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# PUNCTURAL DIAGNOSTICS: MODERN LOOK AT THE METHOD

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***Abstract***

*Methods of testing the meridian system should be subdivided into two main directions: acupuncture diagnostics and segmental neurofunctional diagnostics. The acupuncture diagnostics is based on testing skin physiological properties at acupuncture points; it is aimed at determining the condition of separate parts of the functional systems, but not at diagnostics of meridians themselves. The segmental neurofunctional diagnostics results from testing skin reactions at the meridian projections and identifies the meridian activities. The dynamic method of segmental neurofunctional diagnostics is the most effective one.*

**Keywords:** *acupuncture diagnostics, dynamic segmental diagnostics, acupuncture.*

## Introduction

The interaction of the organs and systems in a single organism seeks to maintain physiological balance – homeostasis; this situation causes changes in the functional state of all systems during the functional violation of any of them. Skin is one of the systems of an organism that changes its function, – to be precise: it functionally adapts to the changing conditions of the organism [*Rusetsky I., 1959*]. Such changes in the function of the cutaneous coverings always occur with changing the properties of the skin, including its electrophysiological characteristics [*Christie M., 1981*].

Of course, a detailed examination of many organs and systems is required for the clear view of the organism. However, more than a century-long research interest to the skin, as the most accessible organ, is still growing in modern medical science and practice [*Moncada M., Cruz J., 2011*]. V.G. Vogralik and M.V. Vogralik indicate that skin covings are, on the one hand, delimiting the organism from the environment (personalization) and, on the other hand, serve for connection with it (ecologization) [*Vogralik V., Vogralik M., 1988*]. Therefore, in the evolution of living organisms the skin was functionally interconnected with the nervous, hormonal, and visceral systems.

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## *Electropunctural diagnostics: main trends of application.*

The number of physicians using methods of traditional Chinese medicine has significantly increased since techniques of instrumental acupunctural diagnostics were developed and introduced into the modern medical practice. The punctural diagnostics or, in other words, the diagnostics of acupunctural points and their status, is a great support for those, who resort to traditional Chinese medicine for diagnosing and therapy planning, as well as for assessing treatment results. Special preference among various methods of punctural diagnostics is given to measurements of skin electric parameters, i.e. to methods of electropunctural diagnostics (EPD). EPD methods began to be widely introduced into the public health care in 1980s. Among all suggested varieties of EPD the methods of R. Voll and Y. Nakatani are the most acknowledged ones. Their success is based on reliable normative scales developed by the mentioned authors, the approach and applications of which, in the long run, always lead to high quality diagnostics.

What these two methods have in common is the assessment of such a diagnostic criterion as skin electroconductivity but, in fact, they are two independent trends of EPD. The main difference between them consists in using different parameters of electrical current for electropunctural testing. Basing on these parameters the authors determined certain conditions for diagnostic procedures and developed specific normative scales and rules of interpreting the obtained results.

While doing his research R. Voll empirically came to the conclusion that electric current parameters used for diagnosing the status of biologically active points (BAP) must be 2-3 *V* (voltage) and about 15 μA (current strength) [*Voll R., 1976*]. Besides, to make the diagnostics reliable, the active electrode must be placed strictly on a point projection, that is why the electrode is designed as a metal rod 3 *mm* in diameter. If this rod exercises pressure on the skin with a varying force, the skin electrical resistance will naturally change depending on the intensity of this pressure. Hence, the pressing force in this method must be strictly regulated for the sake of obtaining reliable values, but in practice it is determined subjectively by the physician, who carries out the procedure. Proceeding from the testing current parameters and conditions of the testing procedure R. Voll developed a corresponding scale for interpreting the obtained results. The current strength values within 5.5-7.0 μA were considered normal for any testing point and corresponding to 50-60 units on Voll's scale [*Voll R., 1976*].

The main peculiarity of Voll's method in the interpretation of the results consists in the author's postulate that electrophysiological properties of a point do not reflect the condition of the whole organ or the whole functional system, but refer only to its certain, strictly determined part (Table). Thus, for example, judging by the state of certain points on the stomach channel one can determine the state of the esophagus, stomach body, pylorus, peritoneum, etc. A special role of R. Voll as a researcher consists in his proof of the fact that classical Chinese channels really have their representation on the skin surface, since all the points for determining the state of a functional system lie on a certain channel corresponding to this system.

Recently there appeared some diagnostic complexes, which, for the sake of reducing a point exposure to an EPD procedure, suggest using the testing current lower than that specified in Voll's method, i.e. 2-4 μA. However, the actual practice implies that one cannot reduce the testing current up to such small values, because the results in the case will depend on a great number of artifacts appearing in the course of testing and, if the measurements are repeated in the same patient under the same conditions 10-15 minutes later, different diagnostic conclusions will be drawn.

Basing on extensive empirical data of his research Y. Nakatani worked out his own method of EPD and convincingly substantiated the application of testing current parameters of 12 *V* (voltage) and 200 μA (current strength) for diagnostic purposes in order to assess the so-called "viscero-cutaneous sympathetic reflex" [*Nakatani Y., Ya-*

***TABLE.***

Electrophysiological properties of some points and their correlation with changes in organs and systems according to R.Voll

| Points to be tested | Correlation with changes in the organism |
|---|---|
| LU.9 | Trachea |
| PC.7 | Coronary vessels |
| HT.7 | Bundle of His: left and right branches |
| SI.3 | Right – descending part of the duodenum;<br>Left – bend between the duodenum and the empty intestine |
| SI.4 | Right – upper horizontal part of the duodenum;<br>Left – descending part of the duodenum |
| SI.5 | Vertebral column, cervical part |
| TH.3 | Hypophysis, epiphysis |
| TH.4 | Practically coincides with the point "Degeneration of the head organs" |
| LI.3 | Right – ascending part of the large intestine;<br>Left – bend of the large intestine |
| LI.4 | Right – the blind gut;<br>Left – left part of the transverse colon |
| LI.5 | No correlation |
| SP.3 | Right – carbohydrate metabolism, amylase and maltase production;<br>Left – function of the red pulp of the spleen |
| LR.3 | Perivascular and periportal field of the liver |
| KI.3 | Glomeruli, convoluted tubules of the kidneys |
| KI.4 | Medium and lower rectal plexus |
| BL.64 | Women – the ovary, the epoophoron, the fallopian tube;<br>Men – spermatic cords, the epididymus |
| BL.65 | Women – the vagina, urethra, uterus, broad ligament of the uterus;<br>Men – the prostate, penis, urethra, seminal vesicles, tubercles |
| GB.40 | No correlation |
| GB.41 | Lobous ducts of the right lobes of the liver |
| ST.42 | The right and left upper part of the esophagus |
| ST.43 | The stomach path, the ascending part of the angular notch |

*mashyta K., 1977; Hyodo M., 1985*]. Nowadays this method is recognized all over the world and is the most popular not only with specialists in acupuncture, but also with general practitioners.

To achieve his goal, Y. Nakatani suggested that not points, but biologically active zones should be tested. Hence, the diameter of the active electrode according to Nakatani's method makes up 10 *mm* and its metal contact is placed inside an ebonite cup with some cotton wool soaked with NaCl before the testing procedure. In this case, there is no direct contact of the active metal electrode with the skin, the effects of the skin polarization are reduced and the testing current – through the soaked cotton wool – is uniformly applied to the skin over the whole surface of the testing electrode cup. During this diagnostic procedure the nerve endings in the skin are exposed to the testing current, and segmentary irritation from afferent vegetative nerve endings is transmitted via intercalary neurons to efferent sympathetic vegetative neurons. The excitement of the latter results in changing of vegetative regulation processes in the skin under the active electrode. The changed vegetative regulation of the skin is responsible for the alteration of skin electrophysiological properties and, as a rule, leads to the decrease of electrical resistance and to the increase of electroconductivity of the given skin area. The skin in the areas of the 12 symmetrical representative zones belonging to certain skin segments or, to be more precise, – to the segmentary vegetative apparatus innervating this or that skin segment, is variously susceptible to Nakatani's signal in a normally functioning organism; that is why the electroconductivity in these skin areas changes differently. Having revealed this peculiarity, Y. Nakatani developed his scales for interpreting electroconductivity values of each skin segment and created standard, the so-called "ryodoraku" charts [*Nakatani Y., Yamashyta K., 1977; Hyodo M., 1985*]. Since the vegetative regulation is normally variable, the "ryodoraku" scales reflect an empirically revealed intensity of response for each skin segment (Figure 1). If the response of each skin segment yielded its theoretical maximum, the resulting picture would be as follows: the peak response would be registered for the three heaters channel and the large intestine channel, whereas the current strength in the case would be equal to the short circuit current of 200 μA. This value would make up about 190 μA for the lung channel, 170 μA for the pericardium and the small intestine channels, 160 μA for the pancreas and kidney channels, 150 μA for the urinary bladder channel and about 140 μA for the heart and stomach channels. The liver and gall bladder channels

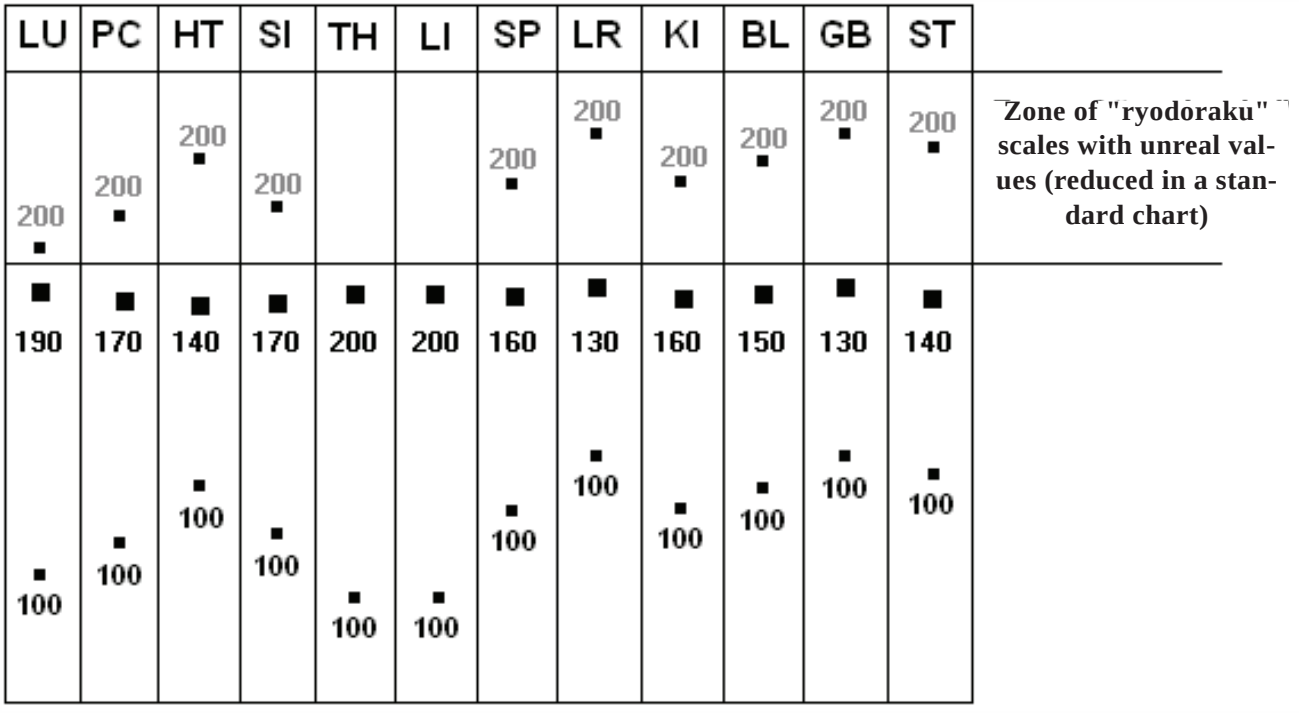


**Figure 1.** *Standard Y. Nakatani's chart.*

are the last in this list: the peak value of current strength in these skin areas would be no more than 130 μA with the testing current of 200 μA, the voltage of 12 *V* and the signal duration of 3 *sec*. The practical experience shows correctness of these values for all skin types independent of the race of the tested subject. Thus, according to Y. Nakatani, each skin segment has its own scale for interpreting electroconductivity values of the skin. Besides, specific intervals of normal values are determined for each testing procedure depending on an average value derived from all obtained figures of electroconductivity values. As shown in Figure 1, equal values of current strength (for example of 100 μA) lie on different levels of the interpretation scales in accordance with the response intensity of the corresponding skin segments empirically set for a normally functioning organism. Such equal values obtained by testing can be normal for some skin segments, but excessive or insufficient for others. This fact makes the main difference in the interpretation of values when compared with Voll's method of BAP testing with light testing current. In the latter case equal electroconductivity values of a certain point are equally assessed being compared to standard values of a norm interval (50-65 units on Voll's scale) [*Voll R., 1976*].

So testing current used in Nakatani's method is heavy enough to provoke a response in the segmentary sympathetic vegetative apparatus. This method is based on the analysis of the intensity of vegetative reactions in skin segments in response to a standard testing signal and of the correlations of these reactions. The author's approach to the assessment of the results consists in estimating the skin segment vegetative regulation, which correlates with the vegetative regulation of the corresponding functional systems according to the doctrine of the oriental medicine about the localization of external branches of classical Chinese channels [*Anatomical Atlas, 1988*].

All the above-mentioned makes it clear that a standard "ryodoraku" chart cannot be used for interpreting electroconductivity values obtained by testing at current values other than those used in Nakatani's method [*Boytsov I., Ulaschik V., 2000*]. Any other testing currents may provoke an unpredictable reaction in the skin, and it is natural that special scales and interpretation rules must be developed for such cases. Unfortunately, many designers of EPD-devices reduce voltage and strength of the testing current simultaneously referring to Nakatani's method in the title of such devices. One cannot agree with the designers of the diagnostic systems who suggest that other current parameters should be used as a testing signal for various channels and simultaneously take peak values of the current strength from "ryodoraku" scales (Figure 1). Such approach violates the main principle of Nakatani's diagnostics: to assess how the values of the sympathetic response reaction in skin segments correlate with the same standard testing signal, while the peak values of the current strength in "ryodoraku" scales reflect an empirically set intensity of such reactions for a normally functioning organism.

The opponents of Nakatani's method put forward rather equivocal arguments. On the one hand, they are against using the testing current parameters of 12 *V* and 200 μA, which, in their view, are unacceptable for diagnostic purposes. On the other hand, they point out that by this method it is impossible to repeat a testing procedure earlier than in 24 hours. To prove their first argument they refer to data of medical literature on adverse reactions, which develop even in cases, when the acupuncture points are exposed to a much lighter current of 10-20 μA. These reactions can include nausea, dizziness, cardiac and breathing arrhythmia, falling or rising blood pressure and general weakness in some patients. Nevertheless, it is well known that such vegetative reactions, although rarely, can be observed in some patients, especially men, because of a common fear for any treatment procedure, for example – an ordinary injection. This is also true for acupuncture, since this method of treatment is new for most patients. In my acupuncture practice there was only one case of a patient fainting, while I was searching the necessary point slightly pressing the skin with a usual metal probe; but none of my other patients examined by Nakatani's method (and their number exceeds 10,000) experienced the above mentioned adverse reactions, even the mildest ones. The attempt to present Nakatani's testing current as hazardous factor is based on misunderstanding or unawareness on the essence of Nakatani's method (evaluation of sympatic skin reactions) and its difference from such methods as, for example, Voll's diag-

nostics (evaluation of electrophysiological properties of skin in the area of acupuncture points).

The second argument of Nakatani's opponents about the impossibility of a repeated testing earlier than in 24 hours does not correspond to the truth. The skin area, which was exposed to testing current and the electrophysiological properties of which were altered, naturally needs some time for restoring its initial values. However, the period for restoring takes from 1 to 5 minutes, and the time interval between any two repeated measurements makes up to 10-15 minutes, so in this period of time the main correlations of electroconductivity values in skin segments will be restored. Besides, Nakatani's method is not used for the analysis of absolute current values, as they are but estimates of their correlations, and this is a more stable index with regard to the repetition of testing results, if compared to absolute values of electroconductivity in a living organism.

**Summing up we single out the following main trends of electropunctural diagnostics:**

1. *Testing skin electrophysiological properties in the area of biologically active points*. One should take into consideration that electrophysiological properties of a BAP do not reflect the condition of the whole functional system, but refer only to its certain part. To test these properties one should apply light current, at parameters determined by R. Voll, i.e. those equal to 15 μA (current strength) and 1-3 *V* (voltage)

2. *Testing the skin segment vegetative regulation and comparing the obtained characteristics with the vegetative regulation of the functional systems and the condition of the corresponding classical channels*. The testing current used for the purpose must be heavy enough to provoke a response reaction in the segmentary vegetative apparatus. The current parameters empirically set by Y. Nakatani make 200 μA (current strength) and 12 *V* (voltage). We call this diagnostic trend "segmentary neurofunctional diagnostics" (SNFD), and it will be discussed in detail below. First of all, we theoretically substantiate application of the SNFD and its methods for determining the functional condition of the channel system in the human body.

SNFD as a method for testing the condition of the channel system.

The above-mentioned term, "segmentary neurofunctional diagnostics", comprises diagnostic methods allowing to test the ability of the segmentary vegetative apparatus to realize the vegetotrophic regulation.

According to traditional Chinese medicine, the diagnostics of the so-called "vital energy" circulation through the human body always precedes the therapy. The method and the place of an acupunctural exposure have always been determined by the character of disturbance in the YING-YANG balance [*Sun Xue Quan, 1985; Chinese Acupuncture, 1987; Boytsov I., 1996*]. The most informative method of acupunctural diagnostics in traditional Chinese medicine consists in examination of the pulse in the radial points of the upper extremities. The main principles of the pulse diagnostics determining the disturbance levels of the YING-YANG balance are discussed below.

First, it is stated: if there is amplification or reduction of all superficial or deep pulses in both upper extremities that is characteristic of general surplus or deficiency of the vital energy in the human body. It is the so-called first level of disturbance – the level of "the general energy of the human body".

The main distinction of the second level of disturbance in the balance of the general YING and the general YANG is the difference between superficial and deep pulses. The following types of disturbance are to be singled out: 1) surplus of the general YANG and relative deficiency of the general YING (amplification of superficial pulses, which prevail over the deep ones); 2) deficiency of the general YING with relative surplus of the general YANG (reduction of deep pulses and prevailing of the superficial ones); 3) surplus of the general YING with relative deficiency of the general YANG (amplification of deep pulses, which prevail over the superficial ones); 4) deficiency of the general YANG and relative surplus of the general YING (reduction of superficial pulses and prevailing of the deep ones).

The third level is characterized by quadrant disturbance of the YING-YANG-balance, in other words, – this level includes various types of surplus and deficiency of YING and YANG of the upper extremities and YING and YANG of the lower extremities. Pulse diagnostics reveals disturbance typical for such pulse changes; for example, prevailing of superficial pulses in position I and III

on the right arm and in position I on the left arm speaks for YANG-surplus of the arms, whereas prevailing of deep pulses in position II on the right and left arms and in position III on the left arm speaks for YING-surplus of the lower extremities.

However, the cases, when the disturbance of the YING-YANG balance does not refer to the whole channel system, but involves separate channels, are more frequent; that is the fourth level of disturbance, so in this case the pulse diagnostics requires the highest mastery. It takes years under the guidance of an experienced teacher to learn revealing and correctly interpreting single changes of the pulse wave in certain positions in order to be able to constantly compare your own subjective perceptions of patients' pulse beatings with the perceptions of your teacher.

It is practically impossible for western specialists to master the pulse diagnostics: that is why they use instrumental methods of channel system diagnostics for conducting efficient acupuncture therapy. Amongst the numerous instrumental methods of acupunctural diagnostics we have singled out two main trends for measuring the electrical parameters of the skin. The aim of the first trend is to diagnose electrophysiological properties of the skin in the area of acupuncture points and to compare these properties with the state of certain parts of the inner organs. This trend does not solve any problems of channel diagnostics. A vivid example of this trend is EPD by Voll's method. Hereinafter we will apply the term "electropunctural diagnostics", i.e. diagnosing the condition of acupuncture points, namely to this trend. To investigate the condition of the channel system in modern medical practice it is preferable to use methods of the SNFD. One of the varieties of this diagnostics is "ryodoraku" diagnostics (Nakatani's method).

The SNFD consists in determining the degree of vegetative regulation of the inner organs on a basis of changes in activity of segmentary vegetative neurons in response to a slight stimulation of the skin surface in distal parts of the extremities with a standard electric impulse. In other words, the interpretation of the obtained values implies correlation between the vegetative regulation of the skin in the area of certain skin segments and the vegetative regulation of the inner organs. The segmentary vegetative apparatus includes vegetative neurons of the spinal cord and neurons of paravertebral, prevertebral and spinal ganglia, which were formed in the process of embryogenesis. In our opinion, testing of the morphofunctional system (MFS) activity from the standpoint of the segmentary vegetotrophical regulation is, in fact, the main method of diagnosing functional systems in terms of traditional Chinese medicine.

According to theoretical postulates of traditional Chinese medicine, a functional system includes the following constituent parts: a ZANG- or a FU-organ, an outer and an inner run of a channel, a musculotendinous channel of the same name and collateral branches connecting all constituents of a functional system into a single whole. If any of the functional systems is pathological, all its constituent parts also suffer. Modern neurophysiology regards the segmentary vegetative apparatus (Figure 2) [*Boytsov I., 2012*], as a unifying ground for all constituent parts of a MFS. In this apparatus the vegetative neurons of a certain segmentary level (vegetotome) control in terms of vegetotrophic regulation, the corresponding splanchnotome (i.e., an inner organ of a MFS: a ZANG- or FU-organ according to Chinese traditional medicine), the skin segment vegetative provision (SSVP), i.e. representation of the given MFS on the skin – an outer run of a channel, the myotome and the sclerotome (a musculotendinous group of a MFS or a musculotendinous channel of the same name in terms of traditional Chinese medicine). The inner run of a channel is made up of neuron processes, which being a part of the nerve trunk and the conduction trunks provide for the integrity of the whole MFS and its interrelation with other systems. In the process of embryogenesis all constituent parts of a MFS turned out to be interrelated through a common initial innervation, which persists when organs and tissues shift, because of a simultaneous growth of conductors. It means that basic theoretical postulates of traditional Chinese medicine about functional systems, ZANG- and FU-organs and related channels by no means contradict to modern knowledge of anatomy and neurophysiology. Furthermore, the given model of the conformity between a functional system according to traditional Chinese medicine and modern ideas about the MFS do not deny morphological and functional reality of the channel system. In our view, such notion as "channel energy" means an electro-

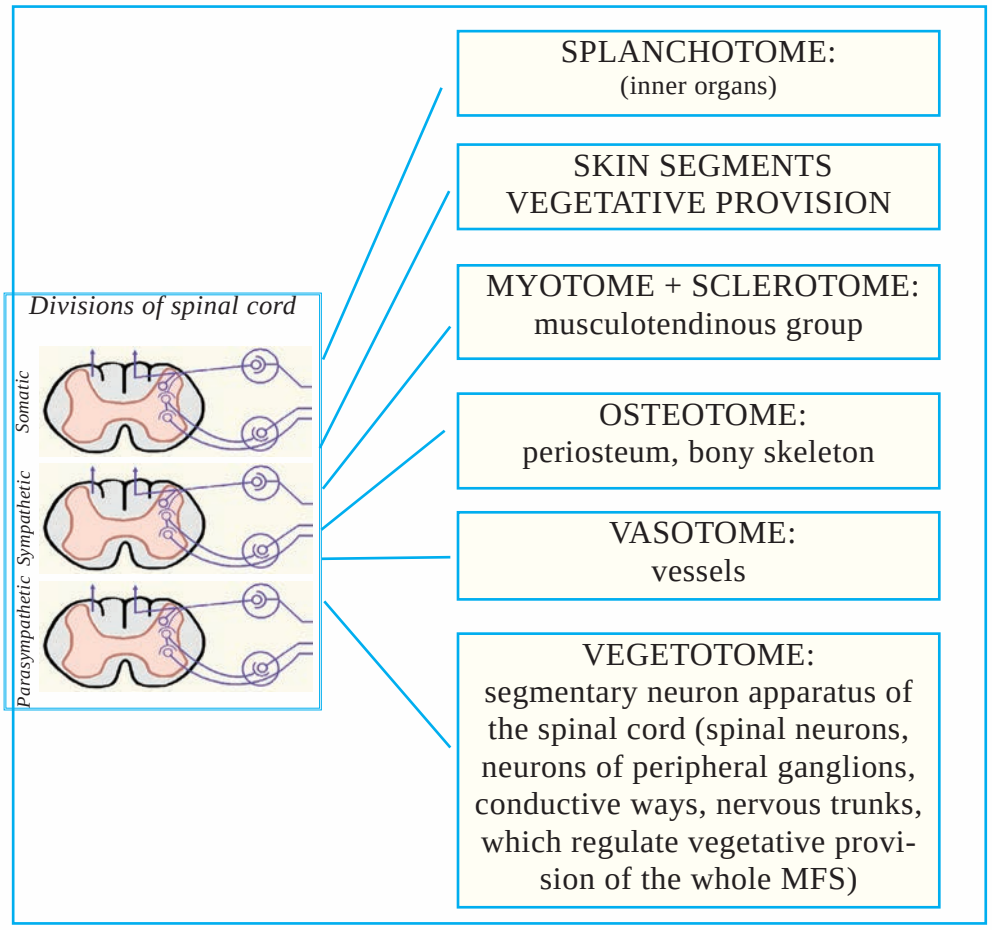


**FIGURE 2.** *Main constituent parts of a morphofunctional system* **(scheme)**

magnetic constituent of all electrical and biochemical processes in the body. This constituent has various frequency parameters and is exposed to the influence of an outer electromagnetic field.

Thus, the SNFD uses the principle of organizing the functional system on a basis of theoretical postulates of traditional Chinese medicine and modern scientific data. The diagnostic procedure can be described as follows (Figure 3):

Step I: the active electrode is placed onto the skin in the area of some SSVP and via it the skin nervous receptors and the subcutaneous tissue are irritated with electrical current (the advantage of electrical current as an irritator lies in an easy standardization of its parameters such as voltage, current strength, time and area of exposure);

Step II: as a result of the irritation a local depolarizing potential is produced in the terminal nervous receptors;

Step III: under the influence of a sufficiently powerful irritator the depolarizing potential reaches its critical level and is transformed into a nervous impulse, which is transmitted to neurons via vegetative afferent fibers;

Step IV: activity of the vegetative neuron apparatus on the corresponding segmentary level is changed, the character of these changes depends on the functional state of neurons prior to irritation;

Step V: the reaction of the neuron apparatus in response to irritation changes the vegetative regulation of the skin under the active electrode;

Step VI: electrophysiological properties of the skin in this area, in particular its electrical resistance, are also changed;

Step VII: electroconductivity of the skin under the active electrode is measured by the investigator and, after the representation zones of all SSVP are tested, the results are interpreted with regard to normative values for a response reaction of the vegetative neuron apparatus on various segmentary levels [*Boytsov I., 1999*].

According to the results of diagnostic investigation a conclusion is drawn about the functional activity of higher supersegmentary centers of the

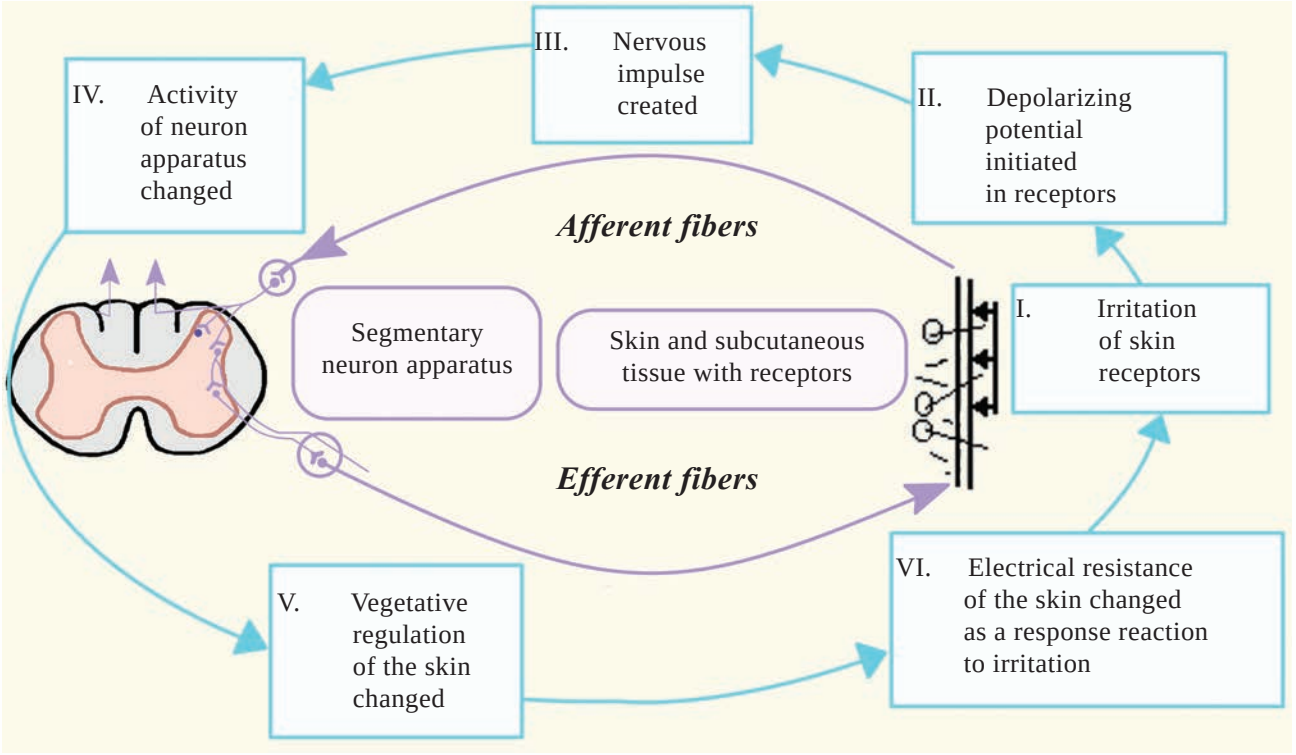


**FIGURE 3.** *Scheme of segmentary neurofunctional diagnostics.*

nervous system, and this is the level of the general tonus of the human body. Increasing or decreasing response reactions of all segments point out to rising or lowering of the general tonus of the organism. If you analyze the clinical picture of this type of disturbance, it will be identical to the picture observed in a patient with increasing or decreasing "the general energy of the organism" according to traditional Chinese medicine.

Then general analysis of the values obtained from SSVP, which correspond to YING and YANG channels – the second level of disturbance, follows. If response reactions from outer SSVP prevail over reactions from the inner surface of the extremities, the clinical picture of the patient will demonstrate the prevalence of the symptoms, which point to excessive activity of the sympathetic part of the vegetative nervous system, and it corresponds to the syndrome of the excessive general YANG according to traditional Chinese medicine. On the contrary, if response reactions from inner surfaces of the extremities prevail, the clinical picture of the patient will demonstrate the prevalence of the symptoms, which point to excessive activity of the parasympathetic part of the vegetative nervous system that corresponds to the syndrome of the excessive general YING according to traditional Chinese medicine.

On the second level the correlation of activities in the sympathetic and parasympathetic parts of the vegetative nervous system is analyzed, being determined by the activities of the corresponding neurons in *medulla oblongata* and *medulla spinalis*. Simultaneously absolute or relative sympathicotonia and absolute or relative parasympathicotonia are differentiated.

On the third level a comparative analysis of conductivity on the outer and inner surfaces of the extremities is performed. The disturbance of conductivity on this level is determined by activity changes in neurons of the whole series of segments and according to traditional Chinese medicine is associated with the balance disturbance between YANG and YING of the upper extremities and YANG and YING of the lower extremities. In neurological practice such disturbance is caused by affection of the brain or spinal cord, as well as of the nervous plexuses.

On the fourth level the disturbance in the activity of the neuron apparatus of separate segments (vegetotome) is analyzed. Such disturbance influences the corresponding MFSs; namely: in the inner organs (splanchnotome), in the skin and subcutaneous tissue (i.e, SSVP), in the muscles and tendons (myotome and sclerotome), in the fascias

and vessels (sclerotome) and in the conductive ways (a part of the vegetotome). This level of disturbance corresponds to changes of activity in separate channels, which according to traditional Chinese medicine correlates with the activity of the related functional systems.

Thus, in order to know the general condition of MFSs or the condition of the channels as their constituent parts western specialists of acupuncture resort to methods of SNFD. The principle of SNFD fully corresponds to traditions of diagnostic search in the ancient oriental medicine, and this type of diagnostic investigation gives a rather complete picture of a patient's state on all levels of the possible disturbance.

Below we discuss in detail the most used methods of SNFD.

### *Characteristics of SNFD methods*

Since the skin is more accessible for investigation than the inner systems of the body the most applied methods of SNFD are those, which use skin segments for diagnosing the functional condition of the segmentary vegetative apparatus. The general scheme of such testing is given in Figure 3.

Qualitative and quantitative parameters of the response reaction depend on the physiological condition of all participants of the reflex arch, but first of all, on the functional activity of segmentary efferent vegetative neurons.

Furter interpretation of diagnostic results or parameters of the reflex response reaction is carried out as follows:

1) Medical doctors interpret the results in the context of functional activity of the inner organs and systems of the body on a basis of the unity of splanchotomes (segmentary vegetative regulation in visceral systems) and SSVP;

2) Surgeons assess the character of vegetative regulation of the skin grafts for further transplantation or on the sites of surgical incisions;

3) Doctors in sport medicine analyze the segmentary vegetative reaction for the assessment of the musculotendinous groups of MFSs (sclero-myotomes);

4) Specialists in cosmetic dermatology compare the vegetative regulation of the skin segments and the outward appearance of the corresponding skin areas;

5) Specialists in traditional Chinese medicine make correlations between the obtained vegetative characteristics and the condition of the patient's channel system.

All methods of SNFD have a common feature: determination of the vegetative regulation character for inner organs, musculotendinous apparatus, and integument on a basis of assessing the excitement of the neurons of the segmentary part of the autonomic nervous system on the background of low-intensity stimulation of nerve receptors in the skin segments.

The electrical current is ordinarily used as an irritator for the conduction of such investigations, a thermal source can be rarely used.

In the first half of the 20th century Doctor Akabane was the first to suggest absinth-cigarette warming-up of certain zones on the distal phalanges of the fingers and toes in order to determine the threshold of pain sensitivity [*Akabane K., 1956*]. According to the findings, the time period from the beginning of the warming-up to the appearance of an intense burning sensation in symmetrical zones of the right and left extremities is assessed. If there is a great difference in time, the conclusion is made that one of the conjugated Chinese channels corresponding to the given skin segment is in the state of disturbance of the right-left balance or, in other words, one of the symmetrical channels is excited and the other is depressed. At present this principle is still used in medical practice and it is known as the method of thermoalgometry. Nowadays a thermal diode is used instead of an absinth cigarette and the process of testing is automated so that the patient himself registers the moment of pain sensation by pressing the button. The range of segments in use is also expanded. Not only those segments, which correspond to the Chinese channels, but also the channels discovered by Doctor R. Voll, are included into the range. However, the criterion for the final assessment remains the patient's subjective answer, whether it hurts. There cannont be any objective parameters, since we cannot foresee how the patient's threshold of pain sensitivity will change in the process of testing and after, for example, the fifth, tenth or after the twentieth sudden painful irritation. Vegetative findings, which unpredictably change in the process of diagnostics, cannot be objectively assessed either. Besides, this diagnostic procedure cannot be applied to children, mentally ill patients, in cases of spinal disturbance, radiculopathy, distal polyneuropathy and the like.

Among other methods of SNFD the "ryodoraku" method is most frequently used. This method was suggested by Doctor Y. Nakatani in the middle of the last century. Electric current is used in the method as an irritator and, what is very important, the power of irritation never exceeds the threshold of the patient's subjective perceptions. Thus, the patient does not perceive any irritation during the procedure of testing, and the response reaction of the efferent neurons is assessed in the context of changing electroconductivity of the skin under the active electrode. The procedure is not complicated from the technical point of view. When the test is over, normative parameters for each SSVP are calculated and the obtained results compared with these parameters. If the general tonus of the body is normal and the sympathetic and parasympathetic systems are well-balanced and, moreover, if there are no specific quadrant disturbances of conductivity in the extremities, the measured parameter lying within the range of the norm points out that the vegetative regulation of the given skin area is normal. It also means that all the constituent parts of the corresponding MFS (the SSVP, myotome, sclerotome, osteotome, splanchnotome) are also normally provided in the context of vegetotrophic regulation. If a measured parameter of any SSVP is higher or lower than the normative range, it speaks for an increased or deficient vegetotrophic provision of the given MFS.

It goes without saying that this test outperforms the thermoalgometry, first of all in the objectivity of the measurements, which do not depend on the patient's mood. However, this method also has its drawbacks, which will be discussed later, when we introduce the fundamentals of the next method of SNFD.

Thus, the next, third, method of SNFD is the author's method of "dynamic segmentary diagnostics" or, as we call it, the DSD-test (*Permission, 2011*). As an irritator we use electrical current with voltage of 6-21 *V* and current strength of 150-250 μA (when the electrodes are closed). The intensity of irritation of the skin receptors does not reach the threshold of the patient's subjective perceptions.

The testing procedure consists of the following steps:

*Step I:* nerve receptors of the representative zone in the skin segment are excited with an irritating signal of low intensity.

*Step II:* the strength of irritation gradually increases and reaches the maximum level at the moment of the peak response reaction.

*Step III:* Dynamic changes of skin electroconductivity under the active electrode are constantly followed. The diagram of these changes is shown in Figure 4. As nerve receptors in the skin are irritated, the electroconductivity begins to grow and

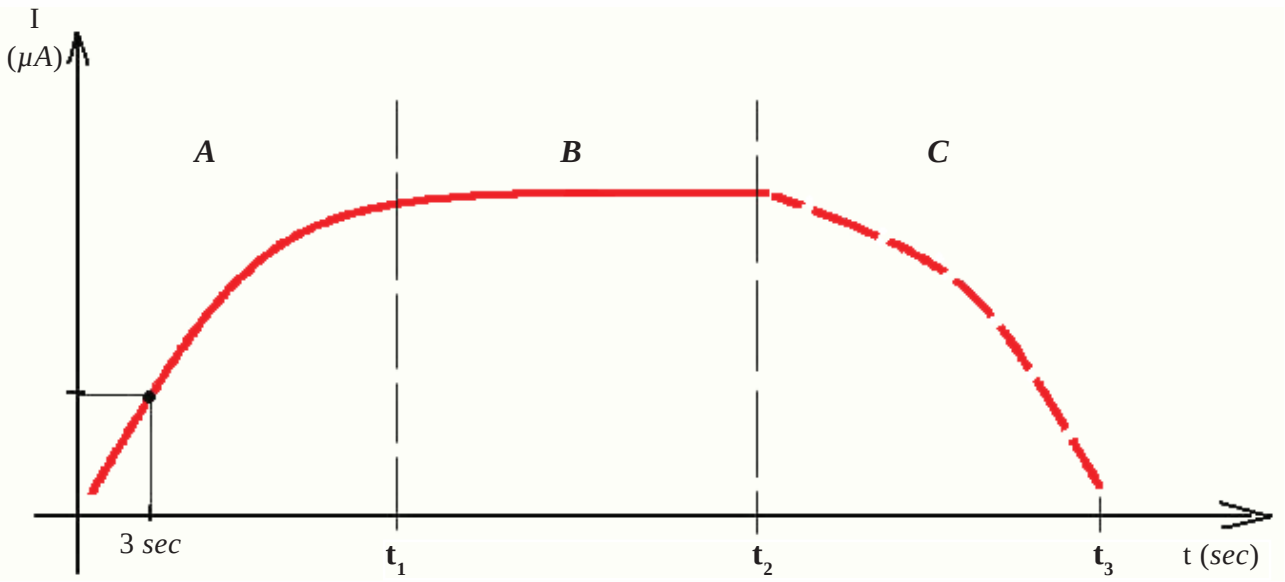


**Figure 4.** *Phases of the neuron apparatus response reaction during DSD-testing.*
***A.*** *phase I – increasing electro-conductivity;*
***B.*** *phase II – stable electro-conductivity;*
***C.*** *phase III - decreasing electro-conductivity.*

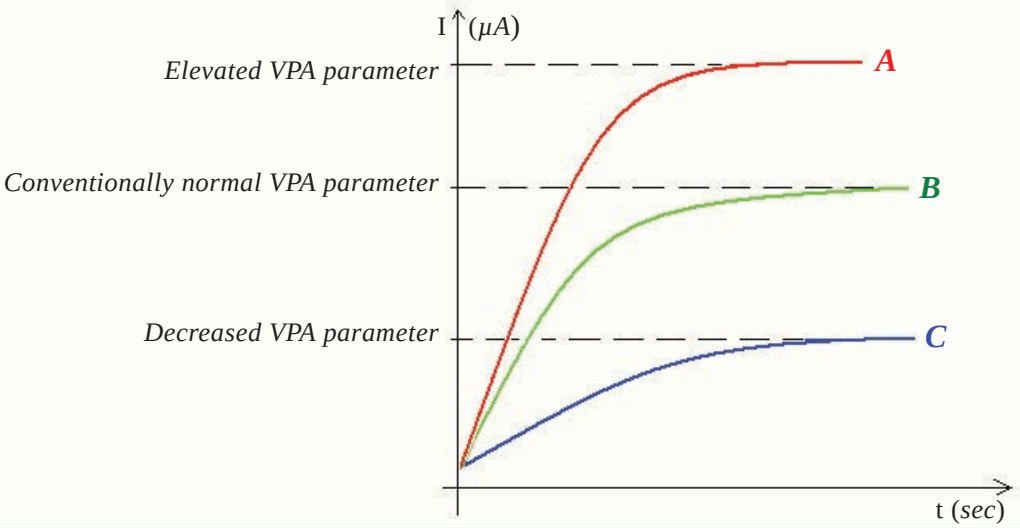


**Figure 5.** *Various changes of the parameter of vegetative provision of activities for a MFS during DSD-testing.*

reaches its peak values in the time period $t_1$, which is equal to 7-50 *sec*, i.e. further irritation of the skin does not lead to an increase of a response reaction from segmentary vegetative neurons. If the skin nerve receptors are further irritated, in a certain period of time $t_2$, which is equal to 1-2 *min*, the activity of the neuron apparatus begins to fall. It is depressed and the skin electroconductivity under the active electrode decreases to its initial values in the period of time $t_3$, which equals 3-10 *min*.

Thus, in the process of testing the following phases are singled out: phase I – excitement of the neuron group (Figure 4 A), phase II – stabilization or "plateau" (Figure 4 B) and phase III - depression of neurons (Figure 4 C). To spare time, the testing in medical practice is conducted until the moment of stabilization of skin electroconductivity parameters on their peak values is reached, i.e. till the moment of reaching "plateau". That is why, if you use the programmed apparatus complex "POINTS", as a rule, the DSD-test procedure of all the 24 skin grafts will make 10-15 *min* [*Boytsov I., 2011*].

The interpretation of diagnostic results consists in calculating and estimating the general index of the body tonus, parameters of the balance between the sympathetic and parasympathetic systems and skin electroconductivity parameters of the upper and lower extremities, as well as parameters of a reflex response reaction of certain MFSs – the parameter of vegetative provision of activities (VPA) and the vegetative reactivity (VR) parameter .

The VPA parameter denotes those peak values of skin electroconductivity, which have been measured, while testing a SSVP, and they are electroconductivity values of the "plateau" phase. Figure 5 demonstrates diagram of the systems with the VPA parameters, which can be normal (B), elevated (A), or decreased (C).

The VR parameter is calculated according to the formula:

$$\mathbf{VR_i = 0.9\ k_i \frac{I_{max}}{t_{0.9}}},$$

where $\mathbf{VR_i}$ – vegetative reactivity parameter; $\mathbf{I_{max}}$ – current strength for reaching the "plateau"; $\mathbf{t_{0.9}}$ – time, during which the current strength increased to 0.9 x $I_{max}$; $\mathbf{k_i}$ – segmentary level factor.

Figure 6 demonstrates diagrams of the systems with a normal VPA parameter, but with different VR), which can be normal (B), elevated (A), or decreased (C).

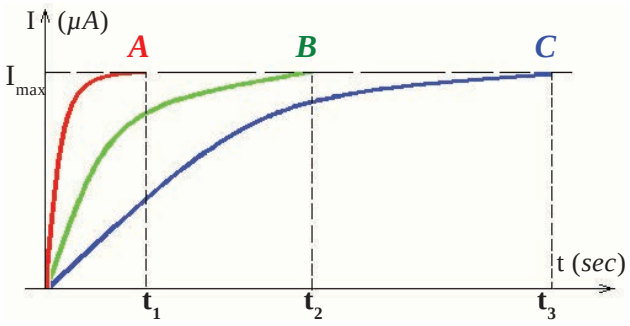


**Figure 6.** *Various changes of vegetative reactivity parameter during DSD-testing.*
A - *Elevated VPA parameter;*
B - *Conventionally normal VPA parameter;*
C - *Decreased VPA parameter;.*
$I_{max}$ *– conventionally normal VPA parameter.*

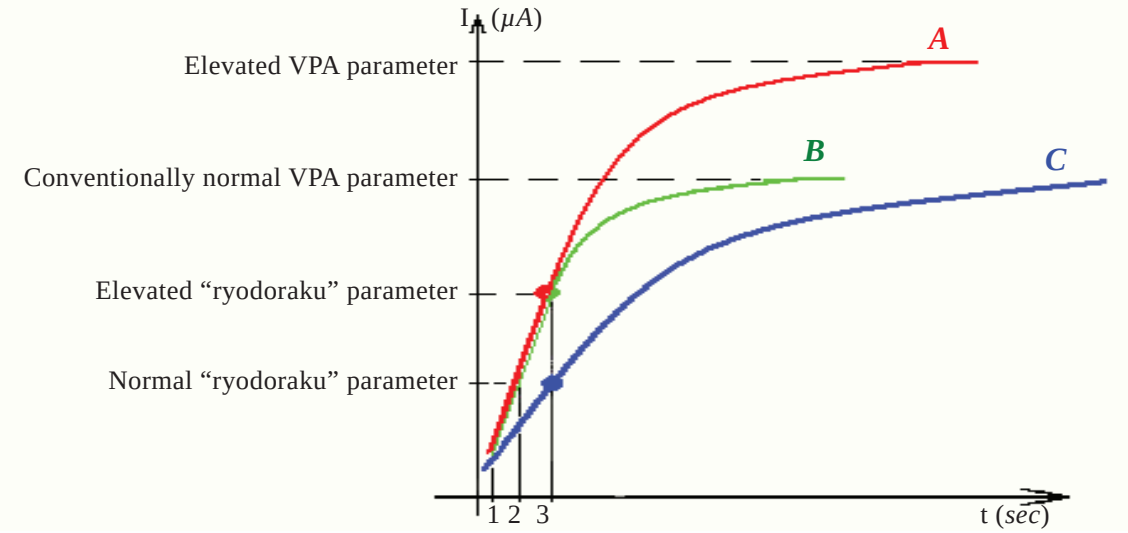


**Figure 7.** *Variants of interpretation of an elevated "ryodoraku" parameter.*

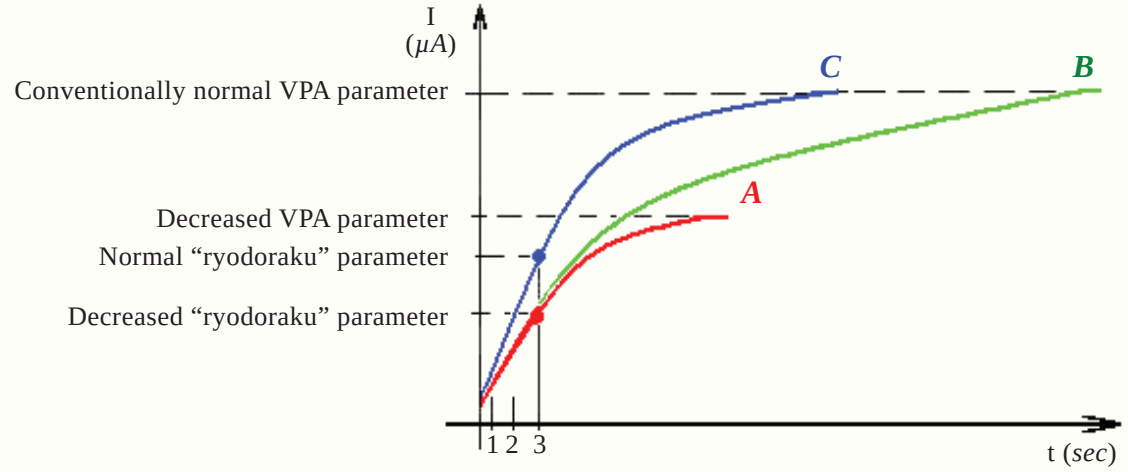


**Figure 8.** *Interpretation variants of a decreased "ryodoraku" parameter.*

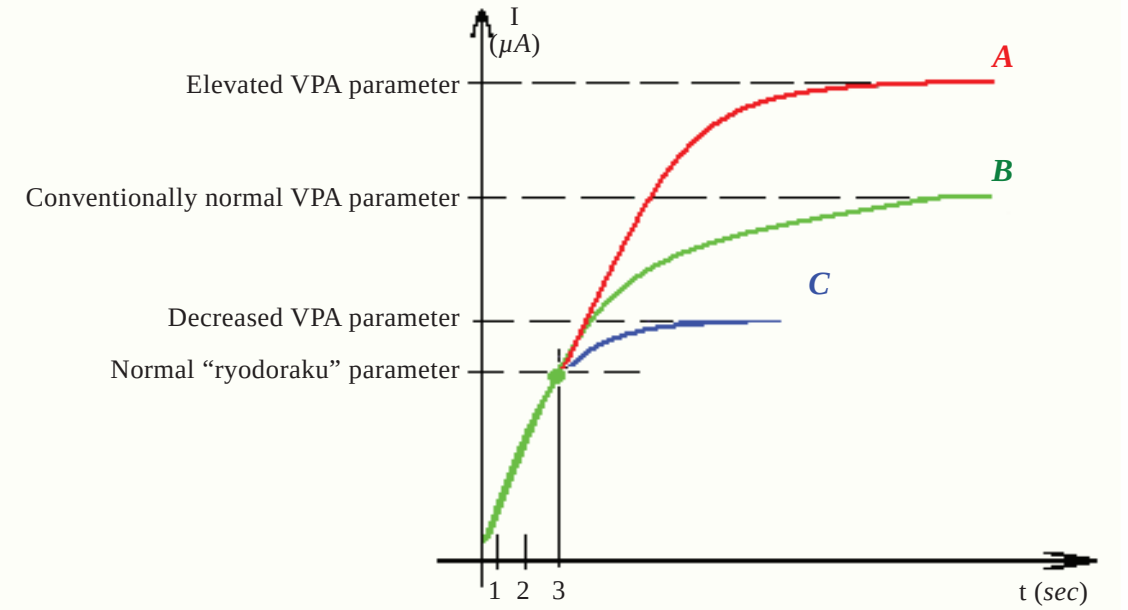


**Figure 9.** *Interpretation variants of a normal "ryodoraku" parameter.*

Thus, using the results of dynamic segmentary diagnostics the physician can obtain objective data about vegetotrophic regulation of MFSs and of the whole body in general. Moreover, DSD-testing avoids the main drawbacks of the "ryodoraku" test, which are as follows.

In the first place, when the investigator measures an elevated electroconductivity parameter by Nakatani's method, he/she cannot determine, what has caused such an elevation of skin electroconductivity and cannot decide, whether the MFS is overloaded and requires an elevated vegetative provision (Figure 7 A), or whether the system simply has an elevated vegetative reactivity (Figure 7 B).

In the second place, when the investigator obtains a decreased parameter in the "ryodoraku" test, he/she cannot determine, what has caused such a reduction of skin electroconductivity and cannot decide, whether the MFS is really depressed and the parameter of vegetative provision of MFS activities is decreased (Figure 8 A), or whether merely the vegetative reactivity of the system is reduced (Figure 8 B).

In the third place, when the investigator obtains a normal parameter in the "ryodoraku" test, he/she cannot foresee, how this parameter will behave at further irritation of skin receptors. The investigator does not know, whether this parameter will further increase and then stabilize at some normal values (then the vegetotrophic provision of the system is normal – Figure 9 C), or whether after a normal answer to low-intensity irritation the segmentary neuron group will be exhausted by further irritation (Figure 9 B) or, on the contrary, extremely excited (Figure 9 A). In this case the electroconductivity parameter on the plateau phase will be abnormal pointing to an obscure or compensated pathology of the given MFS.

In conclusion, if we compare two main trends of diagnostic search based on electrical parameters of the skin such as electropunctural diagnostics and SNFD, it can be stated that the latter can be used to test the activity of the human channel system. Moreover, among the varieties of the SNFD the dynamic variety or the dynamic segmentary diagnostics is the most reliable and informative method.

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