Chronic Neuropathic Pain decreases through Somatosensory Rehabilitation

Spicher, C.J. & Clément-Favre, S.

Résumé

La méthode de rééducation sensitive est présentée par le biais de son paradigme, à savoir : « Rechercher l'hypoesthésie, car diminuer l'hypoesthésie diminue les douleurs neuropathiques ». L'ergothérapeute va observer les troubles de la sensibilité si, et seulement si, il sait par avance qu'il a, à sa disposition, une nouvelle méthode de traitement pour traiter le patient qui lui est confié. La rééducation et ses effets sont présentés : par le biais du Questionnaire de la douleur St-Antoine qui permet d'évaluer les symptômes douloureux du patient et par le biais de l'indicateur des traitements médicamenteux : le Number Neaded to Treat (NNT). La

Abstract

Somatosensory rehabilitation is presented by means of its paradigm which is : *Look for hypoesthesia, because, by decreasing hypoesthesia neuropathic pain decreases.* Occupational therapists are going to observe cutaneous sense disorders if, and only if they know beforehand that they can offer a new treatment to the patients they are taking care of.
Somatosensory rehabilitation and it's effects are presented : by means of the Mc Gill pain questionnaire which allows the assessment of the patients pain symptoms and by means of the pharmacological treatment indicator: The number needed to treat (NNT).

Address for correspondence :

Claude J. SPICHER, Somatosensory Rehabilitation Centre, Clinique Générale, Hans-Geiler St. 6, CH-1700 Fribourg, Switzerland ; reeducation.sensitive@cliniquegenerale.ch

Clément-Favre, S Unit of Physiology and Program in Neurosciences, Department of Medicine, Faculty of Sciences, University of Fribourg, Chemin du Musée 5, CH-1700 Fribourg, Switzerland

corrélation importante, et forte (Cov = 15,7) entre la diminution de l'hypoesthésie et la diminution des douleurs neuropathiques est démontrée. La rééducation de l'hyposensibilité basée sur la neuroplasticité du système somesthésique est décrite. La 2ème partie de l'article relate l'évaluation et la rééducation des patients neuropathiques chroniques : le raisonnement clinique du rééducateur débutant, la cartographie de l'hypoesthésie, ou le cas échéant de l'hypoesthésie douloureuse au toucher, et surtout le choix de la stratégie thérapeutique en fonction du status de la peau. En conclusion, les possibilités pour en savoir plus sont énumérées.

The important and strong correlation (Cov=15.7) between the decrease of hypoesthesia and the decrease of neuropathic pain is demonstrated. The rehabilitation of hyposensitivity based on the neuroplasticity of the somatosensory system is described. The second part of the article tells about the assessment of patients with chronic neuropathic pain: Clinical reasoning of a beginning reeducator, the mapping of the zones of hypoesthesia or when it occurs, that are hypertensive to touch and especially the therapeutic strategy which will be chosen according to the status of the skin. As a conclusion, the ways to learn more about it are enumerated.

Keywords

Hypersensitivity, axonal lesions, neuropathic pain, distant vibrotactile counter-stimulation, desensitization, hypoaesthesia.

Introduction

The somatosensory rehabilitation method could be presented by a short medical review of the contributions to this topic: Jean Joseph Emile Létiévant (1830-1882) the father of the somatosensory testing, head surgeon at the Hôtel-Dieu hospital in Lyons [Létiévant (1); Spicher & Kohut (2)], Silas Weir Mitchell the father of major causalgia with minor lesions of cutaneous branch characterized by the boiling sensation "as if eggs were being boiled in the limb" [Mitchell (3,4)] and Jules Tinel one of the fathers of the distal sign of regeneration [Tinel (5,6); Spicher *et al.*(7)].

The somatosensory rehabilitation method could also be presented through its five techniques: The rehabilitation of hyposensitivity, or more precisely of the hypoaesthetic territory [Dellon, (8,9)], the desensitization of the site of axonal lesions [Barber (10); Spicher & Kohut (11)], the distant vibrotactile counter-stimulation in the presence of a possible mechanical allodynia [Spicher (12,13); Spicher *et al.* (14)], the rehabilitation of its underlying hypoaesthesia [Degrange *et al.* (15)] and the deactivation of the vibration-induced irradiation signs [Spicher *et al.* (16)].

We prefer introducing the somatosensory rehabilitation method through its paradigm: *Look for hypoaesthesia, because, by decreasing hypoaesthesia neuropathic pain decreases.* Occupational therapists assess the cutaneous sense because they have a rehabilitation method to propose to the Neuropathic Pain Patient (NPP) to treat his problem: his lack of life habits. Consequently, for once, we are stating by the rehabilitation.

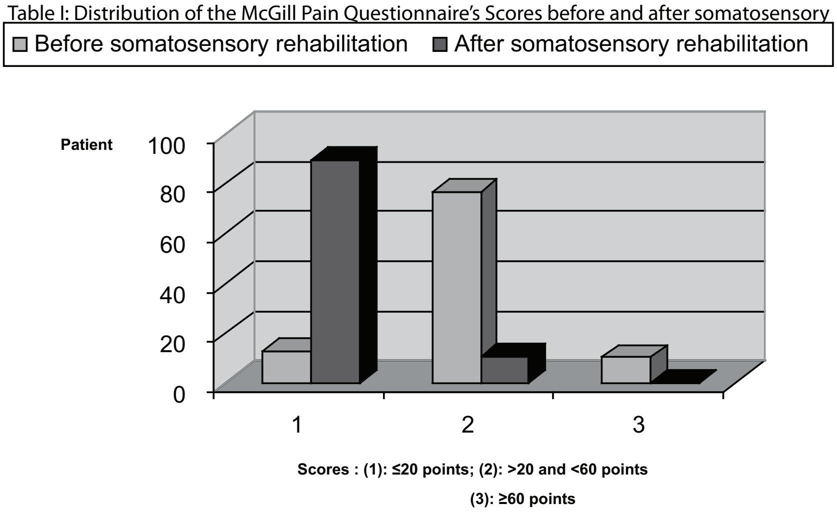
Rehabilitation

(…) neuropathic pain decreases

Symptoms

The best way to assess chronic neuropathic pain appropriately is to evaluate and measure the patients symptoms during the last 24 hours. The McGill Pain Questionnaire is a critical tool to assess these complex somatosensory disorders. It has existed exist for 30 years and is now available in more than 30 languages. In the Swiss Journal of Physiotherapy, Mathis *et al.* (17) have demonstrated how somatosensory rehabilitation can diminish these neuropathic pain symptoms.

Table I: Distribution of the McGill Pain Questionnaire's Scores before and after somatosensory



rehabilitation (n = 111 patients); this table is adapted in English by Mathis *et al.* (17).

Number Needed to Treat

The best way in medicine, to assess appropriate pharmacological treatment is to calculate the Number Need to Treat (NNT) Index. The question which is asked to the medical doctor is how many patients he is supposed to prescribe a medical treatment to in order to obtain one success. For example a pharmacological treatment which has a NNT = 4.0 means that within 4 patients to whom this treatment was prescribed, only one was successful. In NPP, treatment is considered as being successful if the patient has 50% pain relief on the McGill Pain Questionnaire. In the Swiss Journal of Medicine, Mathis *et al.* (18) have demonstrated how somatosensory rehabilitation can diminish these neuropathic pain symptoms in femoral neuralgias.

32 / 36	1 / 23
89 % (NNT = 1.1)	4 %
33 / 59	
56 % (NNT = 1.8)	

Table II: The successful patient in somatosensory rehabilitation (n = 59 chronic patients with femoral neuralgias; Pain relief successful: ⊠ 50 %); this table is adapted in English by Mathis *et al.* (18).

(…) by decreasing hypoaesthesia neuropathic pain decreases

Patient Explanation

The somatosensory therapist's tool to decrease neuropathic pain is the rehabilitation of hyposensitivity. The aim of this technique is to diminish hypoaesthesia, in particular to diminish the Pressure Perception Threshold (PPT). A correlation between this decrease and the decrease of the McGill Pain Questionnaire's Score has been calculated [Degrange *et al.* (18)]: Cov_{xy} =15.3. In other words, the covariance is important. The best way to explain to the patient (as an adult continuous education) this very important aim is to illustrate it with the following Table III:

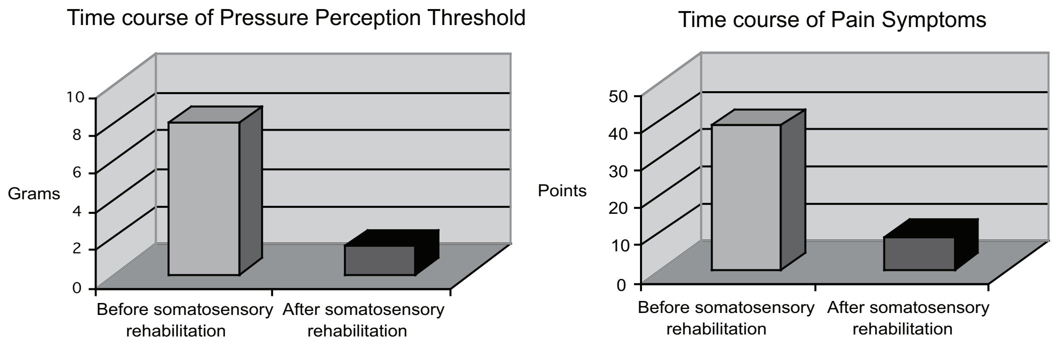


Table III: Pressure perception threshold and pain symptoms are correlating in somatosensory rehabilitation; **A**: the PPT in grams before and after treatment; **B**: the McGill Pain Questionnaire in points before and after treatment (n = 123 chronic neuropathic patients; this table is adapted in English from Degrange *et al.* (19).

Rehabilitation of hyposensitivity

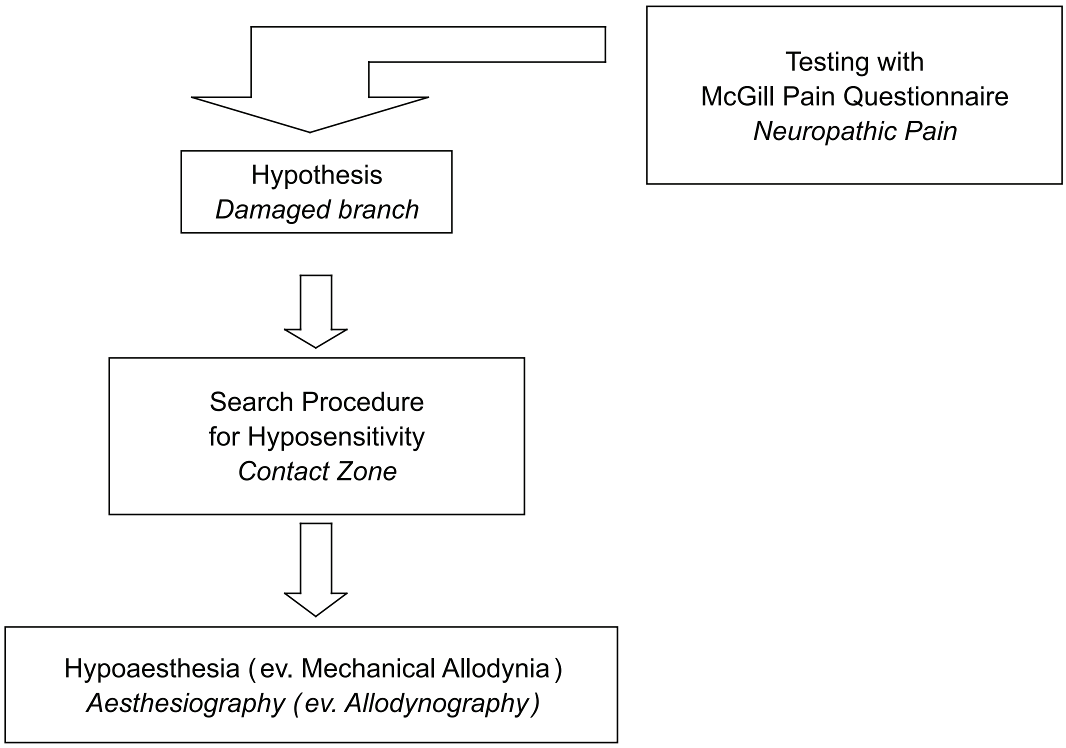
The rehabilitation of hyposensitivity is done during therapy sessions and other exercises are suggested as part of a home program. The technique depends on the quality of the hypoaesthesia: "Hands-on Therapy" for a slight hypoaesthesia and "Line Rehabilitation Program" for a strong hypoaesthesia. The "Hands-on Therapy" is a manner in which the patient explores everything that comes into his hand during the day and then checks its sensations with his other, non-damaged, hand. In short, the patient compares the strange sensations with known ones. This aspect of rehabilitation of hyposensitivity is very important, since it allows a comparison with the touch beforehand, with life before the accident. However, a weekly follow up by the therapist is necessary, without which, the patient is often discouraged by attempting differentiations that are too difficult. The rehabilitation of hyposensitivity is most likely based on the neuroplasticity of the somatosensory system.

Testing & Rehabilitation

Look for hypoaesthesia, because, by decreasing hypoaesthesia neuropathic pain decreases

As you now know the reasons to look for hypoaesthesia, we may now present the manner to assess hypoaesthesia : the "Hypoaesthesia Research Process" (Figure 1), It is the corner stone of this process : the step which consists to presume which branch of the cutaneous affected nerve is damaged.

Figure 1 : Hypoaesthesia Research Process : From neuropathic pain symptoms to clinical examination signs, the clinical reasoning, step-by-step, from the moment when the occupational therapist recognizes the patient's pain to the moment when he maps the hypoaesthetic territory with an aesthesiography.



Aesthesiography (see Appendix A for a detailed description of the procedure)
The aesthesiography [Létiévant (1); Tinel (6); Spicher & Kohut, (2)] provides an estimation of the location and the extent of the hypoaesthesia (Figure 2 and Appendix A). The term "aesthesiography" is used because it refers to the mapping of hypoaesthesia. Aesthesiography is a sensitive test, which is the first part of the "Diagnosic Testing of Axonal Lesions" [Noël *et al.* (20); Spicher (13)].

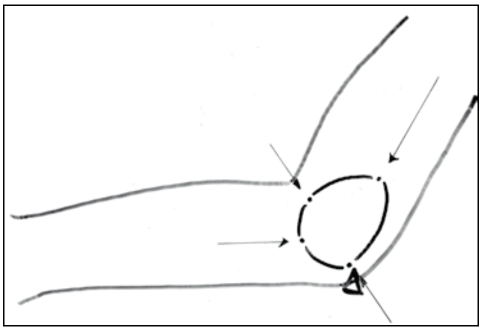


Figure 2 : The 16th of June 2008, Aesthesiography (posterior branch of the medial cutaneous nerve of the forearm) where the application of a force of 0.7 gram was not detected

Unfortunately, as written at the bottom of the figure 1, instead of an aesthesiography, the occupational therapist had to map an allodynography : the skin is not numb but hypersensitive. The patient presents a stimulus-evoked pain named "Mechanical allodynia" in medicine.

Allodynography (see Appendix B for a detailed description of the procedure)
The allodynography [Spicher *et al.* (14); Spicher (13)] is a technique used to quantify and map a hypersensitive territory on the skin (Figure 3 and Appendix B). The test is conducted by varying the application site of the stimulus in order to delineate the borders of the hypersensitive territory. This test allows visual inspection (both by the therapist and the patient) during testing.

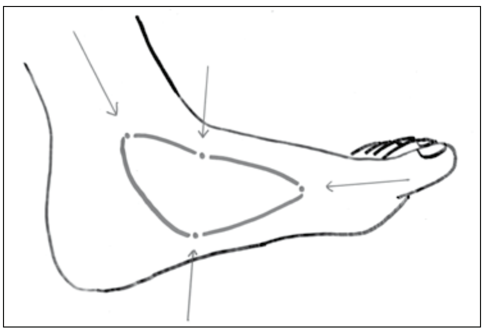


Figure 3 : The 20th of May April 2008, Allodynography (terminal branch of the saphenous nerve) where the application of a force of 15 grams was perceived as a pain of 3/10 cm on the Visual Analogue Scale.

Physical treatment management

The day of the first session the skin is either numb, or hypersensitive to touch. The occupational therapist has the choice between two techniques: either the rehabilitation of hyposensitivity directly on the skin, in particular, in the area of the aesthesiography, or the distant vibrotactile counter stimulation (DVCS), at some distance of the allodynography. The occupational therapists task firstly consists in defining a limited zone of the skin where DVCS should be applied and train the patient to perform his own therapy at home by the application of tactile stimuli, 6 times a day for 1 minute. Secondly, her task consists in delineating a limited zone of the skin on which touch should be avoided as much as possible. Distant vibrotactile counter stimulation [Spicher *et al.* (14); Degrange *et al.* (19); Spicher (13)] is a neologism. This new technique uses a tactile and vibratory device, allowing the patient to perceive a non-nociceptive stimulus in a non-nociceptive manner on a cutaneous territory that is initially allodynic. The variable parameter of the DVCS is the localization of the stimulus, but not its amplitude.

Skin status	Slight or strong numbness	Hypersensitive to touch
Testing	Aesthesiography	Allodynography
Treatment technique	Rehabilitation of hyposensitivity	Distant vibrotactile counter stimulation

Table IV: The somatosensory management: either a rehabilitation of hyposensitivity directly on the aesthesiography, or a distant vibrotactile counter stimulation on a zone where the patient perceive a non-nociceptive stimulus in a non-nociceptive manner.

Conclusion

In conclusion it is clear that "the field of somatosensory rehabilitation has no room for impatient and imprecise clinicians. The material set forth in the *handbook for somatosensory rehabilitation* can now serve as a basis for systematic investigation of the evaluation and treatment of somatosensory rehabilitation (...). The aim of this handbook is to bring together information from the disciplines of rehabilitation, neuroscience, rheumatology, and surgery into one single volume for clinicians attempting to rehabilitate somatosensation." [Lang (21)]. The somatosensory rehabilitation is a method developed in the Somatosensory Rehabilitation Centre but described in detail. This Handbook has been the subject of many Book reviews in several Journals of Therapy (For example: *Kinésithérapie scientifique* [Bridon (22)], *Ergotherapie* [Jörn Good (23)], *American Journal of Hand Therapy* [Beaman (24)].

This method can be taught to a therapist in 28 hours. Continuous education courses have been organized every year in French (for 8 years), in German (for 3 years) and shall be taught in English for the first time this winter.

The last word to Prof. Susan E. Mackinnon : "It is, in fact, Spicher's personal touches, anecdotes, and musings that readers will find enjoyable and perhaps stimulating and beneficial to the evaluation and management of their own patients" [Mackinnon : (25)].

References

1. Létiévant, E. *Traité des sections nerveuses : physiologie pathologique, indications - procédés opératoires*. Paris, France : J.-B. Baillère, 1873.
2. Spicher C & Kohut G. Jean Joseph Emile Létiévant : A Review of His Contributions to Surgery and Rehabilitation. *J Reconstruct Microsurg,* 2001 ; 17 :169-177.
3. Mitchell, S.W. *Injuries of Nerves and their Consenquences*. Philadelphia : JB Lippincott Co, 1872 translated in French as :
4. Mitchell, S.W. *Des lésions des nerfs et leurs conséquences*. Paris : Masson, 1874.
5. Tinel, J. *Les blessures de nerfs*. Paris : Masson, 1916 translated in English as :
6. Tinel, J. *Nerve wounds*. London : Baillère, Tindall and Cox, 1917.
7. Spicher, C., Kohut, G. & Miauton, J. At which stage of sensory recovery can a tingling sign be expected? A Review and Proposal for Standardization and Grading. *J Hand Ther,* 1999; 1, 298-308.
8. Dellon, A.-L. (1988). *Evaluation of Sensibility and Re-education of Sensation in the Hand* (3rd ed.). Baltimore : Williams & Wilkins.
9. Dellon, A.L. *Somatosensory testing and rehabilitation*. Baltimore : The Institute for Peripheral Nerve Surgery, 2000.
10. Barber, L.M. Desensitization of the traumatized hand. In J.M. Hunter, L.H. Schneider, E.J. Mackin & A.D. Callahan (Eds.), *Rehabilitation of the Hand* (3rd ed) (pp 721-730). St-Louis : C.V. Mosby Co, 1990.
11. Spicher, C. & Kohut, G. Rapid Relief of a Painful, Long-standing Posttraumatic Digital Neuroma Treated by Transcutaneous Vibratory Stimulation. *J Hand Ther,* 1996; 9, 47-51.
12. Spicher, C. *Manuel de rééducation sensitive du corps humain*. Genève, Paris : Médecine & Hygiène, 2003 translated in English as :
13. Spicher, C.J. *Handbook for Somatosensory Rehabilitation*. Montpellier, Paris : Sauramps Médical, 2006.
14. Spicher, C.J., Mathis, F., Degrange, B., Freund, P. & Rouiller, E.M. Static Mechanical Allodynia is a Paradoxical Painful Hypoaesthesia : Observations derived from neuropathic pain patients treated with somatosensory rehabilitation. *Somatsens Mot Res,* 2008; *25*(1), 77-92.
15. Degrange, B., Noël, L., Spicher, C.J., & Rouiller, E.M. De la rééducation de l'hyposensibilité à la contre-stimulation vibrotactile. In M.-H. Izard, R. Nespoulous (Eds.), *Expériences en ergothérapie,* 19ème série (pp. 207 -220). Montpellier, Paris : Sauramps medical, 2006.

16. Spicher, C.J., Degrange, B. & Mathis, F. La désactivation des signes d'irradiation provoquée; une nouvelle technique de rééducation sensitive pour traiter les douleurs chroniques. *ergOThérapies*, 2006; *22*, 13-18.

17. Mathis, F., Degrange, B. & Spicher C.J. La nouvelle méthode de rééducation sensitive peut soulager les douleurs neuropathiques chroniques une étude prospective de 111 patients. *Fisio active,* 2006; *42*(7), 24-27.

18. Mathis, F., Degrange, B., Desfoux, N., Sprumont, P, Hecker, E., Rossier, Ph & Spicher, C.J. Diminution des douleurs neuropathiques périphériques par la rééducation sensitive. *Rev Med Suisse,* 2007; *3*(135), 2745-2748.

19. Degrange, B., Joern, U., Mathis, F. & Spicher, C.J. Chronische neuropathische Schmerzsyndrome: Ein neuer Behandlungsansatz aus der somatosensorischen Rehabilitation. Die Korrelation zwischen dem McGill Schmerz-Fragebogen und der Schwelle der Druckempfindung. *e-News for Somatosensory Rehabilitation,* 2006; *3*(2):41-60. http://www.unifr.ch/neuro/rouiller/somato.enews.htm

20. Noël L., Desfoux, N. & Spicher, C.J. Le bilan diagnostique de lésions axonales. In M.-H. Izard (Ed.), *Expériences en ergothérapie*, 21ème série, (pp 109-115). Montpellier, Paris: Sauramps medical, 2008.

21. Lang, C.E. Book Review: Handbook for Somatosensory Rehabilitation. *Somatosens Mot Res*, 2008; 25(3):207–208.

22. Bridon, F. « Lu pour vous »: Manuel de rééducation sensitive du corps humain. *Kinésithérapie Scientifique,* 2004; 449:63–64.

23. Jörn Good, U. « Literatur »: Handbook for Somatosensory Rehabilitation. *Ergotherapie,* 2008; 4:32 (one page).

24. Beaman, N. « Book Review »: Handbook for Somatosensory Rehabilitation. *J Hand Ther,* 2007; 4:369 (one page).

25. Mackinnon, S.E. & Novak, C.B. Book Review »: Handbook for Somatosensory Rehabilitation. *J Hand Surg* (Am)*,* 2007; *32*(8):1306 (one page).

Appendix A : Experimental protocol for the Aesthesiography

Objective : to map the boundaries of the hypoaesthetic territory

Material :

– A4 millimetric graph paper for the hand or possibly A3 for the hand together with the forearm,
– Set of 20 Semmes-Weinstein pressure aesthesiometers.

Test procedure :

The limb to be examined should be stable, if necessary stabilized by the examiner's hand.

Type of stimulation :

The pressure to be applied to the aesthesiometer by the therapist is the minimum force required to bend the nylon filament. The stimulation on the skin should only last for 2 seconds and the interstimulus interval (ISI) should be 8 seconds. The time between each aesthesiometer application is thus 10 seconds, to be counted mentally.

Choice of aesthesiometer by the therapist :

In a descending series, the last aesthesiometer detected on the contralateral side is determined. i.e. it is 0.1 gram (mark: 2.83) on the palm and 0.2 gram (mark: 3.22) on the dorsal face of the hand. Subsequently, select two aesthesiometers next to the first aesthesiometer detected both in the ascending and descending directions. This series of five aesthesiometer is then used for delineating the hypoaesthetic territory. If the aesthesiometer is too small, the contour will be imprecise. If on the contrary, it is too large, there will be no hypoaesthetic territory.

Explanation on the determination of the aesthesiography are given to the patient : the aesthesiometers are shown to the patient, who is told that he is going to be touched by some of them in order to determine the territory where he feels less than normal. He is asked to look away by turning his head slightly to the side. The patient replies by touched as soon as he detects the stimulus.

Localization :

In order to help the therapist trace the final polygon, it is easier to place the graph paper besides the hand and parallel to it, so that he only has to mentally effect a transfer between the hand and the recording paper.

Longitudinal axis : the first point not-detected by the patient is identified. On the longitudinal axis, from the proximal to the distal, the first stimulating site not-perceived by the patient is determined, advancing centimeter by centimeter. Move then back from distal to proximal in order to find the first detected point. Finally, the first point not-detected along this axis is found by moving forward again from proximal to distal, but now advancing millimeter by millimeter.

Transverse axis: Search the first point not-detected by the patient along the axis perpendicular to the presumed damaged nerve. On the axis from right to left (e.g. for a palm face of a right hand, in case of lesion of the ulnar nerve), search the first point not detected by the patient, advancing centimeter by centimeter. Then return towards the right to find the first point detected. The next step is to return towards the left, but advancing millimeter by millimeter, in order to find the first point not-detected on the transverse axis. Finally, mark the point found on the paper and trace with an arrow the axis that was considered (see Fig. 2). If necessary, continue the search for other points on the lines: transverse axis of the metacarpal heads, transverse axis of the PIP joint, longitudinal axis from distal to proximal, etc.

Result:

trace a polygon joining up the points determined, reflecting the extent and position of the hypoaesthetic territory.

Appendix B: Experimental protocol for allodynography

– The stimulus is applied at multiple locations on the skin;
– The stimulus is arbitrarily fixed at an applied force of 15 grams (Pressure: 69.1 g/mm^2);
– The pain invariant is defined as 3/10 cm on a visual analogue scale (VAS) or the pain at rest + 1 cm

Objective: to map the allodynic territory

Material:

– A4, possibly A3 millimetric graph paper.
– 15 grams aesthesiometer (Semmes-Weinstein: mark 5.18).
– Visual analogue scale of pain understood by the patient.

Test procedure:

The limb to be examined should be stable, if necessary stabilized by the examiner's hand.

Type of stimulation:

The pressure to be applied to the aesthesiometer by the therapist is the minimum force required to bend the nylon filament. At the beginning, skin stimulation is rapid and then, as the precise zone is approached, stimulation should be for 2 seconds and the interval between questions, 8 seconds. The interstimulus interval (ISI) is thus 10 seconds, to be counted mentally.

Choice of the pain invariant:

great attention is required during the initial testing. In particular, the patient is asked, "Can you imagine a worst possible pain?" A pain for the search of the allodynic territory is fixed at 3/10 cm. In this way, a large vertical red line is traced at a pain of 3/10, which is marked "STOP", thus representing the pain invariant.

Explanations on the allodynography procedure are given to the patient: the aesthesiometer is pressed against the skin of a non-painful limb, and the patient is told that the place evoking moderate pain is being sought; the "STOP" mark is shown to him at the same time. He is asked to look at the scale and using his finger, to progress along the "no pain" line to the "STOP" mark when pain begins to appear. The patient replies by "STOP" when the stimulus provokes a pain corresponding to 3/10.

Localization :

On the longitudinal axis of the limb, from proximal to distal, the first allodynic point is found by moving the stimulus site centimeter by centimeter. The patient is asked if the pain is red (line color at 3 cm on the visual analogue scale) : if no, the test is continued moving the stimulus further; if yes, move the stimulus back from distal to proximal in order to find a less painful stimulation site. Then, move again from proximal to distal, but now advancing millimeter by millimeter in order to find the first allodynic point along this axis. Mark the final stimulated site on the paper, trace the axis that was followed, and add an arrow (see Fig. 3). Carry out the procedure on the perpendicular axes. Finally, trace a polygon by joining the border sites obtained along the various axes investigated.

Result :

this is the 15 grams allodynic territory for a pain invariant of 3/10 cm on a VAS.