FORCE-TORQUE SENSORS

SENSIX

Improving manual dexterity by training technology that promotes brain plasticity

DexTrain

www.sensix.fr

info@sensix.fr

MANUAL DEXTERITY DEFICIENCY

Manual dexterity allows a wide variety of functions and movements of the hand. It is controlled by a complex sensorimotor system :

- brain,
- spinal cord,
- peripheral nerves.

It can not be quantitatively described by a single variable, but its characterization requires several variables :

- Ability to move fingers independently
- Force control of each finger
- Maximum strength of the hand
- Temporal aspects, such as sequences or rhythmicity movements

Manual dexterity is often affected in neurological, psychiatric and musculoskeletal pathologies :

- Stroke
- Arthritis
- Schizophrenia, Autism
- Neurodevelopmental disorders
- …, …

STATE OF THE ART

However, the current clinical measures of skill are mostly subjective and inefficient and do not allow quantification, monitoring or rehabilitation.

Today, better treatment of dexterity is hampered by the absence of two critical elements :

- no dedicated diagnostic tools
- no dedicated therapeutic instruments.

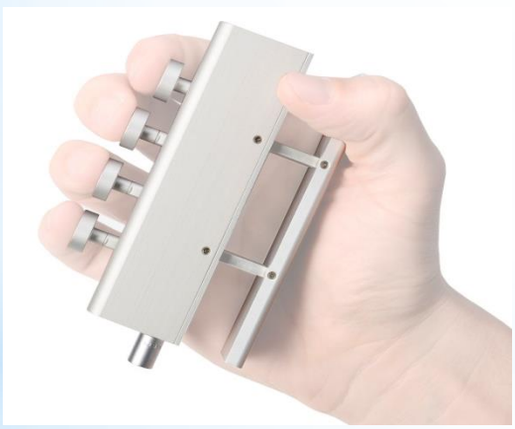
This leads to the following problems :

- Clinical measures today are non-specific with no information on dexterity components affected.
- Measures used are subjective ordinal scales with poor reliability
- Lack of targeted treatments for manual dexterity, i.e., no specific training of timing, force control, sequences
- Lack of knowledge on neural substrate mediating and limiting recovery

SENSIX SOLUTION

Sensix has developed efficient and dedicated therapeutic devices for training of manual dexterity. These devices should in clinical terms :

- Provide a novel and quantitative assessment of manual dexterity, which is key to diagnostics, assessment of therapeutic progress, and follow-up.
- Provide a novel behavioural training tool for manual dexterity in and out of clinics.
- Promote motor recovery over its spontaneous limits by association with interventional techniques that enhance neural plasticity.



FINGER FORCE MANIPULANDUM : FFM

POWER GRIP MANIPULANDUM : PGM

POWER PINCH MANIPULANDUM : PPM

Better diagnostics and treatment depend on a coherent, comprehensive, quantifiable and reliable concept of dexterity.

Brain stimulation coupled with specific practise will have an additive effect. Thus, activating the underlying brain circuits (during motor practise) coupled with brain stimulation will lead to greater movement gains than either passive brain stimulation or motor practise alone.

Clinical validations are established at :

- Sainte Anne Hospital, Neurology Clinic, Paris
- Rehabilitation Clinic at Danderyds Hospital, Karolinska Institute, Stockholm

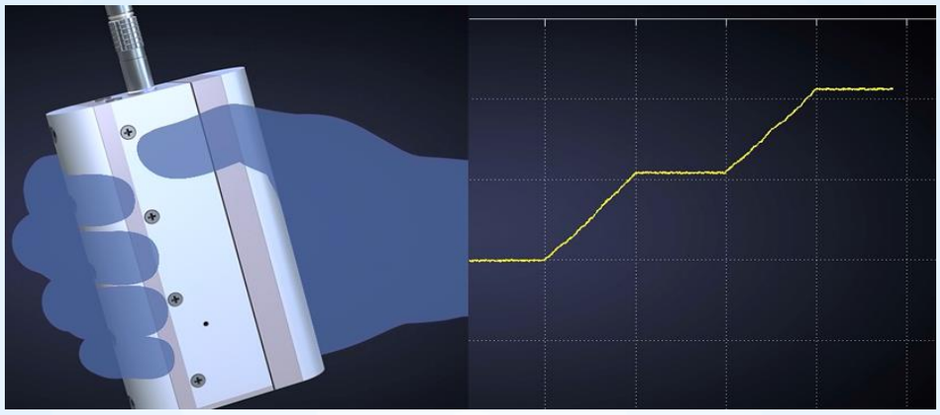
Training techniques coupled to computer games offer the advantage that they can be used by the patient in their home environment not requiring the presence of a therapist, **making technique less costly**.

Provision of feedback of task performance is important for learning and this can be provided online in the form of a motivating and challenging game.

Such behavioural training has been shown to lead to reorganization of cortical networks controlling movement and these “plastic” changes are believed to underlie the functional gains.

These training approaches consist of highly repetitive reach-to-grasp movements and lead to improved reach control and maximal precision grip force along with improvements in general clinical scales.

POWER GRIP MANIPULANDUM



PGM is a measurement tool of the grip tightening effort between the palm of a hand and its fingers. It allows the study of gripping functions of healthy as well as motor disable subject.

The force applied on the PGM constitutive from the gripping force can be applied along the full PGM length. The sensor measurement does not depend on the location of the application point.

The resolution of the PGM (0.1N) allows very light effort measurement. Its measuring range allows heavy grip tightening effort measurement.

The PGM can be used with any measuring chain accepting an analog signal from 0 to 5V.

In order to fit user's specifications, the following PGM characteristics can be modified:

- Measuring range
- General dimensions and weight
- Signal output

An electronic card integrated into the sensor regulates the power supply provided by the PC (USB) and the measurement signal conditioning.

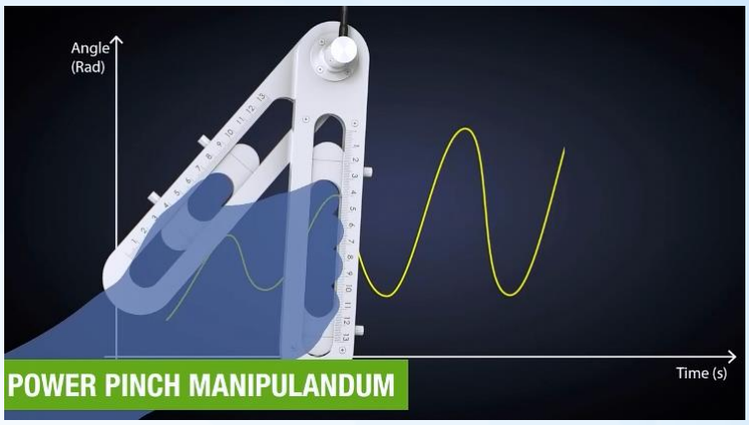
Used in rehabilitation, PGM via its software interface provides:

- an accurate diagnosis of the gripping function,
- a personalized rehabilitation programs,
- the issue of quantified assessments before/after surgery, before/after rehabilitation.

In order to proceed to the measurement acquisition you simply have to connect the PGM to the PC DAQ-Card. The electronic conditioning is integrated into the sensor. The USB cable provides a 5V power supply.

Technical characteristics : PGM	
Dimensions	120x45x25 mm
Weight	from 200 to 500 g
Measuring Range (MR)	Fx : 0…600N
Precision	0.166 % MR
Analog channel number	1
Output voltage range	0..5V
Maximum supply voltage	5V

POWER PINCH MANIPULANDUM

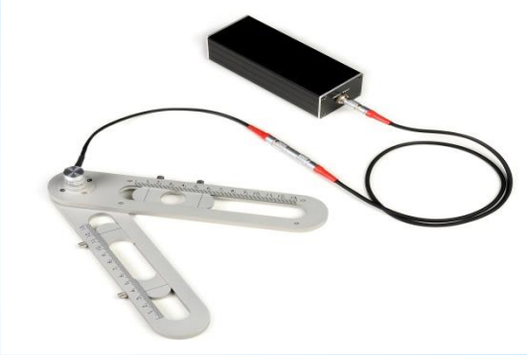


PPM is a measurement tool of the grip tightening displacement between the fingers and the thumb. It allows the study of finger flexion-extension tasks of healthy as well as motor disable subject. It allows displacements without any resistance.

Used in rehabilitation, PPM via its software interfaces provides:

- an accurate diagnosis,
- a personalized rehabilitation program,
- the issue of quantified before/after surgery assessments,
- the issue quantified before/after rehabilitation assessments.

Technical characteristics : PPM	
Dimensions	225x45 mm
Weight	350 g
Measuring range	0..360°
Precision	± 0.144°
Analog channel number	1
Output voltage range	0..5V
Maximum supply voltage	5V



FINGER FORCE MANIPULANDUM

FFM is a measurement tool of the fingers flexion. It is a combination of a force-torque sensor and a displacement sensor. It allows the study of finger flexion individually, one after the other or all together.

The measurement tool is light, accurate and easy to use. It is adaptable to any hand size. It integrates a bio-feedback in real time.

Used in rehabilitation, FFM via its software interface provides:

- an accurate diagnosis,
- a personalized rehabilitation program,
- the issue of quantified before/after surgery assessments,
- the issue of quantified before/after rehabilitation assessments.

Technical characteristics : FFM	
Dimensions	110x30x36 mm
Weight	290 g
Measuring range	On demand
Precision	0.10% EM
Analog channel number	4
Output voltage range	0..5V
Maximum supply voltage	5V

SENSIX
BIOPOLE - 4, RUE CAROL HEITZ
86000 POITIERS - FRANCE
www.sensix.fr
T: +33(0)5 49 00 76 03 - F: +33(0)5 49 00 74 34
info@sensix.fr