

# Application of Electrophoton Capture (EPC) Analysis Based on Gas Discharge Visualization (GDV) Technique in Medicine: A Systematic Review

Konstantin G. Korotkov, Ph.D.,<sup>1</sup> Peter Matravers, Pharm.D.,<sup>2</sup>  
Dmitry V. Orlov, M.S.,<sup>1</sup> and Bernard O. Williams, Ph.D.<sup>3</sup>

## Abstract

**Objectives:** The objective of this study was to evaluate the scale and scope of implementing electrophoton capture (EPC) analysis based on gas discharge visualization (GDV) technique in diverse medical applications and psychophysiology; to identify the range of applications in medicine; and to show in which areas the procedure can be useful to health professionals.

**Design:** The design of the study is a systematic review.

**Methods:** The database included articles published in peer-reviewed journals, proceedings of the international scientific congress “Science, Information, Spirit” (2003–2007), articles from the International Union of Medical and Applied Bioelectrography database, and proceedings of other conferences devoted to EPC or GDV, bioelectrography, and biophotonics. Search restrictions were human subjects, English or Russian language, and publication date from 2003 to 2007. All randomized controlled studies (RCTs) and systematic research reports (SRRs) were evaluated using Scottish Intercollegiate Guidelines Network and Jadad checklists.

**Results:** The search yielded 136 articles addressing four different fields of medical and psychophysiological applications of EPC (GDV). Among them were 26 SRR, 19 RCT, 18 case reports or case series, and 13 cohort studies. Thirteen (13) RCTs and 19 SRRs were rated “high” on the two conventional checklists.

**Conclusions:** (1) The software and equipment EPC/GDV-complex is a convenient and easy-to-use device, easily allows examining patients with various pathologies and, therefore, offers a wide range of applications. (2) The GDV method has shown itself to be very fast (i.e., it is an “express-method” for studying states of the human organism). (3) Our review has revealed that GDV method can be implemented as an express method for assessment of treatment procedure effectiveness, evaluating emotional and physical conditions of people, and in many other fields.

## Introduction

THE GAS DISCHARGE VISUALIZATION (GDV) camera is based on the well-known Kirlian effect<sup>1</sup> and utilizes modern optics, electronics, and computer processing for analyzing weak photon emission from diverse subjects stimulated by a pulsed electromagnetic field. The first GDV camera was made in 1995. Since that time, the Russian company Kirliionics Technologies International (KTI) has produced hundreds of such cameras and developed new designs. There are various different types of devices based on GDV technique currently available from KTI. GDV cameras are being used in

63 countries around the world. The GDV/electrophoton capture (EPC) method can be judged as an express method because it takes only 1–5 minutes to take images of 10 fingers, around 1 minute to calculate parameters of GDV images, and not more than 15 minutes to display and interpret obtained results.

The GDV-camera has a Russian Certificate of Conformance as a medical device.

The name electrophoton capture (EPC) has appeared only recently, to describe the technique more directly. This technique is becoming very popular in alternative medicine and in a wide range of scientific applications (e.g., research on

<sup>1</sup>Saint-Petersburg State University of Information Technologies, Mechanics and Optics, St. Petersburg, Russia.

<sup>2</sup>Aveda Co., Blaine, MN.

<sup>3</sup>Energy Medicine University, Sausalito, CA.

TABLE 1. SIGN CHECKLIST

Section 1: Internal validity <sup>a</sup>	
1.1	Study addresses appropriate, clearly focused question.
1.2	Treatment group assignment is randomized.
1.3	Adequate concealment method is used.
1.4	Subjects and investigators are kept “blind” about treatment allocation.
1.5	Treatment and control groups are similar at the start of the trial.
1.6	Only difference between groups is the treatment under investigation.
1.7	Outcomes are measured in a standard, valid, and reliable way.
1.8	What percentage of subjects in each treatment arm dropped out before the study was completed? (record %)
1.9	All subjects are analyzed in the groups to which they were randomly allocated (intention-to-treat analysis).
1.10	Where the study is multisite, results are comparable for all sites.

Section 2: Overall assessment<sup>b</sup>

How well was the study done to minimize bias? How valid is the study? *code* +, *n*, or -.

<sup>a</sup>Each item in Section 1 is to be evaluated using these criteria: Well-covered; adequately addressed; poorly addressed; not addressed (i.e., not mentioned, or indicates that this aspect was ignored); not reported (i.e., mentioned, but insufficient detail to allow assessment); and/or not applicable.

<sup>b</sup>The overall assessment uses the following ratings: +, Strong. All or more of the criteria have been fulfilled; *n*, Paper is neither exceptionally strong nor exceptionally weak; -, Weak. Few or no criteria fulfilled.

SIGN, Scottish Intercollegiate Guidelines Network.

water, various materials, diverse research in agriculture and biology, etc.).<sup>2-8</sup> Simultaneously with these applications, the EPC technique has also been used in conventional medicine and in psychophysiologic applications. This systematic review examines applications of EPC in conventional and alternative medicine, and psychophysiologic practice.

TABLE 2. JADAD SCALE<sup>a</sup>

	Yes	No
Study was described as randomized.	1	0
Study was described as double-blinded.	1	0
Description of withdrawals and dropouts was provided.	1	0
Methods to generate the sequence of randomization were described and were appropriate.	1	0
Methods to generate the sequence of randomization were described and were inappropriate.	-1	0
Methods of double blinding were described and were appropriate.	1	0
Methods of double blinding were described and were inappropriate.	-1	0

<sup>a</sup>Scoring: 0-2 = low quality; 3-5 = high quality. From reference 10.

This medical technique offers the following advantages:

- screening evaluation of the psychophysiologic state and functional activity of an individual;
- noninvasiveness, safety, and complete sterility of the technique;
- assessment of anxiety and stress levels;
- quantitative information on the energy homeostasis level, both for the organism as a whole and for specific functional systems;
- monitoring an individual’s reaction to various treatment procedures, allopathic and homeopathic medicines, and mild or subtle informational influences;
- possibility of tracking the evolution of various processes in time and comparing structural, functional, and time processes that take place in the organism;
- objective information, independent from the preferences and experience of the user;
- simplicity and convenience: absence of any particular requirements for the room, the environmental conditions, or the qualification of the personnel; during the investigation of an individual’s state, measurements are taken only from the fingers and toes;
- clear and easily interpreted results, easy data storage and processing;
- relatively low cost of the equipment and procedures.

This review shows that the advantages listed are serious considerations when choosing medical techniques. The GDV technique is becoming widespread in alternative and conventional medicine.

**Materials and Methods**

*Article selection*

The literature search yielded 136 sources published in peer-reviewed journal articles, theses, monographs, study aids, and proceedings of scientific conferences during the years 2003–2008, each using the GDV method in medicobiological and psychophysiologic investigations.

Many doctors and researchers who use GDV cameras or EPC technology in their work are united in the International Union of Medical and Applied Bioelectrography (IUMAB). IUMAB has organized an annual conference called “Science, Information, Spirit,” held in Saint-Petersburg, Russia, since

TABLE 3. SUMMARY OF PAPERS

Field of study and reference	Type of paper						
	RCT	SRR	CO	Other <sup>a</sup>	CS	CR	Total
Total:	19	26	13	3	13	5	79
Clinical studies <sup>11-42</sup>	10	11	6	1	1	3	32
Psychophysiology <sup>43-60</sup>	4	7	3	1	2	1	18
Alternative medicine <sup>2,61-78</sup>	5	2	4	1	6	1	19
Research <sup>79-88</sup>	0	6	0	0	4	0	10

<sup>a</sup>Includes pilot studies, quasi-experimental (nonrandomized) designs, single-group interventions, and other small experimental or pre-experimental designs.

RCT, randomized controlled trial; SRR, systematic research report; CO, cohort study; CS, case series; CR, case report.

TABLE 4. SUMMARY OF RCTs AND SRRs IN CLINICAL STUDIES

<i>Citation</i>	<i>Number of patients</i>	<i>Summary</i>
Alexandrova 2003 <sup>18</sup>	303 (247 with bronchial asthma, 56 healthy)	It is advised that GDV bioelectrography be used as a screening exam to subclass relative groups at risk of bronchial asthma development. This assists in prophylactically addressing these issues for bronchial asthma prior to acute exacerbations and to bring them under clinical control. Serial application of the GDV technique for the monitoring of the patient's functional systems during the process of treatment and rehabilitation can be valuable in correlating the energetic influence of medications and treatments, both standard and complementary, and in earmarking patients where prophylaxis against potential side-effects of various therapies can be realized. Clinical observations with GDV-bioelectrography when people have vegetative instability resulted in considerable asymmetry of parameters' values for the left and right hands; these data can infer evidence of a decreased adaptation reserve of an individual's energy homeokinesis, and perhaps be viewed as predictive. Patterns of GDV-grams of fingers from patients with bronchial asthma correlate with known main pathogenic identifiers, giving evidence of the clinical usefulness and informativeness of bioelectrography and its complementary role in clinical medicine.
Alexandrova 2003 <sup>34</sup>	43 (ages 16–53; 23 ill, 20 healthy)	There are two EPC risk factors marking hypersensitivity to cosmetic substances with phytocomponents: high level of anxiety index and low values of integral square coefficient of bioelectrogram (GDV-gram). Patients with these initial changes in static bioelectrogram are advised to make dynamic GDV-gram measurements during contact with a cosmetic substance under investigation in a test tube, for preventive assessment of potential for allergic reaction risk (reaction from applying the preparation).
Alexandrova 2003 <sup>35</sup>	87 (30 with CVH, 25 with chole-lithiasis, 32 with PBD)	Obtained results make it possible to recommend using holeodoron in treatment of chronic viral hepatitis (CVH) and patients with cholelithiasis after cholecystectomy and primary biliary dyskinesia (PBD). Also, it is recommended to make corrections of choleresis dysfunction with homeopathic preparations under control of GDV bioelectrography method, which shows high sensitivity to changes of patient's state and reflects the normalization of bile passage, hepatic blood flow, and improving of patient's well-being during holeodoron therapy.
Bolehan 2006 <sup>36</sup>	30 (ages 17–22)	Comparisons between serum GDV parameters of patients and clinical-laboratory data from medical reports show correlation and some dependence between them. These results can be used in further GDV method implementations for investigation of infectious pathologies.
Gagua 2004 <sup>27</sup>	347 (249 ill, 98 in control group)	GDV technique presents objective measures for evaluation of cancer state and monitoring of the patient's condition after treatment. Method is easy for application, noninvasive, objective, and cheap. From several years of experience, a good potential for the development of method of early evaluation of the probability of potential cancer is clearly seen. This approach should be based on computer data-mining multiparametric comparison with database of nosological cases.
Gimbut 2004 <sup>12</sup>	20 (ages 18–26)	Rising tendency of imbalance factor of uterus sector in the GDV-gram of the right hand in the first phase of the cycle is reflected on the state of conjugated acupuncture points and zones, which can be registered by the means of GDV. Small sample size did not identify the essential connection between lateral behavior phenotype and imbalance factor parameters.
Gagua 2006 <sup>26</sup>	347 (109 with lung cancer, 140 women breast cancer, 98 in control group)	Statistical analysis of large amount of obtained experimental data that were gathered during a long period of time showed significant differences between parameters of GDV-grams of healthy people and patients with breast or lung cancer. After treatment procedures of patients with cancer there was registered convergence tendency between ill and healthy peoples' GDV parameters. It was found that GDV parameters of little finger's GDV-grams are most representative for this kind of nosology, which in turn correlates with ideas of traditional Oriental medicine about meridians, situated on people's fingers.

(continued)

TABLE 4. (CONTINUED)

Citation	Number of patients	Summary
Gedevanishvili 2004 <sup>16</sup>	57 (22 with lung cancer, 35 with breast cancer)	GDV monitoring is optimal for estimation of patient's organism conditions during radiotherapy of breast and lung cancer. GDV allows describing energy-entropy condition, which is similar to functional state of organism as a whole and its organs and systems and monitor changes of this state <i>in vitro</i> and <i>in vivo</i> . Combination of classic and traditional medical approaches allows us to describe human organism as a whole.
Gimbut 2004 <sup>12</sup>	20 (ages 18–26)	Rising tendency of imbalance factor of uterus sector in the GDV-gram of the right hand in the first phase of the cycle is reflected on the state of conjugated acupuncture points and zones, which can be registered by the means of GDV. Small sample size did not identify the essential connection between lateral behavior phenotype and imbalance factor parameters.
Gimbut 2004 <sup>22</sup>	226 (pregnant women)	The developed modification of GDV technique demonstrated an informative and stable GDV parameter—the coefficient of disbalance (CD). The coefficient of disbalance for acupuncture points associated with the uterus is a highly specific and highly sensitive indicator for the course of pregnancy: (1) regardless of the period of gestation, stably low CD GDV parameters correspond to the normal course of pregnancy—the coefficient of disbalance tends to zero for both hands; (2) when the parameters of utero- and fetoplacental blood flow deviate from the normative values, the CD reliably increases for one hand; (3) under the danger of miscarriage, regardless of the period of gestation, the CD is higher for both hands as compared to the norm; (4) the stimulation of EP-147 point under the danger of miscarriage, simultaneously with the normalization of parameters of uterine blood flow, leads to reliable decrease of the CD down to the normal values. There exists an inversely proportional correlation between the CD of acupuncture points associated with the uterus and the intensity of gestational dominant. Low values of the CD correspond to the manifested characteristics of the gestational dominant; the CD parameters are reliably higher when the gestational dominant weakens.
Kolkin 2006 <sup>32</sup>	107 (ages 18–62; 65 men, 42 women)	The deviations of GDV-grams of the fingers revealed during some pathologic processes do not always correspond to the borders of the sectors tentatively projected to particular organs or systems and quite often extend beyond these sector boundaries. For deviations showing postoperative period increases, the majority of patients demonstrated disappearance of pathologic marks and restoration of integrity and saturation of energy field patterns.
Korotkov 2003 <sup>24</sup>	96 (ages 30–71; 33 men, 63 women)	There are reliable differences between parameters of GDV-grams of practically healthy people and patients with chronic abdominal surgical pathology. GDV parameters are connected with the functional status of the organism and reflect the severity of the somatic state of patients with abdominal surgical pathology. The parameters of GDV-grams reliably change in response to the operative trauma, and their dynamics depend on the severity of the somatic state of the patient, which allows using the technique for functional monitoring of patients in a postoperative period, as well as for the assessment of the operative stress. The GDV technique is most appropriate for dynamic assessment of the functional state of a patient in the perioperative period. Not all the fingers need to be used, but only one finger of each hand, for example, the fourth finger, where the GDV changes are the most significant.
Krashenuk 2006 <sup>38</sup>	21	Systematic action of hirudotherapy harmonizes functioning of regulative processes in the autonomic nervous system. Therapeutic effects of hirudotherapy were clearly confirmed by the use of monitoring and GDV signals analysis, and also confirmed by nonlinear, fractal and specific analysis of HRV.
Kupeev 2006 <sup>31</sup>	73 (ages 37–83; 31 men, 42 women)	GDV method can be used as an express method for assessing treatment procedure effectiveness and persistence of acquired positive changes in organisms. GDV technique is quite sensitive and can detect changes in a few minutes.

(continued)

TABLE 4. (CONTINUED)

<i>Citation</i>	<i>Number of patients</i>	<i>Summary</i>
Mamedov 2006 <sup>30</sup>	More than 300	During research from 2002 on the development of optimal filtration methods of obtained signals, comparative assessment of GDV data with data, gathered using ultrasonic methods, there were revealed several regularities (laws) in distribution and character of lightning on GDV-grams. These regularities (laws) are identical to the changes in organs and organism's systems of patients that were in turn validated basing on clinical presentation, and data from instrumental and non-instrumental diagnostic methods. Further investigations showed that changes in human's musculoskeletal and bronchi-pulmonary systems identified by GDV method coincide with changes registered by roentgenologic methods. Diagnostic analysis was based on proven blind control method (data from GDV analysis was compared with the results of clinical trials that were made after the conclusion based on GDV data). Pathologies registered by GDV method were confirmed by traditional methods in 75–80% of cases. Therefore practical harmlessness, safety, objectivity and accuracy of musculoskeletal and bronchi-pulmonary systems' pathology detection, and rapidness of diagnostic process (10–15 minutes) allow to conclude that GDV method can be judged as an express-method of diagnostics on pre-clinical stage.
Olalde 2004 <sup>42</sup>	109 (40–90 ages, 65 female, 54 male)	A Retrospective, Multicentric, Descriptive, and Comparative Study based on data collected in the Adaptogen Medical Centers (CMA) of La Trinidad and Sabana Grande, Caracas, Venezuela. Patients' bioelectric field photographs were stored in a data base. Under the study were subjects who suffered diabetes with foot amputation risk. It was demonstrated that a low level of functional energy reserves corresponds to chronic pathology. Clinical improvement in the patient with System Medicine approach was associated with an increase in total bioelectric field area. From this, we can infer that the functional energy reserve is an important indicator of the general condition of the patient. In effect, there exists a correlation between the variation of the GDV image and the clinical evolution of the patient whose functional energy reserves are affected. Normalization in the area corresponds to an improvement of the clinical manifestations of patients with chronic diseases.
Polushin 2003 <sup>11</sup>	131 (35 healthy, 96 patients with chronic surgical pathology)	GDV technique is a perspective method for anaesthesiology and reanimatology. The GDV can be applied for the assessment of functional status of patients in a perioperative period, as well as for the determination of adequacy of response of the organism to a surgical trauma. A possibility of using GDV technique for the prognosis of development of complications in the early postoperative period was shown by the example of acute postoperative pancreatitis. The disclosed dependence of GDV-gram parameters on the age indicates that the normative range for GDV-gram parameters for different age categories shall be determined.
Polushin 2004 <sup>19</sup>	150 (35 healthy)	The decrease of GDV-gram parameters of patients with the most severe somatic state is conditioned by low functional reserves of their organism. The parameters of "dynamic" gas discharge images correlate with the assessment of anxiety by the Spielberger-Khanin scale, which enables using the GDV technique for objective assessment of anxiety for patients before surgical operations. The GDV technique can monitor the functional state of patients in a postoperative period. The GDV is a perspective technique for anesthesiology and reanimatology, providing functional examination of patients and monitoring their states in the perioperative period.
Polushin 2004 <sup>21</sup>	96 (63 women, 33 men)	GDV parameters demonstrated pronounced dynamics with age in the majority of cases. The most significant changes in bioenergy homeostasis take place in an early postoperative period (within the first day). A reliable increase appeared for all GDV-gram parameters, in comparison with the initial levels measured the day before the operation. Most of the GDV parameters restored within 2–3 days, and some within 3–4 days, for patients who had undergone extensive surgeries.

(continued)

TABLE 4. (CONTINUED)

Citation	Number of patients	Summary
Strukov 2003 <sup>25</sup>	94	Dependence demonstrated between GDV-gram parameters and the types of surgical interventions, sex and age of the patients. Developed informational parameters of GDV-grams should support production of software packages that can provide automatic express-evaluation of patients' functional state during pre- and post-operative periods.
Tumanova 2007 <sup>41</sup>	300	Comparative studies of GDV method and traditional clinical diagnostic methods (blood studies, ultrasonic studies, neurophysiological studies, electrophysiological studies, etc.) were made. There were two kinds of studies: 1 - GDV analysis, then traditional clinical methods and consecutive comparison; 2 - GDV analysis of patients with fixed diagnosis. Comparative analysis of GDV data has showed very high percentage of coincidence with clinical diagnostic methods (79–94% in different groups) in prognosis and early diagnosis of pre-clinical states (pre-illness) and proved that GDV method is more informative (more than twice) than clinical diagnostic methods. All these results state that GDV bioelectrography should be used in different applications in preventive medicine.
Verpkhivadze 2003 <sup>28</sup>	209	60 practically healthy people; with lung cancer and 93 people with flat-cell lung cancer; 56 with pneumonectomy; both before the treatment and in different stages after surgery. All subjects were diagnosed with cancer with conventional means including biopsy; GDV measures were taken from 10 fingers of both hands before any oncology treatment and 2 and 6 weeks after complex treatment including surgery, chemotherapy and irradiation. Blind study design. Statistically significant difference between GDV parameters of oncology patients and non-oncology groups was found for all studied cases. After treatment statistical trend of GDV parameters towards healthy population parameters was revealed. Conclusions: GDV Technique presents objective measures for evaluation of cancer state and monitoring of the patient's condition after treatment. Method is easy for application, non-invasive, objective and cheap. From several years of experience a good potential for the development of method of early evaluation of the probability of potential cancer is clearly seen. This approach should be based on computer data-mining multiparametric comparison with Database of nosological cases.

RCT, randomized controlled trial; SRR, systematic research report; GDV, gas discharge visualization; HRV, heart rate variability; EPC, electrophoton capture; CVH, chronic viral hepatitis; PBD, primary biliary dyskinesia.

1995. Proceedings from this conference provided an initial base for the literature search. Articles related to application of EPC in medicine were also included from proceedings of international scientific conferences such as "Measuring energy fields," "Measuring the human energy field: State of the science," and some other sources directly related to the EPC (GDV) technology.

Search restrictions were human subjects, English or Russian language, and publication date from 2003 till 2008 (the last 5 years).

From all of the articles that were found, we selected only those related to medicine and psychology. Articles were also excluded if they did not present original data or an analysis of original data (excluding commentaries, editorials, or expert opinion pieces), or if they were descriptive surveys.

#### Evaluation procedures

Articles were classified by the first author as follows:

- Randomized controlled trial (RCT): studies using random assignment to treatment group and making between-group comparisons of an intervention and a

comparison treatment to evaluate efficacy. This includes studies using placebo or sham comparison groups as well as those using comparisons of different treatments.

- Systematic research report: articles that correspond to and observe some research over a long period of time by one group in a concrete field of study.
- Cohort and case control: large observational studies examining risk factors or prognostic factors.
- Other controlled studies:
- pilot studies: small randomized or nonrandomized studies for the explicit purpose of developing protocols or feasibility, not evaluating efficacy; or studies that were defined by their authors as "pilot studies";
- quasi-experimental: nonrandomized studies with two or more treatment groups;
- single group interventions: pre-experimental studies performed under controlled conditions;
- other small experimental studies of various designs.
- Case series: articles reporting more than 2 cases observed in clinical practice.
- Case reports: articles reporting 1–2 cases observed in clinical practice.

TABLE 5. SUMMARY OF RCTs AND SRRs IN PSYCHOPHYSIOLOGIC FIELD OF STUDY

<i>Citation</i>	<i>Number of patients</i>	<i>Summary</i>
Bundzen 2003 <sup>58</sup>	39 (age 16)	Basic and integral parameters of optoelectronic emission correlates with humoral–metabolic and reflex regulation processes on the level of the vegetative nervous system. Increase in activity of central (neurohumoral) part of autoregulative mechanisms corresponds with power increase in the optoelectronic emission processes, increase of stress tolerance parameters, and an overall functional index, and corresponds with decrease in an index of energetic deficiency.
Dobson 2007 <sup>54</sup>	75 (age 35)	Significant relationships between GDV parameters and State anxiety and less significant relationships with Trait anxiety and Neuroticism. Significant relationships are also found for the personality dimensions of Openness and Agreeableness.
Gursky 2006 <sup>57</sup>	328	Strong correlation between the GDV parameters and the diagnostic parameter measuring functional reserve capacity of a patient. This correlation has been revealed at its largest value for the filtered measures of GDV parameters on the left hand. The parameter “Number of fragments” shows large differences between ill and healthy patients at 6 of 10 fingers in the skin disease group.
Korotkova 2006 <sup>51</sup>	275 (ages 16.5–26.3, sportsmen)	GDV bioelectrography method allows screening examination of sportsmen and their level of preparedness between the competitions. GDV-gram patterns of right and left hands correlate with parameters of psycho-emotional state and psychophysiological readiness for sports competitions. The EPC technique provides reliable characterization of the energetic state of sportsman at the moment of examination.
Lovygina 2005 <sup>55</sup>	60 (ages 18–23)	Comparative study was made: Data obtained by heart rate variability (HRV) analysis was compared with the GDV results. Statistical correlations between central mechanisms of heart regulation and GDV area parameter were found. Strong correlations between GDV parameters and results of other methods were also obtained.
Mamedov 2005 <sup>44</sup>	>700	Changes in organs and systems in men registered by the GDV method coincide in 60%–90% of cases with changes registered by conventional diagnosis methods, and do not contradict the results obtained by other researchers. Pathology initially detected by the means of GDV technique was confirmed afterwards by conventional methods in 60%–70% of cases.
O’Keeffe 2006 <sup>60</sup>	97	Excessively high level of the GDV parameter Entropy can indicate mental disorders (e.g., schizophrenia, etc.). If the level of GDV entropy is excessively low, it points to the prospect that this individual may be “running out of options” and he is in danger of “burning out.”
Priyatkin 2006 <sup>50</sup>	17 (ages 17–60, woman)	GDV method is capable of registering influence of odorants on humans. Developed procedure of investigations can be judged as an instrument for registering influence of environment on human’s state. Dynamics of GDV images in the moment of presenting some odorant (or stimulus) are connected to changes of psycho-emotional state of a person under investigation, and situational psychologic state of a person has an influence on the overall result.
Senkin 2004 <sup>53</sup>	64 (35 average age)	Fighting aircraft pilots participated in the research on the tolerance to radial acceleration up to 6 g, performed according to the standard scheme. It was found that the most informative GDV bioelectrographic criterion of tolerance is the relative value of dynamics of image areas of the right and left hands, obtained during background and control examination. It was found that the sensitivity of bioelectrographic approach makes up 86%; specificity—82%; prognostic value of positive and negative results—38% and 98%, respectively; ratio of likelihood of positive result of bioelectrographic approach—4.9; ratio of likelihood of negative result—0.17; and accuracy—83%. Thus, the prognostically significant bioelectrographic correlates of individual stability to pilot overloads, found in the present research, enable assessment of functional capabilities of organism of the pilot, his training in the effect of overloads, and the level of functional reserves.
Senkin 2006 <sup>46</sup>	45	During research there were found several GDV parameters that strongly correlate with traditional methods of functional diagnosis. Correlations between tolerance to stress and some GDV parameters were revealed. GDV bioelectrography shows high informativeness and can be implemented as complementary and independent express method of analysis of functional state of a pilot team, as a monitoring method and for assessment of functional capabilities of human organism.
Sergeev 2004 <sup>45</sup>	>600	The GDV method can assess general improvement of an emotional condition, and removal of emotional and nervous excitation and tension during short-term rehabilitation procedures.

RCT, randomized controlled trial; SRR, systematic research report; GDV, gas discharge visualization; EPC, electrophoton capturing (new name of GDV technique).

TABLE 6. SUMMARY OF RCTs AND SRRs IN ALTERNATIVE MEDICINE FIELD OF STUDY

<i>Citation</i>	<i>Number of patients</i>	<i>Summary</i>
Bell 2003 <sup>2</sup>		GDV method is capable of differentiating ultramolecular doses of homeopathic remedies from solvent controls and from each other. GDV technology may provide an electromagnetic probe into the properties of homeopathic remedies as distinguished from solvent controls. However, the present findings also highlight the need for additional research to evaluate factors that may affect reproducibility of results.
Bulanova 2006 <sup>69</sup>	21 (17–18 ages)	Entropy changes were studied in people being exposed to rays in small doses using a GDV method. After a fluorography method in a group of people consisting of 21 persons, 13 of them had a rise of organism entropy, 7 people had entropy reduction, and 1 person did not have any changes. The entropy reduction shows that it is possible to process the information with the help of organism systems. The neural organism reaction on the exposure is realized when a negative feedback is activated. The feedback provides stability of organism characteristics under the influence of external factors. The rise of entropy (reduction of free energy stocks) in a number of examined people indicates and shows the rise of chaos in organism systems in the postradiation period because of the surplus of received signal information.
Bykov 2006 <sup>70</sup>	56 (6–9 ages, children)	The aim of the work was to evaluate the efficiency of using laser therapy on fields and biologically active points under a complex of sanatorium-and-spa treatment for children's diseases of upper air passages based on parametric dynamics of GDV bioelectrography combined with clinical and functional methods of research. The achieved data correlate with figures of cardiointervalogram (neurohumoral activity spectre increase), with nonspecific adaptive responses according to Garkavi L.Kh., Kvakina E.B., Ukolova M.A., and is the evidence of stabilization of the energo-informatic state of organism, formation of long-term adaptation, and allows use of indices of GDV bioelectrography as a method characterizing adaptive mechanisms against a background of sanatorium-and-spa treatment. Thus, the research carried out allows recommendation of GDV bioelectrography as a method of complex diagnostics of an organism's functional state, characterizing alteration of adaptive mechanisms against a background of rehabilitation treatment. Use of the method enables correct choice of strategy and tactics of rehabilitation, taking into consideration individual organism peculiarities.
Roberts 2004 <sup>66</sup>	33 (randomly chosen)	The GDV device is thought to work by interacting with the bio-energy field that surrounds the body and captures an aspect of it on video for diagnostic evaluation. The GDV device is able to reliably measure the changes in the electromagnetic field of the body as a result of an interventional therapy (i.e., acupuncture stimulation), and will perhaps be helpful in evaluating the efficacy of other therapies, thus eventually reducing costs, and improving the results of the applied therapy by customizing it to the individual patient's response. Also, because stress is a potent contributor to many of the conditions that affect health, such powerful measurement systems are invaluable tools for gathering and interpreting stress-related information as a preventative medicine tool. The GDV device, as seen by the results of this study, can be used to conduct a comprehensive meridian stress assessment and to determine appropriate ways to achieve healthy energetic balance.
Tumanova 2007 <sup>78</sup>	134	Experiments revealed the priority role of GDV bioelectrography and therapy in complex treatment of different eye diseases (connected with different pathologies such as pancreatic diabetes, atherosclerosis, hypertension, etc.). Systemic complex of color-magnetic influences on organism was chosen based on results of GDV bioelectrography. It is clear that multimodal methods of rehabilitation of patients with chronic eye diseases should be realized in sanatoria and health resorts practice.
Voeikov 2004 <sup>62</sup>	15	A proposed complex of diagnosis criteria using multiple diagnostic approaches can evaluate the organisms' response to therapy and assess the appropriateness of using different therapeutic influences. Using the GDV method in addition to other diagnostic approaches substantially simplifies (and speeds up) goal achievement, creating an individualized rehabilitation program and preventive recommendations.
Volkov 2005 <sup>63</sup>	177	Classification of new patients by using a statistical model of GDV parameters coincided with the conventional classifications with an accuracy of 80%. Most information about the diseases in this experiment was derived from the finger sector $-45^{\circ}$ to $45^{\circ}$ .

RCT, randomized controlled trial; SRR, systematic research report; GDV, gas discharge visualization.



### Quality rating

The examination of the discovered data determined the range of issues to be discussed:

- search for data with scientific foundations;
- decision-making concerning the inclusion of certain data into the meta-analysis;
- description of the characteristics of the original articles;
- results obtained in each article;
- analysis of the obtained data.

RCT and systematic research report (SRR) articles were evaluated for quality using the Scottish Intercollegiate Guidelines Network (SIGN) and Jadad checklists.<sup>9,10</sup> The SIGN checklist rates studies as high quality (+), low quality (-), or neutral (0) (Table 1). Three (3) coauthors independently rated each study. Differences in opinions and rates were resolved by discussion. The Jadad scale rates studies on a scale of 0–5 (Table 2).

### Results

The search yielded a total of 136 articles. Applying the exclusion criteria reduced the collection to 79 papers. Table 3 summarizes the literature by field of study and type of article. Thirteen (13) of 19 RCTs and 19 of 26 SRRs were rated high in both standard checklists.

We have chosen two groups of articles to show the evidence of efficiency of the EPC/GDV method application in the four fields of studies listed in Table 3, because they represent the most extensive studies. These are the systematic research reports or articles (SRR) and randomized controlled studies (RCT). These types of articles were chosen because they present results of systematic studies of some group of scientists in one exact medical case, studies that are being carried out for a long period of time, and at the present moment are the most serious, professional, and describe science-based experiments.

Tables 4–6 give the summaries of these articles with the number of patients involved in each study.

### Clinical studies

Considering the results of all studies listed below, we can conclude that the GDV method or EPC technique can be used in diverse applications in conventional medicine (e.g., preventive assessment of allergic reaction risk, investigation of infectious pathologies, detecting different pathologic processes, anesthesiology and reanimatology, assessment of hirudotherapy effects, monitoring the functional state of patients in postoperative period, and others). The GDV method has shown that it can be implemented as an express method for assessments of treatment procedure effectiveness.

### Psychophysiology

Results in the psychophysiological field of study show many different significant correlations between psychophysiological parameters and parameters of GDV-grams (i.e., processes in the autonomic nervous system, anxiety, neuroticism, functional reserve capacity, emotional and nervous excitation). These results show that the GDV method is a very useful and quick (express) technique for evaluating emotional and physical conditions in human beings.

### Alternative medicine

In alternative medicine, the GDV technique can be used as an express method for evaluating impact from various treatment procedures. Numerous correlations were found during this research between GDV parameters and the patients' states after treatment procedures.

### Research

This field of study shows that the GDV method can be applied almost everywhere humans are and in whatever they do. Examples given in these articles show that such human activities as polar expeditions, alcohol drinking, listening to music, focused meditation, and so on are not exceptions from the large field of applications of the EPC technique, and that there are significant correlations in these fields.

### Discussion

There are several limitations to this study. First, the number of studies based on EPC/GDV technique in medicine and psychophysiology is relatively small. The number of all studies based on the GDV technique is not large, because this technique is comparatively young in the scientific world. Our literature search was limited to Russian and English articles. It is possible that some studies were missed because they were not presented during the last 5 years. Despite its young age, the EPC/GDV technique shows very good results in the surveyed fields of study and becomes increasingly popular every year. Another limitation is the possibility of bias in evaluating the studies. We attempted to avoid this bias by using accepted checklists.

### Conclusions

We have made several conclusions regarding EPC analysis based on the GDV technique in conventional medicine, psychophysiology, alternative medicine, and research studies.

1. Systematic review has revealed that the EPC/GDV method is being used in many different applications in these fields of study and shows excellent or very good results.
2. Researchers have already found diverse correlations between EPC/GDV parameters and various medical, psychologic, and physiologic parameters in humans. Furthermore, they continue their research with an aim to find other correlations.
3. The software and equipment EPC/GDV-complex is a convenient and easy-to-use device, which allows examination of patients with various pathologies and, therefore, offers a wide range of applications. The GDV method has already shown itself to be an express method for evaluating the human organism's psychophysiological state.
4. The investigations showed that the GDV method delivers valuable diagnostic information on the functional state of patients, allows their state to be monitored, and constitutes a convenient and easy method for conducting preventive examinations of individuals, professional training, and control in various areas of application.

5. All RCTs and SRRs reviewed suggest the GDV method as a prospective and effective method for different nosological and psychophysiological applications and investigations.
6. There are no negative or undesirable characteristics identified for the GDV method in all reviewed articles. Also, there are no contraindications to application of the EPC technique.

### Acknowledgments

The authors thank all the abovementioned colleagues for presenting their results of many years of their research, and especially Roman Usubov and Guram Achmetely for preparing materials for this review.

### Disclosure Statement

The authors state that no competing financial interests exist.

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Address correspondence to:  
Konstantin G. Korotkov, Ph.D.  
Ligovski Prospect 56-E  
St. Petersburg 191040  
Russia

E-mail: [kk@korotkov.org](mailto:kk@korotkov.org)

