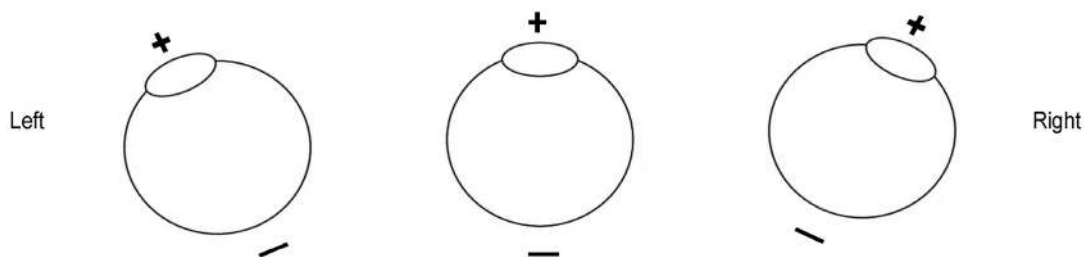




김 성 희  
이화의료목동병원

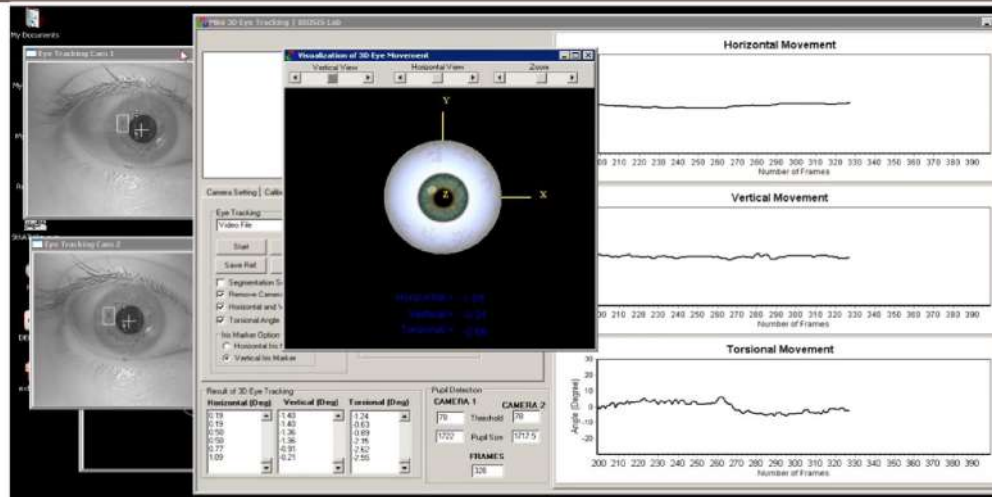
## ELECTRONYSTAGMOGRAPHY (ENG)



### Limitation

- No recording of the torsional movement
- Eye blink artifact
- Bell's phenomenon artifact
- Affected by the retinal disease and external light

## VIDEO-OCULOGRAPHY [VOG] / VIDEO-NYSTAGMOGRAPHY [VNG]



### Limitation

Ptosis  
Children  
Gaze angle > 30 degrees

## COMPONENTS ≠ PROTOCOL

### Spontaneous eye movements

Spontaneous nystagmus or Saccadic intrusion  
with visual fixation / without fixation

### Active eye movements

Gaze  
Saccades  
Smooth pursuit

### Induced eye movements

Vibration induced nystagmus  
Head-shaking nystagmus  
Positional nystagmus

## BEFORE THE TEST

## ■ Preparation

- Clinical information
- Aim
- Attention, Mood
- Medication
- **Light** : On - spontaneous nystagmus with fixation, gaze, saccades, smooth pursuit  
Off – spontaneous nystagmus without fixation, head shaking, vibration, position
- Sound
- Background

## ■ Calibration

5

2016-03-15

Protocol				
코드 FZ733	검사장 이름 VNG & ENG	내용 정규 VNG	시행 프로토콜 1. Spontaneous nystagmus with fixation 2. Spontaneous nystagmus without fixation 3. Horizontal gaze : rightward gaze → primary position → leftward gaze → primary position 4. Horizontal smooth pursuit 5. Horizontal saccades 6. Head shaking nystagmus 7. Position : lying down → right head turning → primary supine → left head turning → primary supine → sitting → straight head hanging → sitting → right Dix-Hallpike → sitting → left Dix-Hallpike → sitting	비고 각 프로토콜 항목은 30초 이상 충분히 관찰 환자 협조 안 될 경우 지시봉 사용 진찰 당시 중요하게 관찰되는 소견이 있을 경우 임상 소견 항목에 기재 예정 Vertical plane evaluation, OKN, VOR, VV OR 평가가 필요할 경우 전달사항에 기재 모든 오더의 임상 소견 및 전달 사항 항목을 꼭 확인한 후 검사 진행
FZ733B-1	VNG & ENG	추적 검사 VNG	상기와 동일	정규 VNG 이상 소견을 확인하고 변화가 있는지, 해소가 되었는지 확인
MX035-1G	Canalith Reposition Therapy	이석정복술	Posterior canal : Epley or Semont maneuver Horizontal -geo : Barbecue or Gufoni maneuver Horizontal -apo : Gufoni maneuver	각 canal에 맞춰서 시행 후 30분 대기, 이후 좋아졌는지 확인 → 좋아졌으면 귀가 종료 / 좋아지지 않았으면 한 번 더 시행, PC인 경우 Brandt-Daroff 운동 교육하고 귀가

## 연동 및 판독

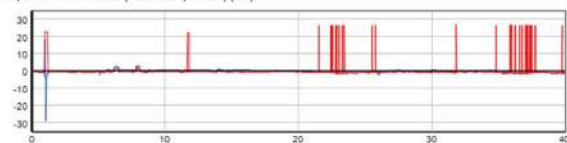
Analysis mode에서 각 항목별 결과 이미지 정렬

EMR 연동

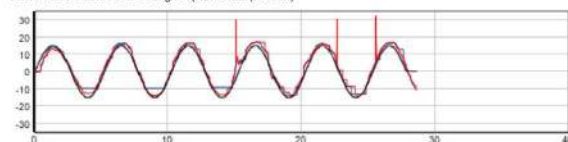
<sup>7</sup> 외장하드에 일자별로 데이터 백업 (default file 제외)

2016-04-25

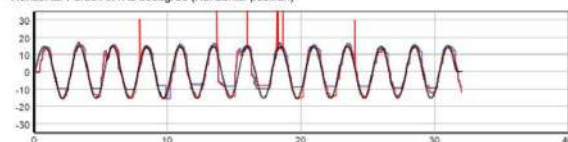
Spontaneous Fixation (Horizontal position) (1/2)



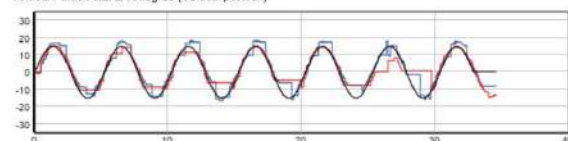
Horizontal Pursuit 0.2Hz 30degree (Horizontal position)



Horizontal Pursuit 0.4Hz 30degree (Horizontal position)



Vertical Pursuit 0.2Hz 30degree (Vertical position)

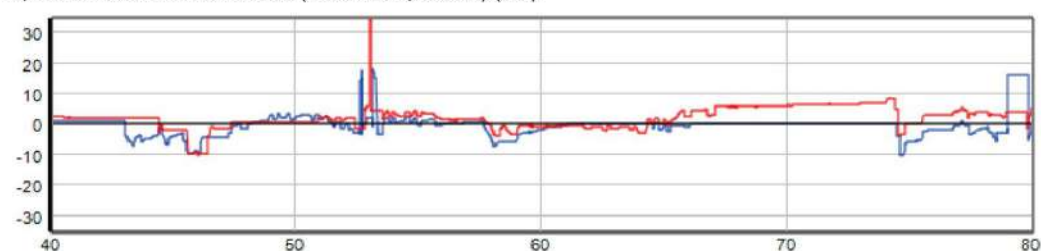


Horizontal Pursuit 0.2Hz 30degree (Horizontal position)

Pupil이 큰 18세 여자이며 의식 명료하고 협조적인 환자인데 이렇게 계속 artifact가 낄 이유가 없습니다. 빨간색 붉은 줄 전부 artifact이며, vertical pursuit에서도 양눈 제대로 안 잡히고 있습니다.

고글 장착 안정적으로 잘 되어 있는지, pupil이 잘 포착하고 있는지, 그래프 양쪽에서 잘 나오고 있는지 검사자 선생님이 계속 확인하면서 보정하는 과정이 필요합니다.

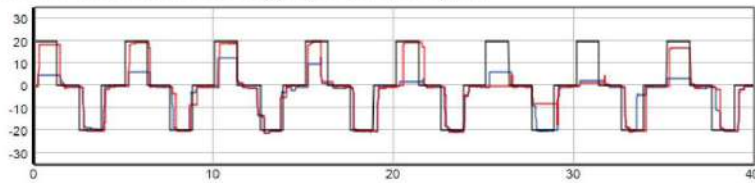
Spontaneous Without Fixation (Horizontal position) (2/3)



이 환자분 양눈 정렬이 일치하며, in darkness에서도 별다른 oscillation 없이 안정적으로 유지되고 있던 분입니다. 붉은줄 missing artifact 말고도 도중에 그래프가 찌글찌글하게 나오는 부분들도 전부 artifact로 보입니다.

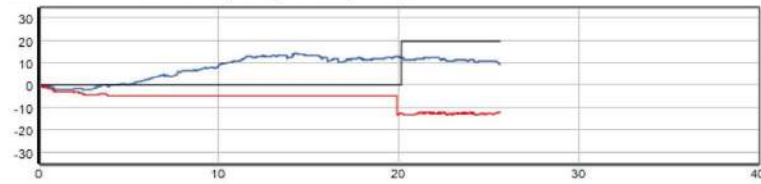
Without fixation 상태로 만들면 환자분들이 어두우니까 무의식적으로 이리저리 눈을 굴리거나 서성대거나 눈깜박임이 늘어날 때가 있습니다. 멍하니 한 곳 보고 있다고 생각하시라고 이르고, 눈깜박임 억제하시라고 우선 말로 여러 번 교육하고 보정하면서 검사 진행 필요합니다. 눈꺼풀 taping은 정말 안 될 때 노인 환자분들에서 하는 수 없이 사용했으면 좋겠습니다. Taping 자체가 많이 불편해서 검사 결과에 영향을 미칩니다.

Horizontal Saccade Center Fixed 40degree (Horizontal position) (1/2)



한쪽은 처음부터 기계가 인식을 못 하고 있습니다. 그래프가 이렇게 나오면 검사 하는 의미가 없습니다.

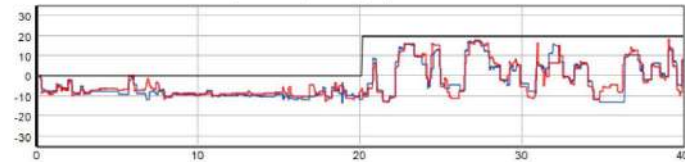
Horizontal Gaze Center Convergence (Horizontal position)



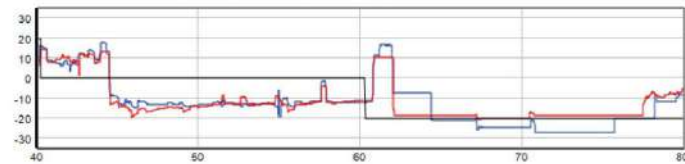
마찬가지로 반대쪽 눈 처음부터 안 잡히고 있습니다.  
Convergence 더 안쪽으로 근접해서 만나는 지점까지 가서 유지하는 것이 필요합니다.

11

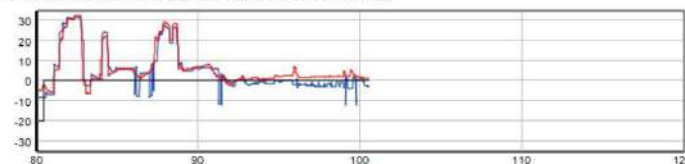
Horizontal Gaze Center H20, 20sec (Horizontal position) (1/3)



Horizontal Gaze Center H20, 20sec (Horizontal position) (2/3)



Horizontal Gaze Center H20, 20sec (Horizontal position) (3/3)



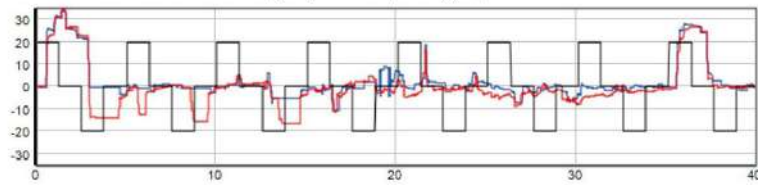
12

다른 환자입니다.

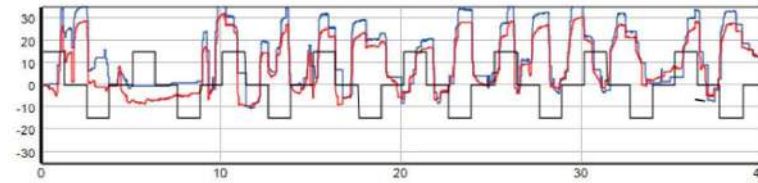
우안의 6<sup>th</sup> palsy로 right esotropia가 있어서 우안이 안쪽으로 쏠려 있고 환자분 협조도 제한적일 수 있다는 점을 헤아립니다만, gaze graph가 이렇게까지 안 나올 이유는 없어 보입니다.

환자분 우안이 잘 안 보여서 오른쪽 잘 못 보고 오른쪽 주시 못하는 것 같으면 우측 타겟 쪽에 검사자가 서서 따로 타겟 지시하면서 보라고 독려하거나, 앞에 보라고 하면서 머리 왼쪽으로 돌리면 우측 주시가 만들어집니다.

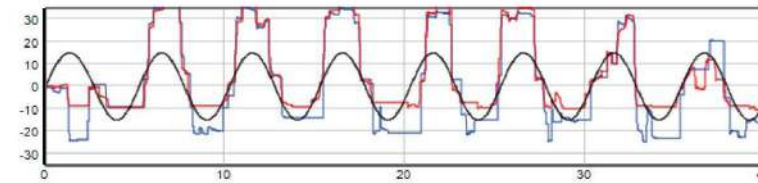
Horizontal Saccade Center Fixed 40degree (Horizontal position) (1/2)



Vertical Saccade Center Fixed 30degree (Vertical position) (1/2)



Horizontal Pursuit 0.2Hz 30degree (Horizontal position) (1/2)



13

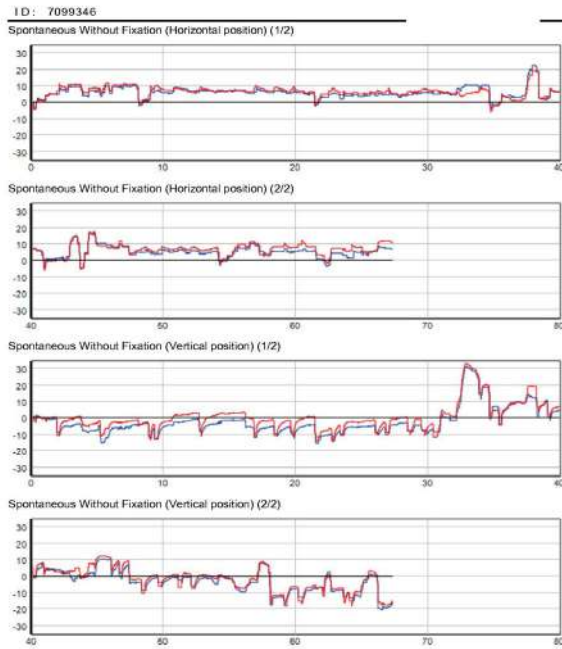
앞장과 동일 환자분이며, 마찬가지로 검사에 제약이 있고 협조가 잘 안 되더라도 이 그래프들은 아무런 정보를 주지 못하고 있습니다.

만일 정말 여러 번 보정하고 시도하고 노력해도 검사 진행이 안 되고 검사 결과가 계속 이렇게 나오는 경우에는 어떻게 할지 저와 상의해주세요. 환자분은 검사비를 15만원 가까이 들었는데 이 환자분에게 제가 말해줄 수 있는 것이 없습니다...

2016-06-15

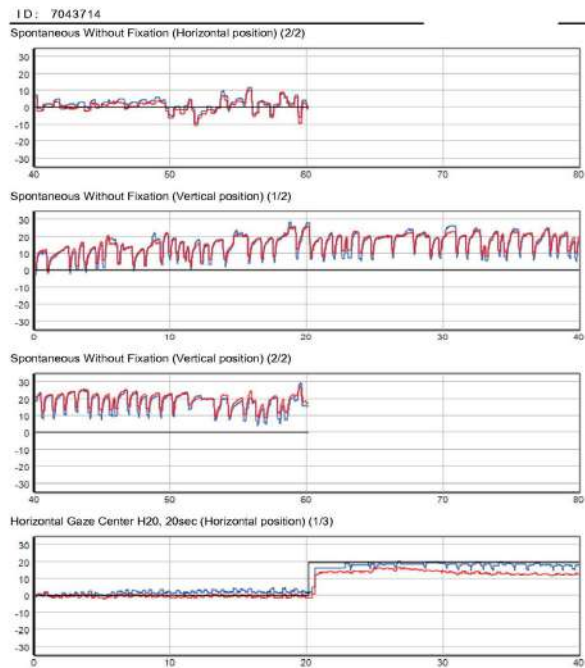


frequent blinking



15

frequent blinking



16



Calibration!

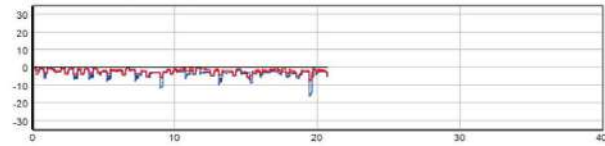
이런 분들이야말로  
정 안 되면 테이핑.

ID: 7087226

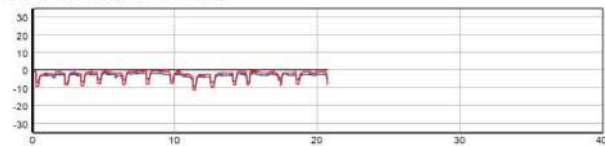
Calibration 5 Point Calibration (Horizontal position)



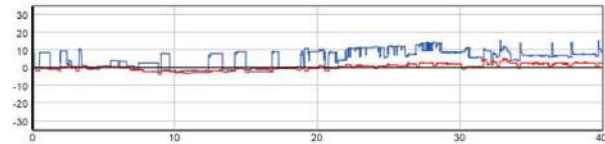
Spontaneous Fixation (Horizontal position)



Spontaneous Fixation (Vertical position)



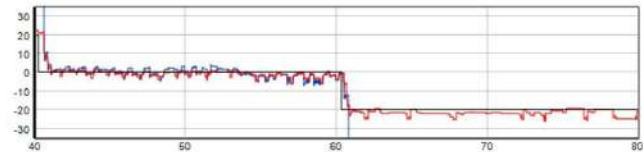
Spontaneous Without Fixation (Horizontal position) (1/2)



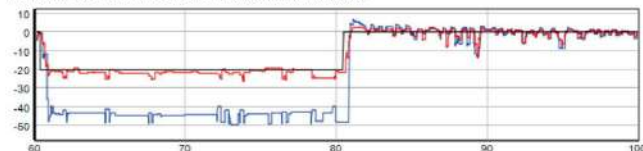
17

ID: 7087226

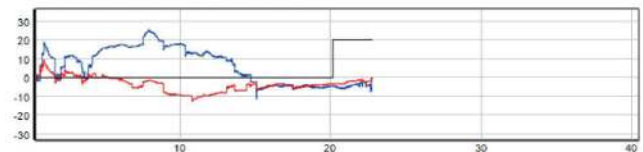
Horizontal Gaze Center H20, 20sec (Horizontal position) (2/3)



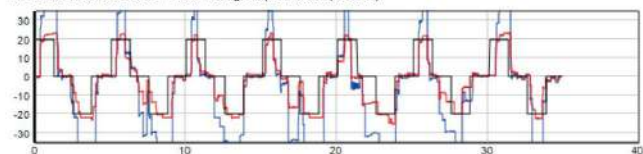
Horizontal Gaze Center H20, 20sec (Horizontal position) (3/3)



Horizontal Gaze Center Convergence (Horizontal position)



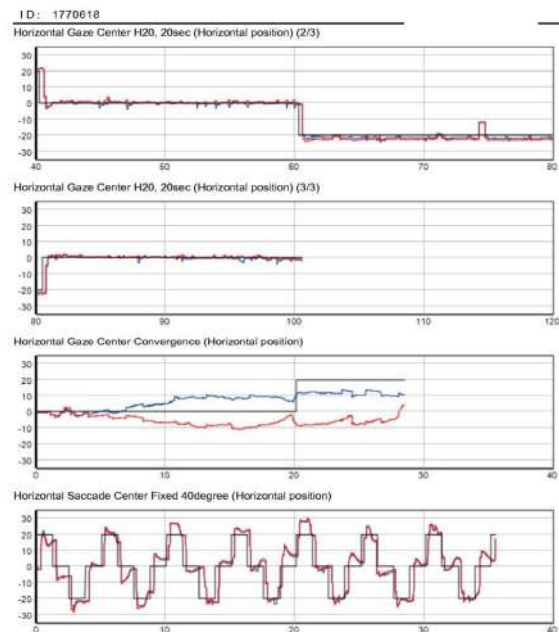
Horizontal Saccade Center Fixed 40degree (Horizontal position)



18

Saccadic hypermetria  
: pathologic mark of  
cerebellar dysfunction

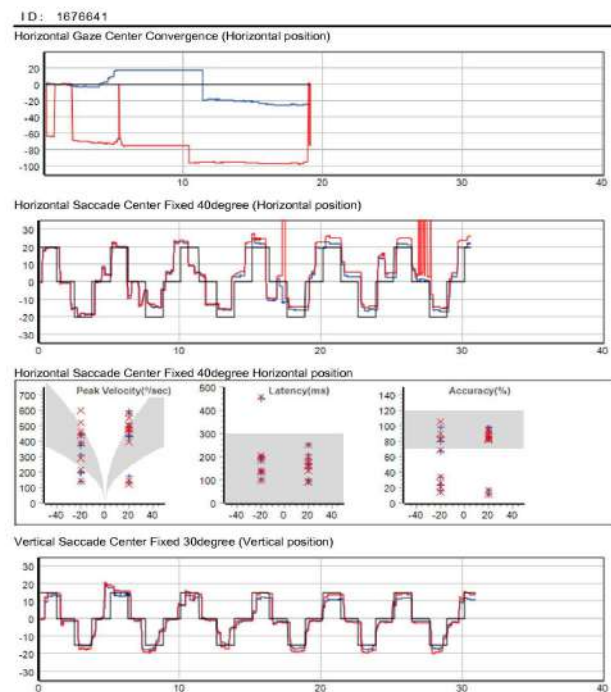
Saccades/SP 최소 60s 검사  
반복



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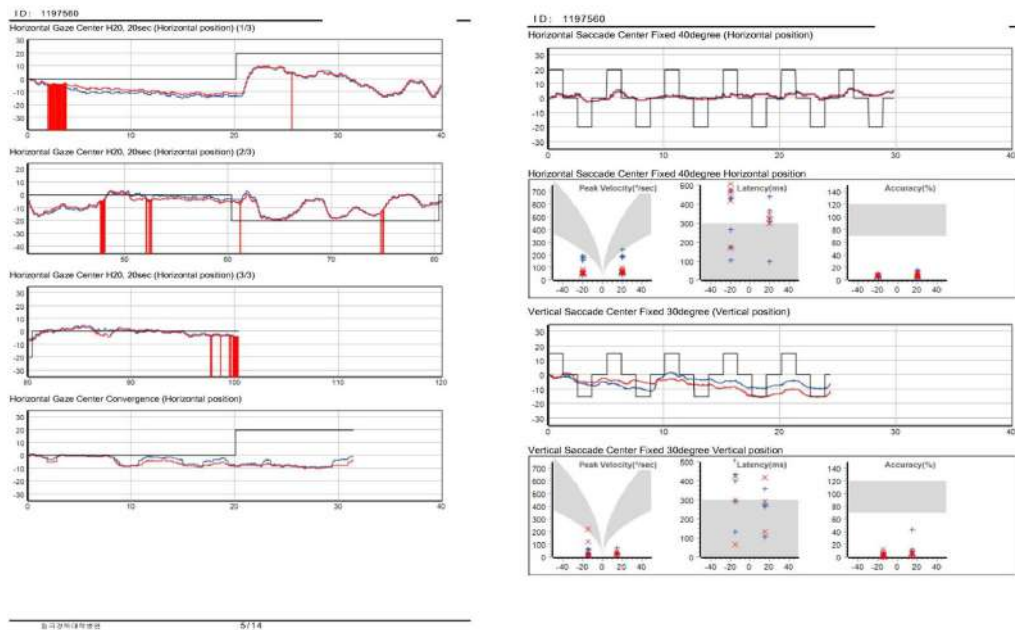
Saccades prediction하고  
있으면 다시, 제대로 시도

각 검사 항목 충분히 길게 검사



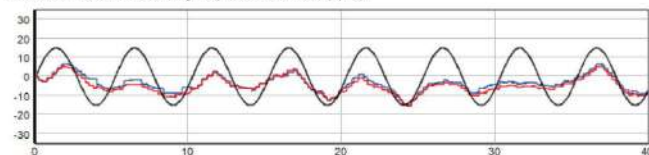
20

## Gaze/Saccades initiation failure를 보이면 VVOR 추가 시행 : supranuclear palsy

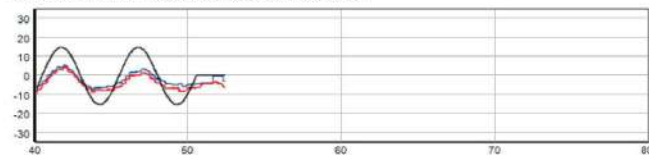


ID: 1197560

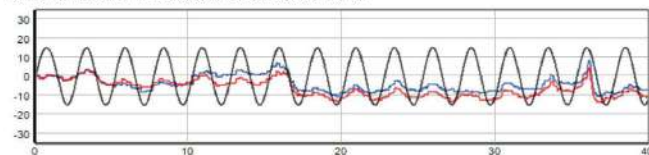
Horizontal Pursuit 0.2Hz 30degree (Horizontal position) (1/2)



Horizontal Pursuit 0.2Hz 30degree (Horizontal position) (2/2)



Horizontal Pursuit 0.4Hz 30degree (Horizontal position) (1/2)

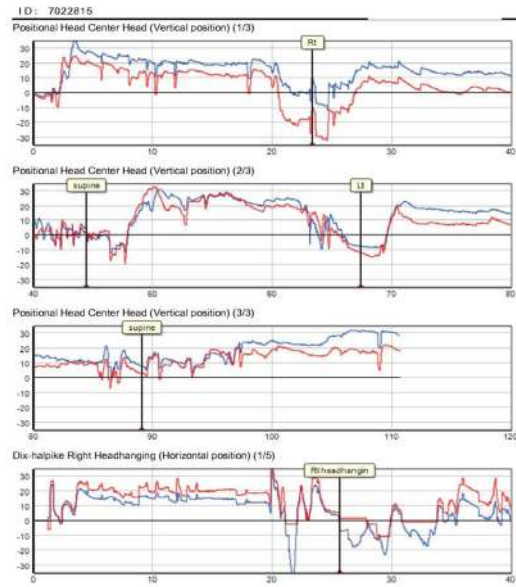
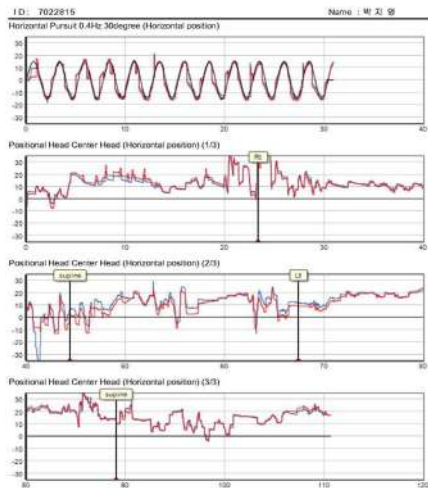


Horizontal Pursuit 0.4Hz 30degree (Horizontal position) (2/2)



22

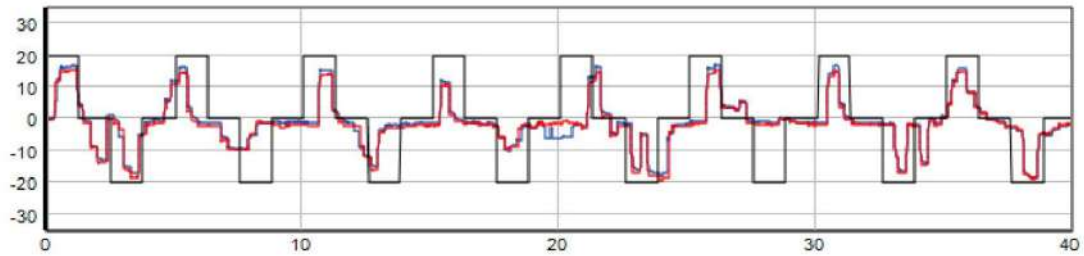
BPPV 아니어도  
Positional nystagmus 보이면  
증상 있는지 확인하고 메모 남겨주세요!



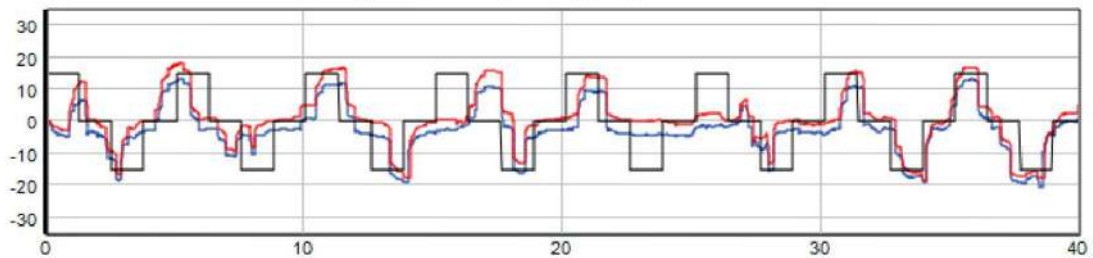
2016-07-20

F/77 : amyloid angiopathy

Horizontal Saccade Center Fixed 40degree (Horizontal position) (1/2)

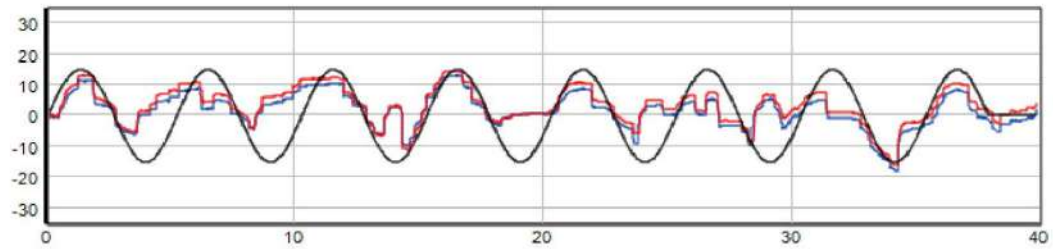


Vertical Saccade Center Fixed 30degree (Vertical position) (1/2)

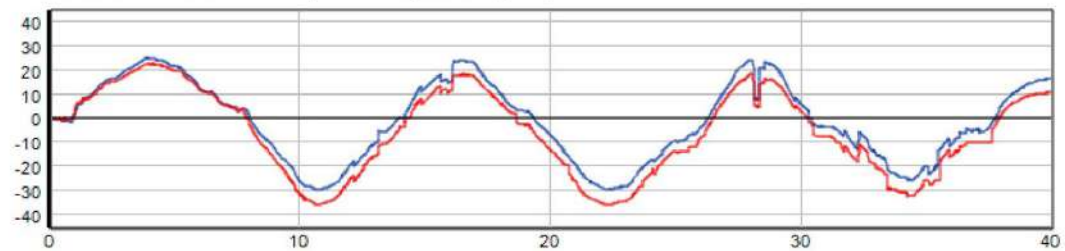


25

Vertical Pursuit 0.2Hz 30degree (Vertical position)



Horizontal Gaze Center VVOR (Horizontal position) (1/2)



VVOR : H and V planes 같이!

26

[구분]

**HIT** : with fixation, high speed and high frequency

**VOR** : in darkness, low speed and low frequency

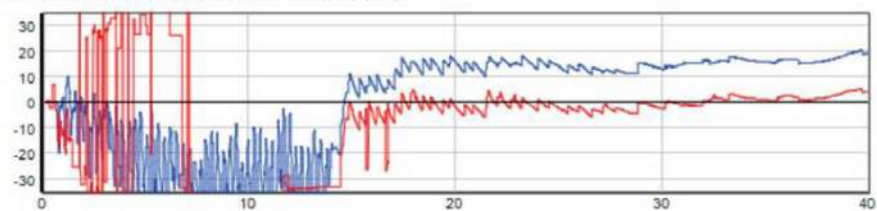
**VVOR (visually enhanced VOR)**: with fixation, low speed and low frequency, passive head motion

**VOR suppression** : with fixation using the patient's own finger, passive chair rotation

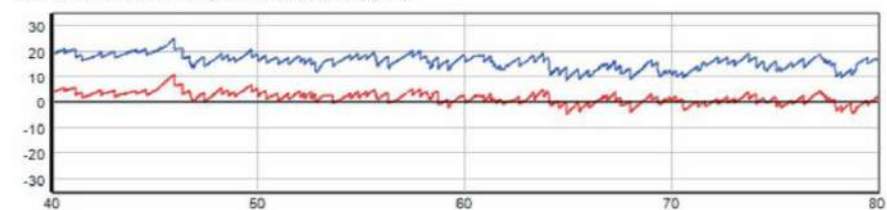
27

7101909 biphasic HSN : good!!

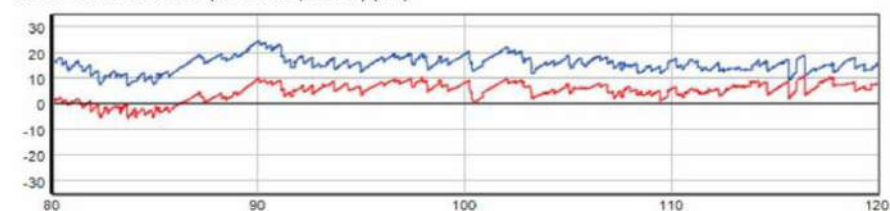
HEAD SHAKING TEST (Horizontal position) (1/4)



HEAD SHAKING TEST (Horizontal position) (2/4)

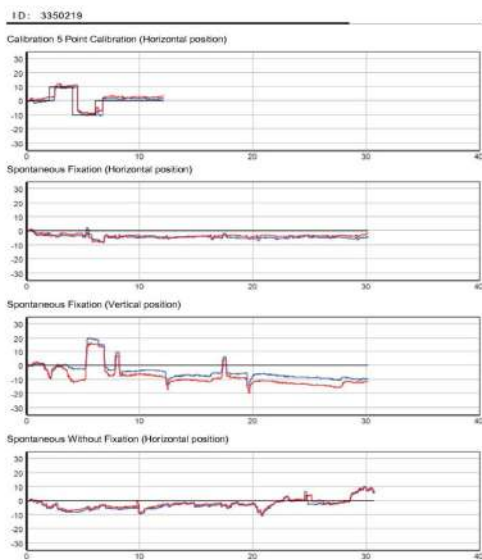


HEAD SHAKING TEST (Horizontal position) (3/4)



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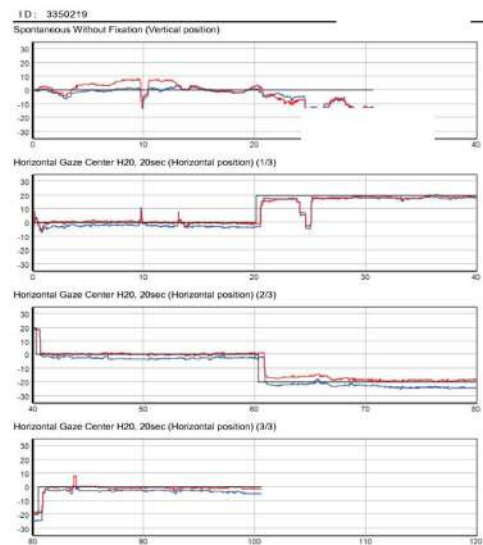
2016-08-24



SN s fix 더 길게 !

동작기록(내역명)

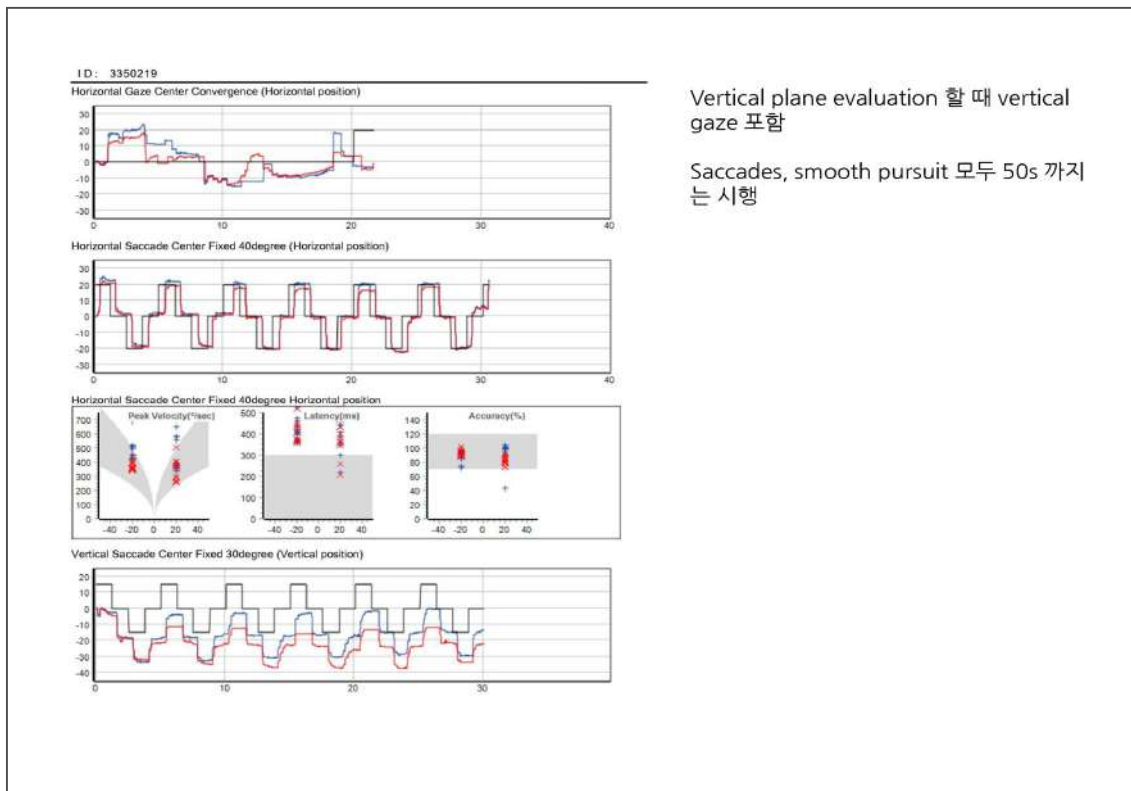
3/11



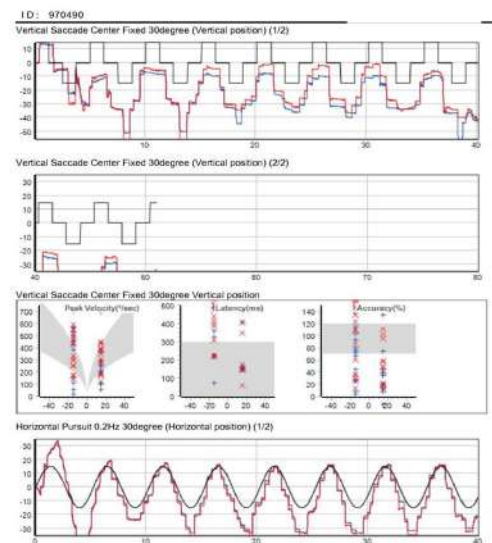
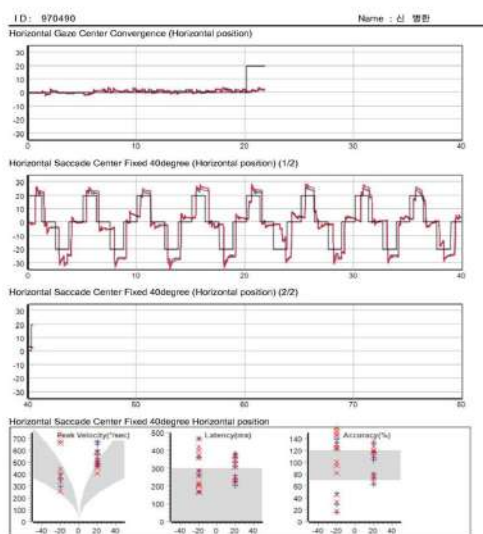
동작기록(내역명)

4/11



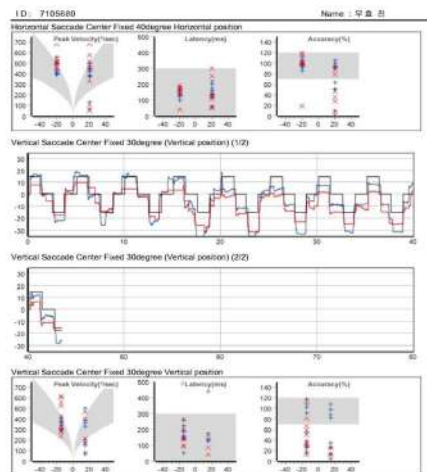
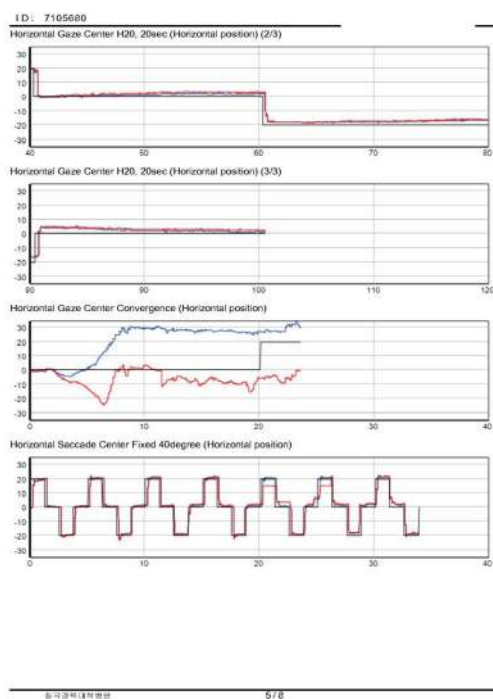


이럴 때 Vertical saccades higher amplitude 추가  
Vertical saccades target-eye 위치 정렬?



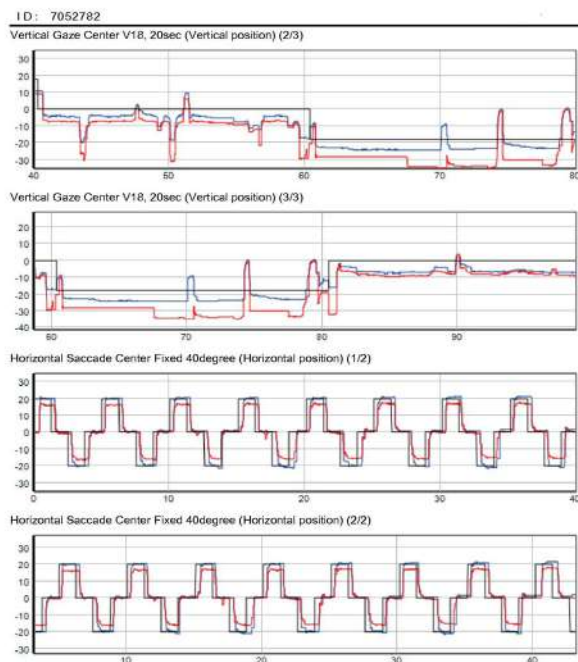
## Myasthenia gravis

\*\*\* 반복해서 눈 움직일 때 정렬이 어긋나면 MG 가능성이 고려해볼 수 있습니다.  
 \*\* MG 환자 오더가 나면 horizontal and vertical saccades를 각 120s까지 시행 부탁드립니다.



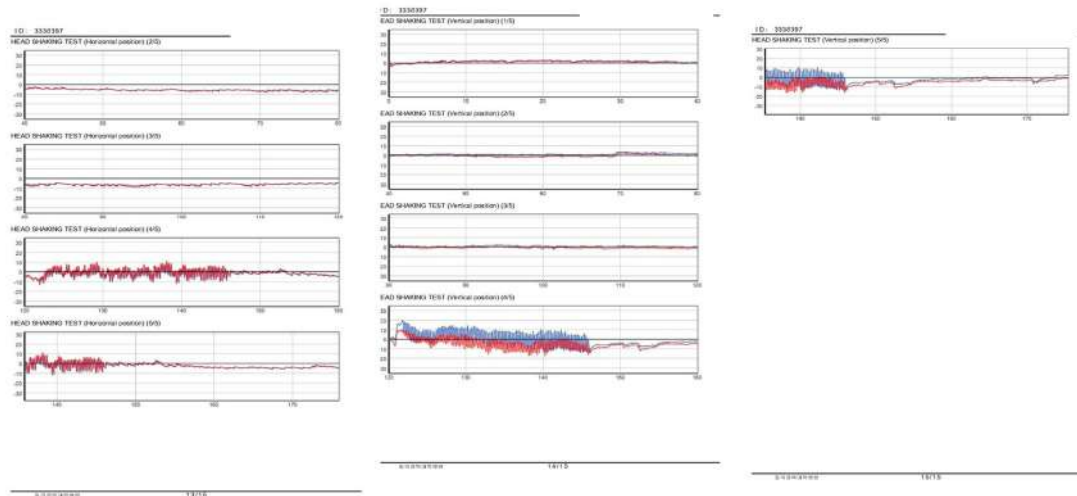
## IPD

처음부터 saccades 할 때 양눈 amplitude가 많이 차이가 있음  
 : Subclinical eso 아니면 calibration 문제



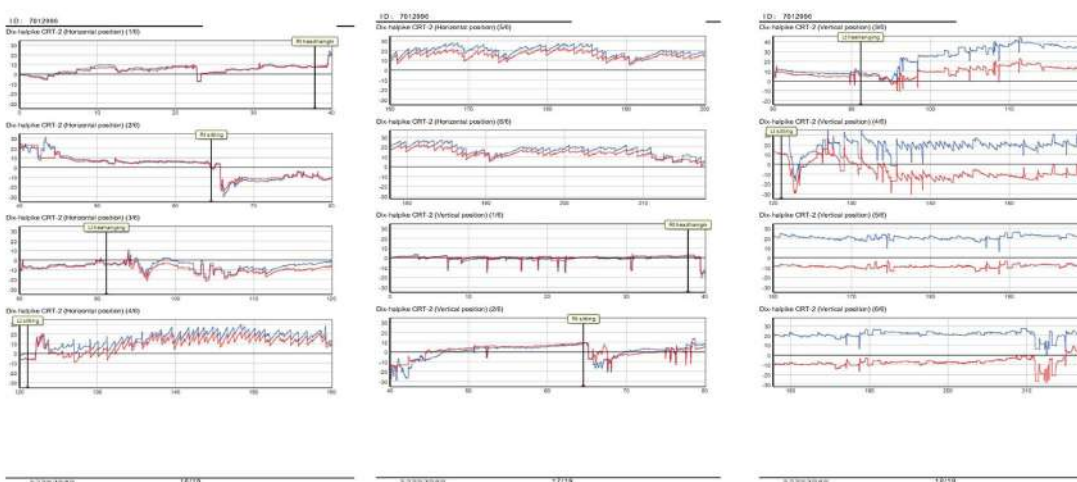
left vestibulopathy due to Ramsay-Hunt

H-HSN 조금 더 세게, horizontal plane에 맞추어서



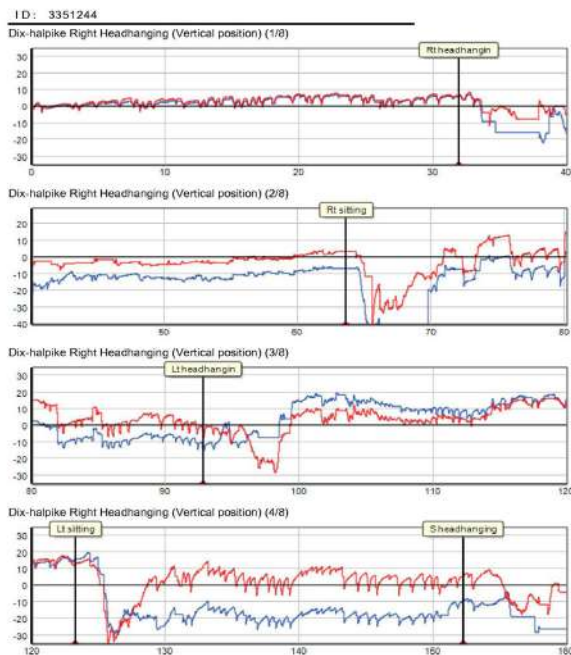
35

Left PC BPPV



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2016-08-24



Position할 때  
증상 여부 반드시 확인

## VOG 정규 시간

분당서울대병원

VOG 30분

v-HIT 20분

CRT 30분 (f/u 1회 포함)

부산대병원

VOG 30분

VOG + CRT 30분

VOG + SVV 30분

VOG 40분

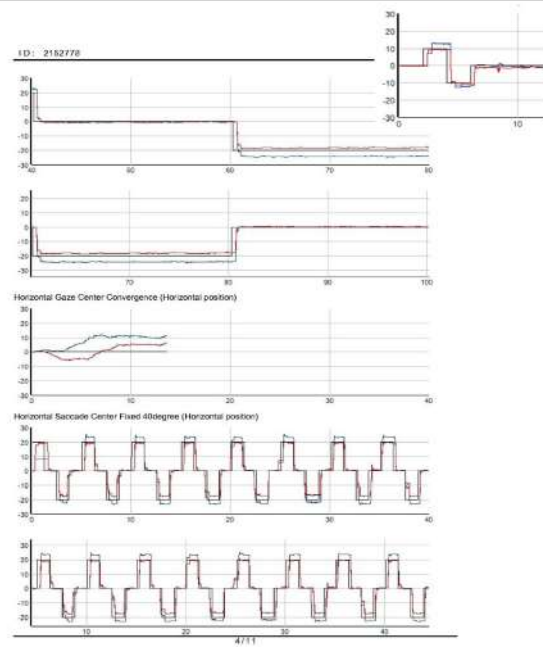
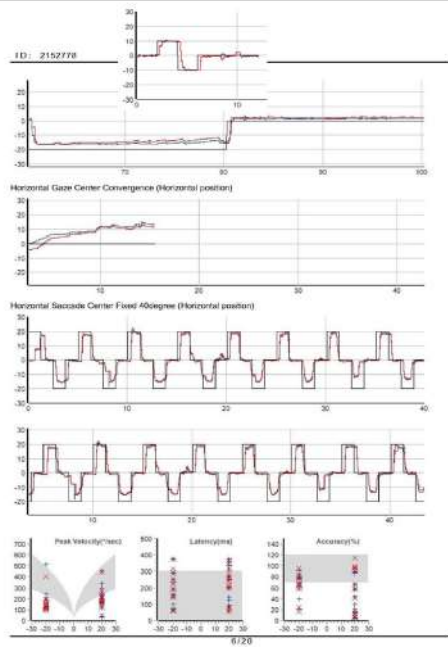
v-HIT 20분

CRT 30분 (f/u 1회 포함)

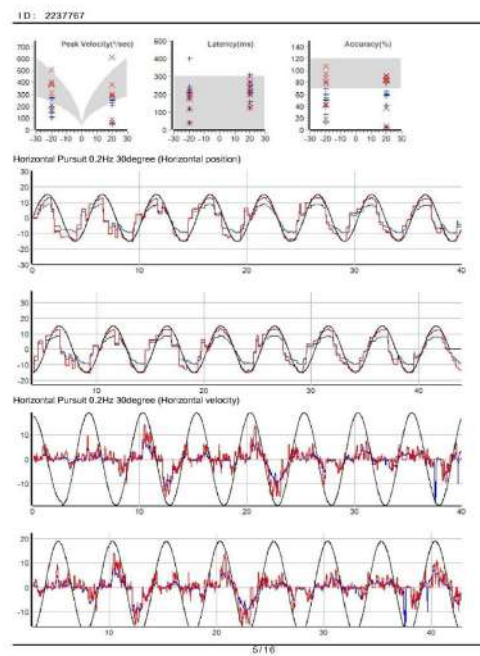
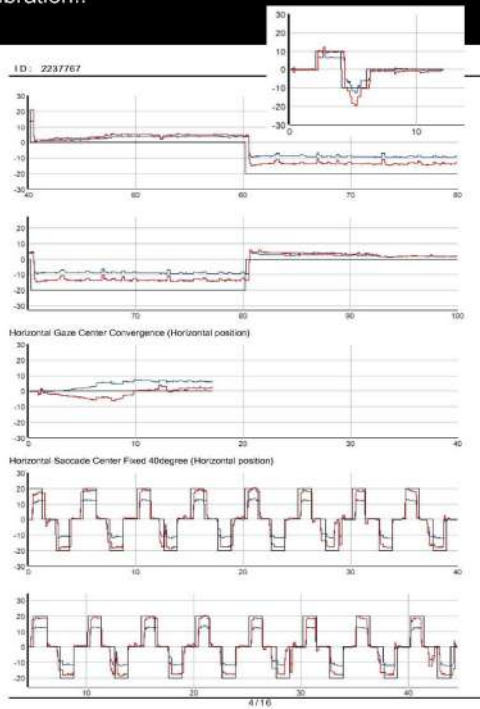
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2017-05-17

## Calibration!!

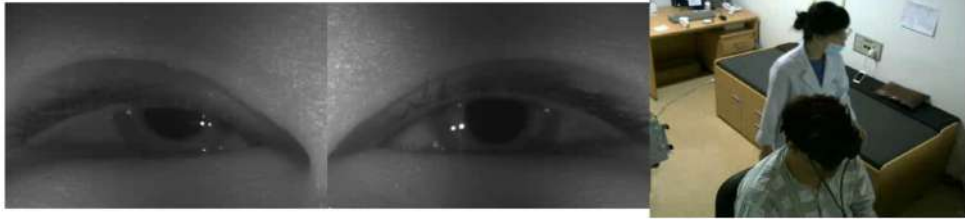


## Calibration!!

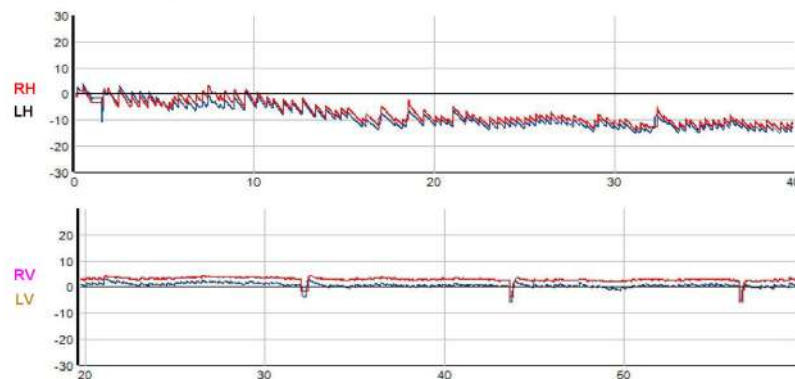




# M/41, Acute spontaneous vertigo

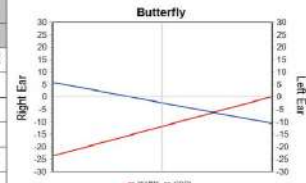


## SPONTANEOUS NYSTAGMUS

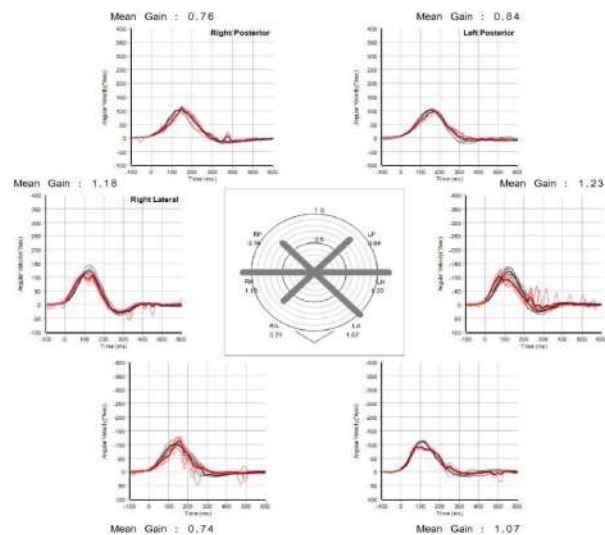


## CALORIC TEST

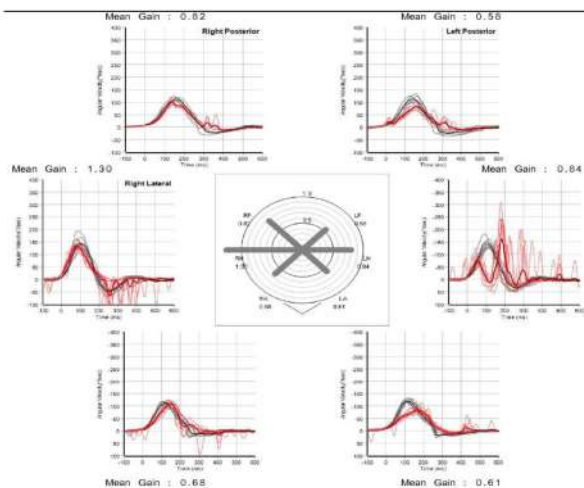
Caloric Test		Right Ear		Left Ear	
		Cool	Warm	Warm	Cool
Peak Velocity (degree/s)		5.81	-23.61	0.00	-10.52
Fixation Index (%)		0.00	0.00	0.00	0.00
Vestibular Paresis (%)		47.3% Left ear weak			
Directional Preponderance		Left Beat 70.9% weak			
Temperature Effect (%)		18.2% Cool temperature weak			
Spontaneous SPV (degree/s)		=			



## HEAD IMPULSE TEST 4/17



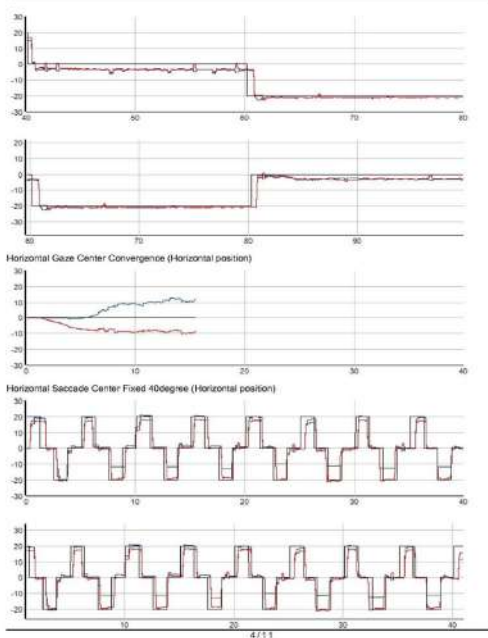


**HEAD IMPULSE TEST 4/19****BAER****BAEP**

Protocol / Run	I ms	III ms	V ms	I-III ms	III-V ms	I-V ms
<b>L - BAER</b>						
1.1 Ipsila	1.46	3.54	5.96	2.08		
1.2 Contra		3.68	5.88		2.20	
2.1						
2.2						
<b>R - BAER</b>						
1.1 Ipsila	1.68	3.84	5.92	2.16	2.08	4.24
1.2 Contra		3.72	5.84		2.12	
2.1						
2.2						

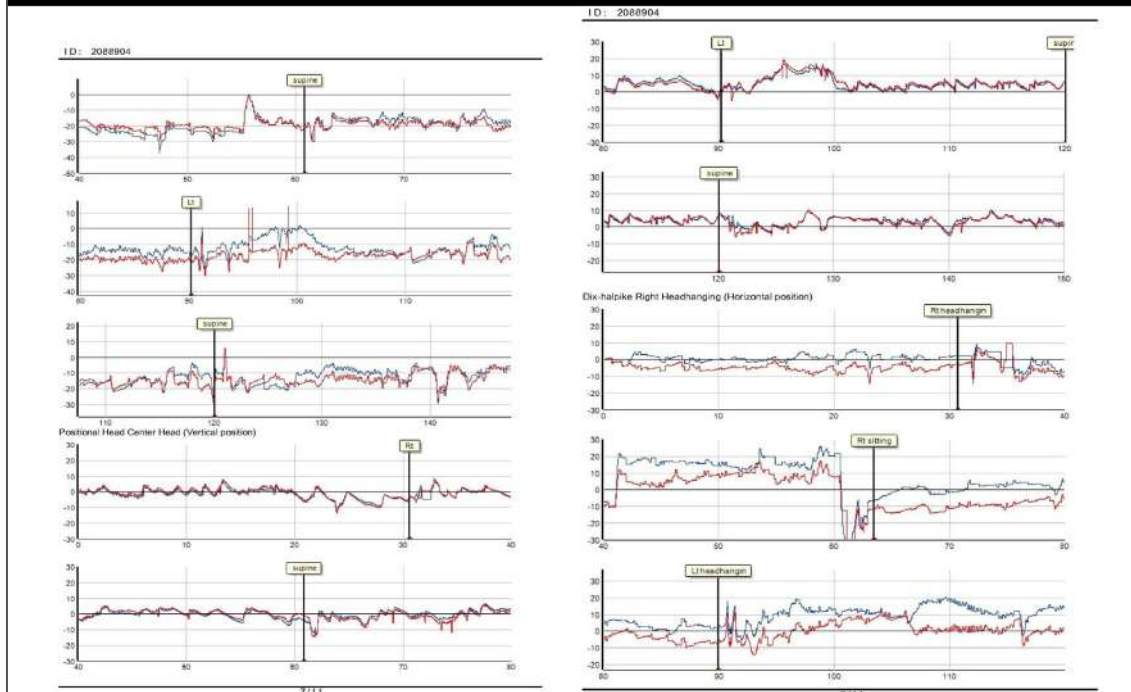
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ID: 7119838

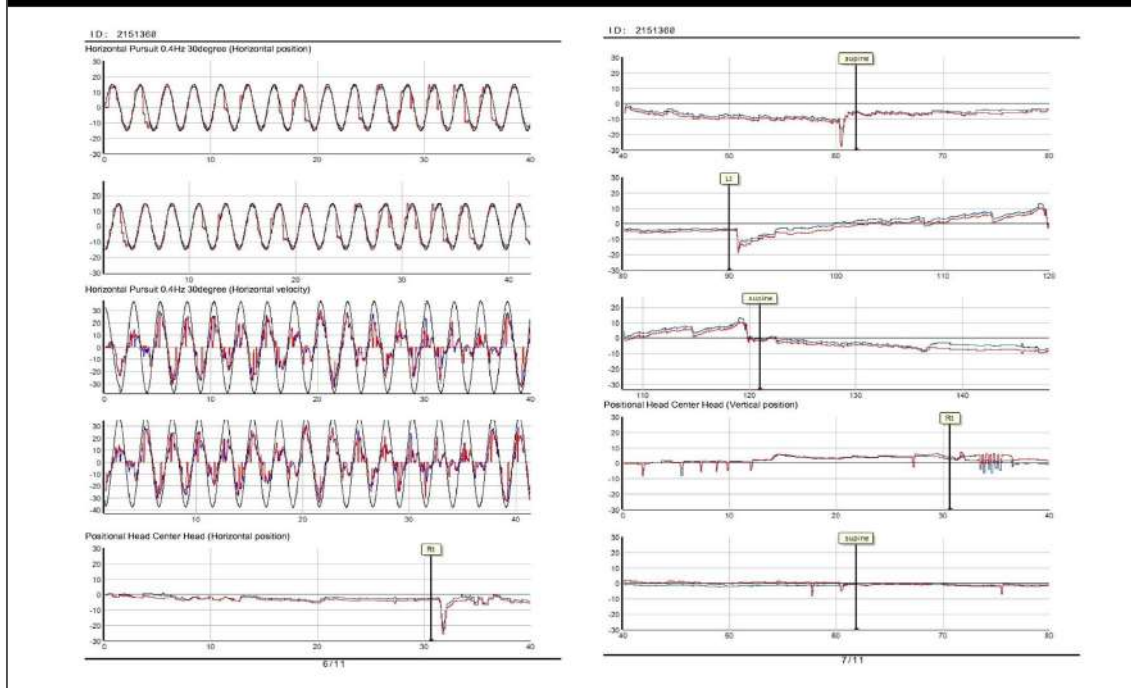


Saccades할 때 눈 놓치지 않도록  
: 특히 왼쪽 눈 계속 놓침

## 눈화장 심하면 최대한 제거하고 시행

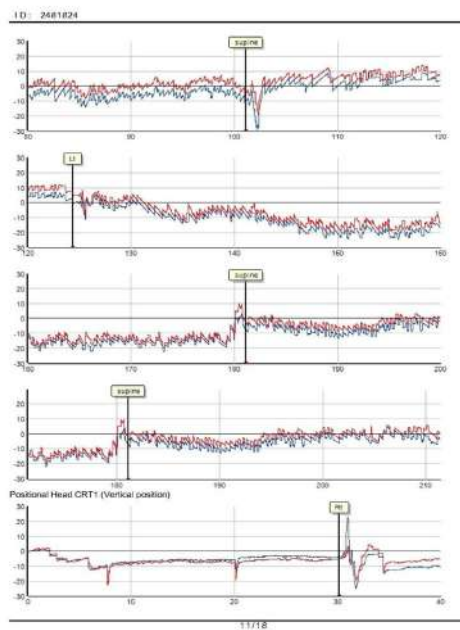
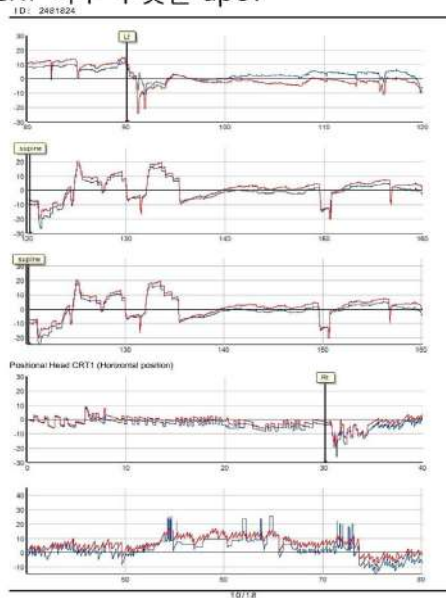


## Positional nystagmus 보이면 연락!



Apo 또는 geo BPPV에서 어느 쪽인지 애매하면 head bending 포함!!

### CRT 이후 뚜렷한 apo?



	Lateralization of the lesion side of HC-BPPV	
	Geotropic nystagmus	Apogeotropic nystagmus
Intensity of nystagmus (Ewald's second law)	Stronger side	Weaker side
Lying-down nystagmus (sitting to supine position)	Usually contralateral	Usually ipsilateral
Head-bending nystagmus (bending the head forward)	Usually ipsilateral	Usually contralateral
Reversal of initial nystagmus	Possibly occurs ipsilaterally*	Uncommon
Null point (during head turning, 10-20°)	Uncommon, <sup>95</sup> but laterality is uncertain	Usually present on lesion side

\*The maximal slow phase velocity of the initial geotropic nystagmus is usually greater than 100°/second.

## Position

Head tilt : 앉은 자세에서 각 옆으로 30도 머리 기울임

Head bending : 앉은 자세에서 머리 앞으로 충분히 숙이기

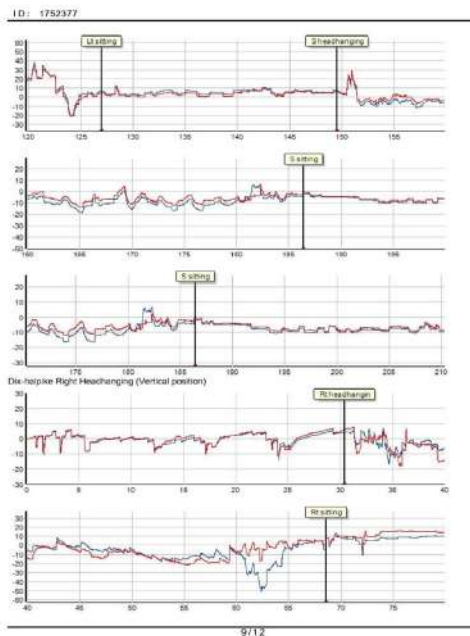
Prone position : 침대에서 엎드린 자세

Lateral decubitus : 침대에 누워서 왼쪽/오른쪽으로 돌아누운 자세

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2019-03-20

VNG: positional nystagmus 나오는지 잘 보고, typical nystagmus 나오면 연락



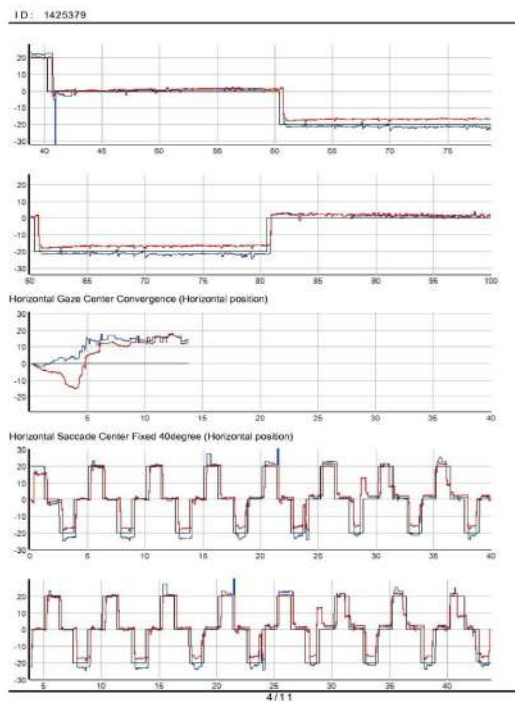
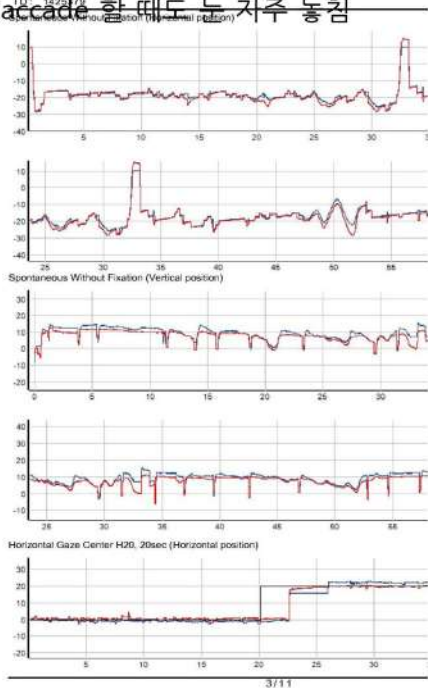
5/16 박교수님 환자

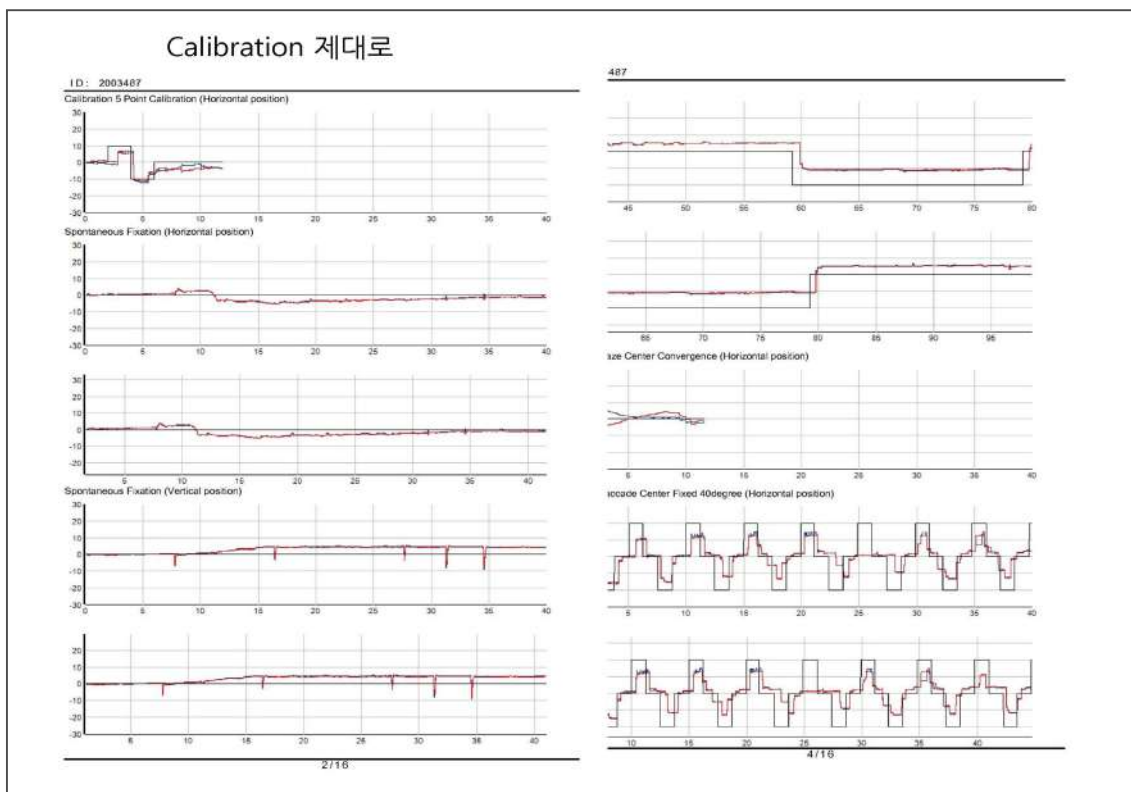
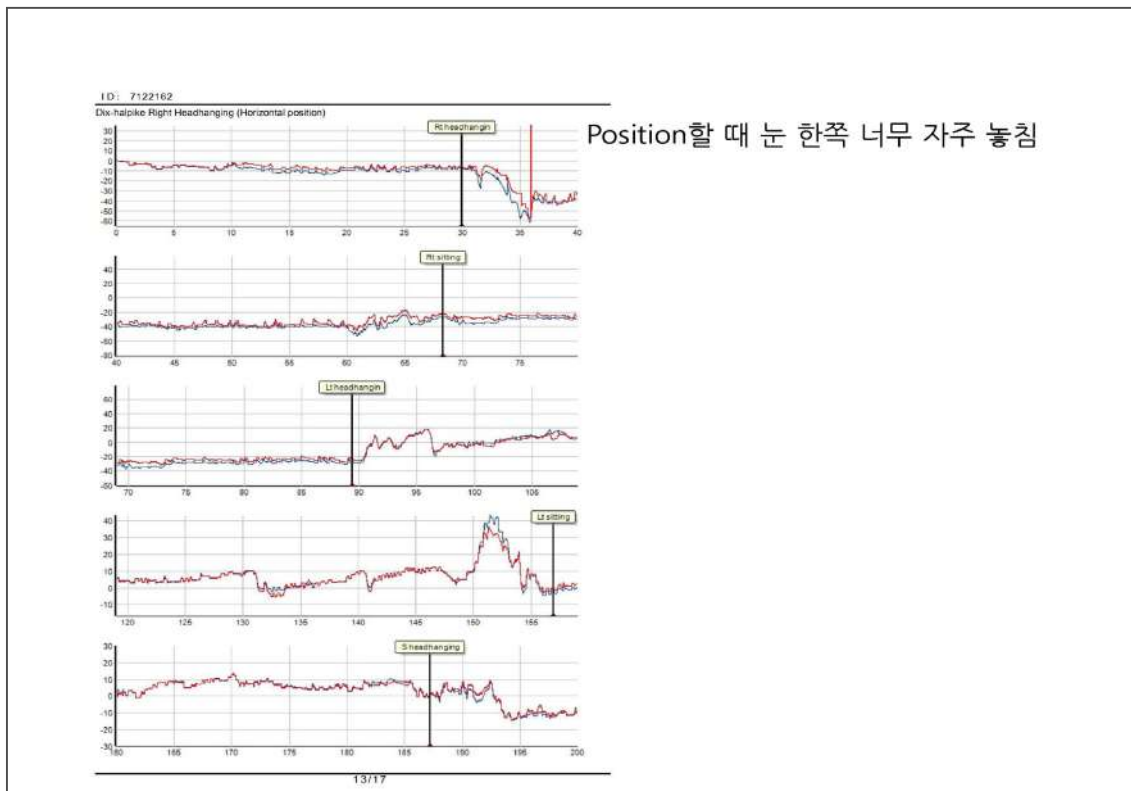
Right PC BPPV

다음 외래 오실 때 position f/u하고 CRT 진행할 것

Gaze할 때 제대로 못 하면 미리 한 번 연습시키고 할 것

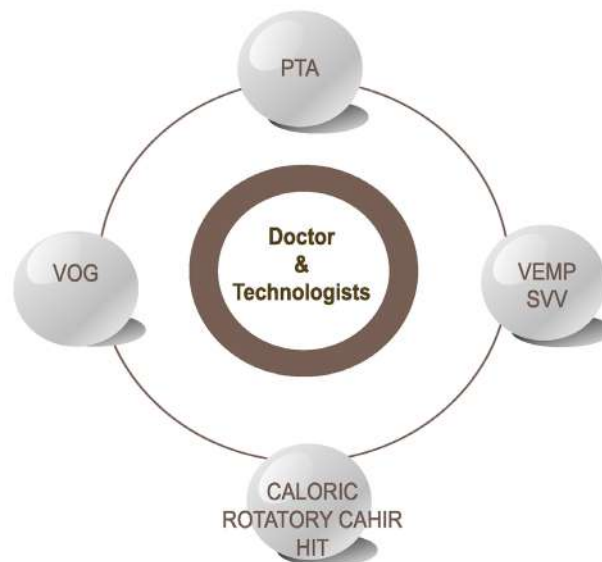
Saccade 할 때도 눈 자주 놓침





## TAKE HOME MESSAGE

모두 함께



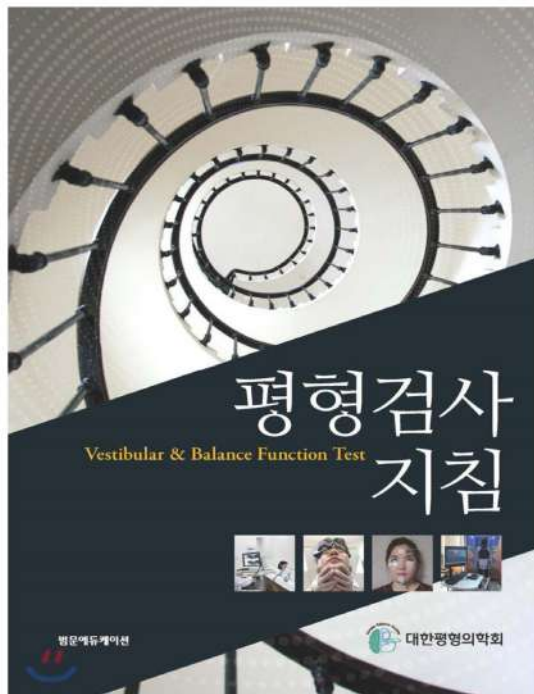
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## TAKE HOE MESSAGE

- VOG는 neurologic examination의 연장이므로 단순 technique만으로는 시행 어려움
- 검사실 담당 기사의 끊임없는 교육 필요
- 임상 정보를 서로 공유하고 빠르게 피드백을 하면서 진행
- 담당 의사의 적극적인 판독 업무와 실제 검사실 라운딩 필요

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