Smooth pursuit module

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This document provides a comprehensive overview of how to perform Smooth Pursuit tests using the NYSTALYZE system in conjunction with the SYNAPSYS VNG Module Plus software. Unique for its adaptability, NYSTALYZE offers both a wireless mask and a wired version, catering to the diverse needs and preferences of users.
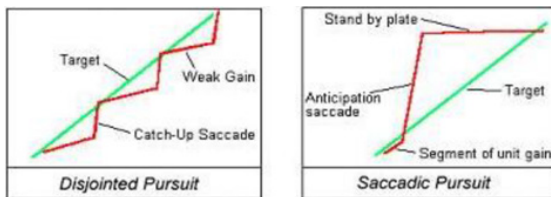
GENERAL CONCEPTS ABOUT SMOOTH PURSUIT

The slow visual pursuit (or pursuit) is strongly conditioned by the patient's attention: in addition to respecting the indications previously provided for the saccadic people regarding the head structure, particular care must be taken to always keep the level of attention sufficiently high. Both simple conditioning performed with a target held in the hand by the examiner at a short distance from the patient before the start of the test, and the use of lower frequencies of visual stimulation that are gradually raised up to that of the true test can be useful own.

The study of pursuit is logically inserted immediately after that of saccades, the latter being an indispensable preliminary to calibration in amplitude. In these circumstances it is not uncommon for patients, conditioned by the indications provided in the previous test, to anticipate the continuous movement of the aim and go and wait for it at the 2 ends of the screen, thus making saccades without pursuit. These saccades are, consequently, separated by more or less stable pauses in relation to the absence of a visual reference of fixation. At the end of the pause, the moving target falls back into the patient's central vision field and the patient repeats the anticipation saccadic cycle. It is therefore essential that the examiner inform the patient in advance of what to do during the test, and that during the execution of the same he endeavours to both encourage and modify the indications given according to the results obtained. The distinction between anticipation saccadic and recovery saccadic is fundamental. The former is usually of great amplitude, and therefore few in number, appearing just after the moment in which the aim changes the direction of the movement (at the top of the sinusoid which represents the trace of the position of the eye). The latter derive from the real difficulty of keeping up with the movement of the aim and are therefore numerous and well distributed along the entire path of the sinusoid. The latter type of saccades does not testify to a misunderstanding or bad will on the part of the

patient; consequently, it is little or not at all sensitive to the renewal of the indications.

Pursuit gain is defined as the ratio of eye velocity to target velocity. Observing a continuous eye position trace without irregularity is the guarantee of a gain equal to or very close to unity. On the contrary, if the track contains many saccades, recognizable by the much higher slope than the pursuit, both for anticipation and recovery, the gain will be less than unity but of a proportion that is often very difficult to assess with the naked eye. Therefore, only the quantitative study will allow us to safely distinguish normal gains from pathological ones and to verify the reproducibility of the measures in several tests. A strong dispersion of values expresses in most cases a misunderstanding or a bad will of the patient: the results must therefore be considered with caution. The repetition of the test associated with the renewal of deliveries generally leads to an improvement in results.

Disjointed Pursuit | Saccadic Pursuit

The recommended frequency is 0.4Hz which is preferable to reduce to 0.3Hz after the age of 50.

PATIENT INSTRUCTIONS ABOUT SMOOTH PURSUIT

Before starting the exam with NYSTALYZE system it is necessary to provide some simple instructions to the patient. Do not move the head for following the target. Avoid any head tilt, pitch, roll before and during the test. Look carefully exactly at the centre of the target, not its immediate surroundings. Move your gaze immediately in sync with the target changes position on the screen, avoid early or late movements.

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INTERPRETATION OF SMOOTH PURSUIT TEST

It is necessary:

- Check the height identity between the patient's eyes and the target.

- Ensure good linearity of the pursuit (paying attention to the presence of square waves due to inaccuracy or pathological type, of a fixation Ny, of blinking and of eye closure, of the instability of the centring in the lateral positions of gaze and of heterophoria of the slave eye).

- Eliminate anticipatory saccades or other artifacts from the evaluation window.

Pathologic findings:

Pursuit gain
- Decreased gain
  - Consistent with central dysfunction, low vision, or oculomotor dysfunction.
- Increased gain
  - Consistent with central dysfunction.

Pursuit phase
- Increased phase
  - Consistent with central dysfunction.

*Adapted from "Interpretation of Video Electronystagmography (VNG)", Elliot Michel, M.D., Neurology*

GENERAL PRESENTATION OF SMOOTH PURSUIT MODULE

The pursuit module is represented by the icon:

This module allows recording and study of the voluntary ocular movements made in response to retinal stimulations generated by the programme. The examination can be carried out in mono ocular or binocular mode in free visual field. The stimulation is in sinusoidal form and gives rise to a "smooth" pursuit.
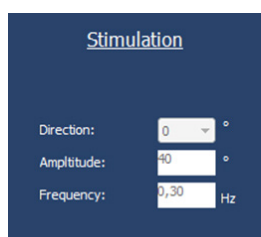
The smooth pursuit study is carried out after the saccade study. For the operator, the observation of the traces benefits from the visual calibration already carried out.
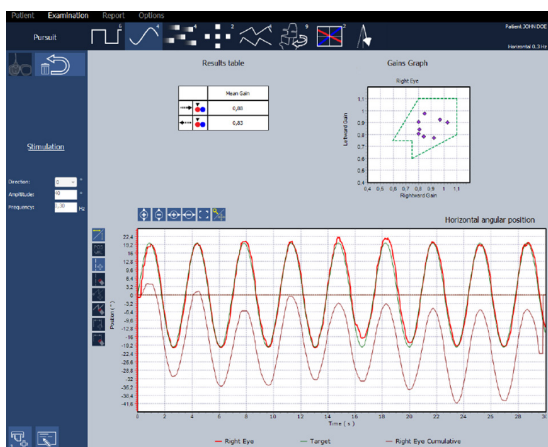
STIMULATION PARAMETERS

The stimulation is achieved by projecting a light point using a video projector or monitor.

The operator can adjust the following stimulation parameters:

- Direction: vertical (90°), horizontal (0°) or oblique (30°)
- Amplitude
- Frequency

SETTING DEFAULT TEST

The settings you will find when you launch the software are the default settings.

DISPLAY OF RESULTS

The results are displayed in a results table and in the gains graph.

The results displayed correspond to the zone displayed in the position graph. In other words, only the sine waves visible on the position graph are taken into account for the purpose of constructing the gains graph and results table.

POSITION GRAPH

The cumulative response of the slow phases shows asymmetry of pursuit at a glance. If the curve rises, the pursuit is better towards the left than towards the right.

RESULTS TABLE

		Mean Gain
◀┅┅	▼●●	0,88
◀┅┅	▼●●	0,83
┅┅▶		pursuit towards the right
◀┅┅		pursuit towards the left
▼●●		Right eye
▼●●		Left eye

This table displays the result of the gain calculations for ocular movements to the right and left. These gains are the ratio of the maximum eye velocity and target amplitudes. The gains are calculated on the segments of the traces shown in the display window.

GAIN DIAGRAMS (FREYSS' FISH)
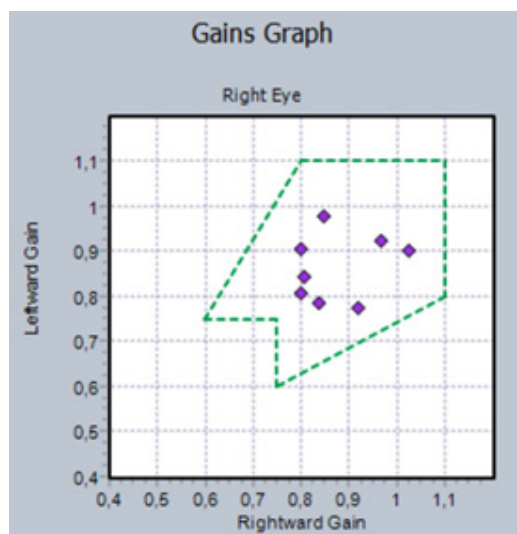
This diagram by Prof G. Freyss allows a comparison of previously calculated gains with standard values. The zone surrounded with green dots corresponds to the area of normality.

Each complete sinusoidal pursuit cycle present in the input window is represented by a coloured point. The X-axis of this point is the gain in pursuit towards the right; the Y-axis is the gain in pursuit towards the left.

In the event of binocular recording, a second gain graph will display the results obtained for the second eye.

NORMATIVE VALUES ABOUT SMOOTH PURSUIT

Using NYSTALYZE system for the Smooth Pursuit module when the visualization of normative data is enabled, reference tables appear. It is important to underline how the normative data can in fact be modified by the user and are associated with the patient's age groups. The tabular results of the tests, if the "Highlight normal/abnormal values" option is enabled from the VNG settings, appear in green or orange, depending on the normative data that have been set.

The normative parameters of the VNG were drawn from the volume "B*alance function assessment and management – third edition – Gary P. Jacobson, neil T. Shepard*".