
R.PARAHIPP.

R.T2 post.

R.G.LINGUAL.

R.T-0. lat.

1s | 50 μ V



Velasco et al 2006

Comparison of spenoidal (sp) and FO electrodes

Fernandez et al 1999 (King's College, London)

- Sp offer no significant increase in detection sensitivity compared to anterior scalp electrodes
- While in the deepest FO contacts among 2280 discharges of 20 pts 70% were not seen in sp electrodes

FO used during presurgical evaluation of (334) TLE/MTLE suspect patients.

- Wieser and Siegel 1991: 77 pts used with good results to verify temporo-medial seizure onset zone and to find reliable predictive signs for postoperative outcome
- Shih et al 1997: 12 pts used to lateralize seizure onset zone during presurgical evaluation (in 75% of pts FO lateralized the onset zone)
- Gómez et al 2001: 33 pts used to analyse ECoG value in differentiating between neocortical and mesial seizure onset
- Alarcon et al 2001: 110 pts using FO as „gold standard” to analyse lateralizing and localizing value of scalp EEG ictal onset.
- Kim et al 2004: 16 pts used to analyse relationship of scalp EEG and FO in terms of ictal patterns, laterality of seizure onset, and propagation pattern of seizures
- Pastor et al 2005, 22 pts reported that video-FOE proved to be the most effective method to localize/lateralize seizure onset during presurgical evaluation using MRI, SPECT, EEG, NPS, with exceptionally good outcome (91% Engel 1 after 2 yrs)
- Velasco et al 2006: 64 pts using FO to identify local seizure onset when scalp EEG failed and found that FO was able to lateralize seizures in 60% of pts. Depth electrodes EEG onset confirmed findings with FO!

Advantages of FO electrodes

- Provide direct (ECoG) comparison between the temporo-mesial interictal and ictal EEG activity of the two temporal lobes
- Provide comparison of the mesial and surface (scalp) interictal and ictal EEG activity
- Safe semi-invasive method providing chronic ECoG of the temporo-mesial region, without any opening of the skull

Questions to be answered by the use of FO electrodes

- Is there an unilateral onset? (laterality ?)
- Evidence of seizure start in the mediobasal region? (localisation ?)
- Evidence of bilateral independent onset?
- Where is the seizure onset zone over the mediobasal surface along the anterior – posterior axis ?
- Seizure propagation routes?

Typical MILE presurgical situations indicating FO implantation

- Complex partial seizures without definitive unilateral onset in the ictal scalp EEG with or without lesion
- Complex partial seizures with contralateral (to the lesion) ictal EEG
- Independent bilateral seizure onset in the scalp EEG
- Extratemporal or contralateral features in seizure semiology of cases with complex partial seizures with lateralizing ictal EEG, without lesion
- Localisation within the temporal lobe (medial/lateral) is questionable with or without a lesion.
- **In general: any uncertainty either in localisation (medial/lateral, temporal/frontal) or in laterality in otherwise according to clinical-EEG-neuroimaging data TLE suspect cases**

Lateralisation of seizure onset (SO) zone by FO electrodes in 37 MTLE pts
(Epilepsy Center Budapest)

MRI/EEG /Seizure constellation	pts No	unilat SO/FO	bilat ind SO/FO	surger y	Follow-up (yrs)	E:1	E:2	E:3≤
Unilat lesion, EEG non lat or contralat	11	10	1	10	2-10	8	2	0
Bilateral HS, EEG nonlat or lat	3	3	0	3	2-5	3	0	0
Without lesion, EEG nonlat or lat	10	10	0	9	2-10	5	3	1
Bilat independent seizure onset (scalp) (3HS)	13	1	12	2	5-10	0	1	1
SUM	37	24	13	24		16	6	2

FO was used in 54 pts (38% of TLE pts with presurgical work-up).
From them 47 had sufficient follow-up.
For lateralisation purposes FO had been introduced in 37 pts

Complications (n=214)

(Wieser)

- V/3, V/2 dysaesthesia (7-9%)
- Bleeding into the face
- SAH (0,46 %)
- Temporal haemorrhage
- Meningitis (0,46%)
- Creutzfeld – Jacob (0,93%)

Morbidity: 47/9 = 9%

No enduring sequel

(Budapest Epilepsy Center)

	PTS	No
Complications:	9	
• Pain in the face:	6	
• Herpes virus inf.	1	
• Chick	1	
haemorrhage	1	
• trig.		
paraesthesia		