# ACUPUNCTURE IN MEDICINE

## Clinical utility of electrodermal activity at acupoints: a narrative review

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| Complete List of Authors: | Colbert, Agatha; National College of Natural Medicine, Helfgott Research Institute  
| | Spaulding, Keith; New England School of Acupuncture  
| | Ahn, Andrew; Martinos Center for Biomedical Imaging, Massachusetts General Hospital; Division of General Medicine and Primary Care, Beth Israel Deaconess Medical Center  
| | Cutro, Jan; Northeastern University, Physics |
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Clinical utility of electrodermal activity at acupoints: a narrative review

Agatha P. Colbert  
National College of Natural Medicine  
049 SW Porter Street, Portland, OR 97201, USA  
acolbert@ncnm.edu  
Telephone 503 552-1745  
Fax 503 227-3750

Keith P. Spaulding  
New England School of Acupuncture Newton, United States

Andrew C Ahn  
Martinos Center for Biomedical Imaging, Massachusetts General Hospital  
Charlestown, United States and  
Division of General Medicine and Primary Care, Beth Israel Deaconess Medical Center, Boston, United States

Janet A Cutro  
Northeastern University, Physics, Boston, United States

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Abstract

Objectives: To provide an in depth analysis of seven well-reported studies that examined electrodermal activity (EDA) at acupoints with regard to three commonly held tenets of acupuncture: 1) EDA at pathology-related acupoints is distinguishable from non-pathology related acupoints 2) EDA at acupoints can assist in diagnosing and monitoring therapeutic progress 3) EDA at acupoints is able to identify substances that are either therapeutically beneficial or toxic to an individual.

Methods: Seven of 29 studies that scored greater than 50% on their quality of reporting 54 essential technical and clinical details of EDA testing in human patients, were identified from a previous literature review. Fourteen categories of data were extracted from these seven studies for further discussion.

Results: Two studies compared EDA at pathology-related auricular acupoints to non-pathology-related sites. Two studies correlated EDA measurements at sites other than auricular acupuncture points with the presence of specific medical conditions. The final three studies assessed changes in EDA at acupuncture points at the finger and toe nailbeds when different substances were placed in the electrical circuit with the patient.

Conclusions: This review highlights the heterogeneity of approaches to EDA assessments and the discrepancies between a common clinical practice and the scientific evidence to support that practice. It also provides pilot data that suggests EDA testing at auricular acupoints may distinguish pathology-related acupoints from non-pathology-related points; decreased skin conductance correlates with tiredness or low energy; and EDA testing at the Jing-well acupoints, on the tips of the fingers and toes, may assist in monitoring effectiveness of acupuncture treatment. The evidence does not support the use of VEGA testing for allergic status.
Introduction

Four commonly held tenets among acupuncturists regarding electrodermal activity (EDA) at acupoints, are: 1) Acupoints have lower electrical resistance than surrounding skin\(^1\)-\(^4\) 2) Pathology-related acupoints are distinguishable from non-pathology related acupoints\(^5\) 3) Changes in electrical skin resistance or conductance at acupoints correlate with acupuncture treatments and with the persistence of, or recovery from, disease\(^6\) 4) Changes in EDA at acupoints occur when substances that are either therapeutically beneficial, or toxic to an individual, are placed in the electrical circuit with that individual\(^7\)-\(^8\). For more than 50 years, these widely held assumptions have formed the basis for the use of electrodermal devices in clinical practice, yet scientific studies to support these beliefs are sparse and methodologically diverse. The first tenet was comprehensively evaluated by Ahn et al in a recent systematic review\(^9\). This review found preliminary evidence to suggest that acupoints and meridians may be electrically distinguishable from non-acupoint and non-meridian tissue. The latter three tenets, however, have yet to be rigorously examined.

We recently critiqued the quality of reporting technical and clinical details in 29 studies of EDA at acupoints in human patients\(^10\). Seven of the 29 studies that scored greater than 50% in Quality of Reporting were selected for an in-depth analysis and further discussion in this narrative review. The objectives for this review are to summarise and appraise data supporting or challenging the clinical use of EDA testing at acupoints and to call attention to the heterogeneity of EDA testing approaches. We will detail the study methodology, assess the quality of the data, interpret the utility of EDA within clinical practice and highlight findings that we believe warrant further investigation.
Materials and Methods

**Literature Review:** Complete details of the literature review of 29 original studies, with inclusion/exclusion criteria and data extraction processes are provided in Colbert et al.\(^{10}\).

**Study quality and scoring criteria:** For the previous review we extracted and scored data on 54 items that needed to be reported if a study was to be replicated. The 54 items were grouped into 10 equally weighted, broad categories (general aspects of study, subjects/settings, skin site selection, controls, electrodes, confounding variables, instrument/electrical parameters, measurements, blinding, results). A quality assessment (QA) score was developed to quantify how completely each item in the 10 categories was reported. Two points were given if an item was described in enough detail to characterize the clinical aspects and electrical parameters. One point was given if the item was only partially described but enough detail was given to make reasonable inferences about that item. For example, if the Electroacupuncture according to Voll (EAV) method was named we assumed, although not clearly stated, that a direct current (DC), not an alternating current (AC) was applied to obtain electrical conductance measurements. In this case one point was given for the item that requested “Type of current and Rationale.” One point was also given if, for example, the authors did not specifically state that control skin sites were assessed under the same conditions as active sites but described testing several sites that included both active and control points in one measurement session. Zero points were assigned if an essential informational item was not mentioned in the report. A perfect QA score was 100% for the 10 categories. Nine of the original 29 studies scored greater than 50% on quality of reporting essential technical information. Of these nine better reported studies seven\(^{11-17}\) provided sufficient clinical detail to permit study replication and a critical assessment of results.
Data synthesis and analysis We extracted data from the seven studies on the 14 categories of information listed in Table 1 and categorized the studies according to the three commonly held assumptions regarding EDA utility i.e., pathology-related acupoint vs. non-pathology-related point, EDA correlation with clinical condition, and EDA changes when substances are placed in the patient/instrument electrical circuit.

Table 1. Data extracted from seven well reported studies\textsuperscript{11-17}

<table>
<thead>
<tr>
<th>Acupuncture tenet examined</th>
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<tbody>
<tr>
<td>Medical condition</td>
</tr>
<tr>
<td>Research question/hypothesis/objectives</td>
</tr>
<tr>
<td>Electrodermal activity evaluation approach</td>
</tr>
<tr>
<td>Number of participants</td>
</tr>
<tr>
<td>Acupuncture points measured</td>
</tr>
<tr>
<td>Controls (substances, skin sites, persons)</td>
</tr>
<tr>
<td>Blinding</td>
</tr>
<tr>
<td>Electrical measurements and instrument</td>
</tr>
<tr>
<td>Number and order of electrical measurements</td>
</tr>
<tr>
<td>Outcome measures</td>
</tr>
<tr>
<td>Statistical analyses</td>
</tr>
<tr>
<td>Results</td>
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<tr>
<td>Conclusions</td>
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</tbody>
</table>

Overall summary

Two studies were performed at ear points\textsuperscript{11,12}, one was a limb to limb comparison\textsuperscript{13}, one measured Jing-well points\textsuperscript{14} at the finger and toe nailbeds and three entailed EAV measurements\textsuperscript{15-17}. Two of the seven studies compared EDA at pathology-related acupoints to EDA at nearby non-pathology-related sites\textsuperscript{11,12}. Two other studies correlated EDA measurements with the presence of, persistence
of, or recovery from specific medical conditions\textsuperscript{13-14}. One study correlated skin conductance between the four limbs in patients with an acupuncture diagnosis of “qi vacuity” (tiredness/low energy)\textsuperscript{13}. Another evaluated skin impedance at the Jing-well acupoints in young women with laparoscopically confirmed endometriosis who were treated with verum or sham acupuncture\textsuperscript{14}. The final three studies assessed whether changes in skin conductance at acupoints occurred when small amounts of substances were placed in the electrical circuit with the patient\textsuperscript{15-17}. The latter three studies all used the EAV approach.

Table 2. Clinical details of seven well reported studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>QA score</th>
<th>Medical condition</th>
<th>Number of participants</th>
<th>Blinding</th>
<th>Controls</th>
<th>Acupoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oleson et al 1980\textsuperscript{11}</td>
<td>55%</td>
<td>Musculoskeletal pain</td>
<td>20 patient volunteers from Pain Management Clinic and Student Health Services aged 18-66 years (mean 34 years)</td>
<td>Physician blinded to patient condition</td>
<td>20 participants who lacked established medical diagnosis involving body part related to auricular acupoint</td>
<td>12 acupoints on each ear (foot/toes, lower leg/ankle, upper leg/knee, hip/buttocks, lower back, upper back, neck, head, hand/fingers, wrist, lower arm and elbow, upper arm/ shoulder)</td>
</tr>
<tr>
<td>Margolin et al 1996\textsuperscript{12}</td>
<td>75%</td>
<td>History of cocaine abuse</td>
<td>34 methadone-maintained patients, average duration of opiate use 13.3 yrs, mean age 36.7 yrs.</td>
<td>No blinding</td>
<td>Four “control” zones on helix of ear not typically needed for substance abuse</td>
<td>Four auricular zones (9-16 mm\textsuperscript{2}) in the concha of ear (Shenmen, Sympathetic, Liver, Lung)</td>
</tr>
<tr>
<td>Yu et al 1998\textsuperscript{13}</td>
<td>57%</td>
<td>Acupuncture diagnosis: Qi Vacuity/tiredness</td>
<td>103 tired patients (53 males and 50 females, aged 24-76)</td>
<td>No blinding</td>
<td>143 healthy volunteers (64 females and 69 males, aged 22-78)</td>
<td>No specific acupoints-measured the balance of skin conductance among four limbs</td>
</tr>
<tr>
<td>Ahn et al 2009\textsuperscript{14}</td>
<td>54%</td>
<td>Laparoscopically-confirmed endometriosis</td>
<td>14 females with endometriosis (aged 14-22) enrolled in acupuncture trial- nine</td>
<td>No blinding of EDA operator</td>
<td>Five study participants who received sham acupuncture</td>
<td>24 Jing-Well points on toes and fingers</td>
</tr>
</tbody>
</table>
Can changes in electrodermal activity be detected at acupoints when substances that are either therapeutically beneficial or toxic are placed in the electrical circuit with an individual?

<table>
<thead>
<tr>
<th>Authors</th>
<th>Polysymptomatic allergic patients</th>
<th>41 patients with 11 medical diagnoses</th>
<th>Operator blinded to contents of test vials</th>
<th>Normal saline, distilled water</th>
<th>1st connective tissue point on medial side of 3rd toe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Krop et al 1997</td>
<td>51%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lewith et al 2001</td>
<td>54%</td>
<td>Previous positive skin prick test to dust mite or cat dander</td>
<td>Operator &amp; participant blinded</td>
<td>Distilled water 15 skin-prick-negative volunteers</td>
<td>Terminal acupoint on lateral side of 3rd toe (spleen/pancreas meridian)</td>
</tr>
<tr>
<td>Semizzi et al 2011</td>
<td>66%</td>
<td>Allergic rhinitis &amp;/or asthma</td>
<td>Operator, assistant &amp; participant all blinded</td>
<td>Normal saline 28 healthy volunteers</td>
<td>Lateral side of 5th finger</td>
</tr>
</tbody>
</table>

QA = quality assessment score

Detailed analysis of each study in accordance with the tested acupuncture tenet

The specific clinical and electrical details of each study are described in Tables 2 and 3 respectively.

Table 3. Electrical and technical details of seven well reported studies

<table>
<thead>
<tr>
<th>Authors and year</th>
<th>Electrical instrument and measurement parameters</th>
<th>Probe</th>
<th>Frequency of measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oleson et al 1980</td>
<td>Constant voltage system, 9V DC, measures conductance</td>
<td>1.5mm spring-loaded dry probe application, hand held metal bar reference electrode</td>
<td>One test session.</td>
</tr>
<tr>
<td>Margolin et al 1996</td>
<td>Custom designed constant current system, 2.5 µA biphasic square pulses, 5Hz, measures resistance</td>
<td>1 mm diameter probe with gel, 0.79 cm² reference electrode</td>
<td>One test session.</td>
</tr>
<tr>
<td>Yu et al 1998</td>
<td>VGH-82A, constant voltage 1.75V, measures conductance, values are normalized on 0-200 scale</td>
<td>Feet placed on metal plates, hands grasp metal cylinders. Conductance measured between limbs</td>
<td>One test session.</td>
</tr>
</tbody>
</table>
Is electrical skin resistance or conductance at pathology-related acupoints different from non-pathology-related acupoints?

Oleson et al's study objective was to scientifically validate the somatotopic pattern of reflex points on the auricle by determining the concordance between auricular electrodermal representation of pain and the actual location of musculoskeletal pain. The researchers assessed electrical conductivity at 12 ear acupoints in 40 patients. Measurements were recorded twice at each point on each ear. The operator categorised the auricular point as “reactive” if the point was both tender and associated with a current reading greater than 50 µA. A Chi-square test determined concordance of auricular diagnosis with medical history diagnosis. The mean current at ear acupoints associated with a pain problem was 60.3 µA compared to 38.6 µA at ear acupoints not associated with a pain problem. Combining the number of “reactive” “problem present” ear points with “non-reactive” “problem absent” ear points yielded an overall correct identification rate of 75.2% with 12.9% false positives and 11.9% false negatives. Abnormal conductivity
was present in both ears, but the current intensity at the ipsilateral ear was greater than at the contralateral ear. This study is limited by small sample size, lack of details about participant recruitment and individuals’ health status, lack of discrimination between recent and past musculoskeletal pain and the simple statistical analysis employed.

The second study conducted by Margolin et al tested the hypothesis that electrical resistance at the auricular acupoints typically needled as part of the National Acupuncture Detoxification Association (NADA) protocol for drug-abusing patients, differs from non-treatment zones on the ear\textsuperscript{12}. Four treatment zones were compared to four control zones in 34 methadone-maintained patients. A fixed amount of gel, used to minimise the confounding factor(s) of pressure and variations in contact resistance, was applied via a syringe between the skin and the test probe. Four measurements were recorded in each of the eight skin sites and an overall mean score was calculated for all active and control zones. Active zones were had significantly lower electrical resistance than control zones. Limitations of this study include small sample size, no details about co-morbid conditions in the participants, lack of comparison with healthy or non-addicted control volunteers, lack of blinding, and lack of generalisability to patients with other conditions.

Conclusions. Evidence from these two well conducted auricular studies suggests that in patients with past or present musculoskeletal pain conditions, increased skin conductance is present at pathology-related auricular acupoints but not at non pathology-related acupoints. That such a correlation was found is a remarkable validation of the homuncular map originally identified by the French acupuncturist, Nogier\textsuperscript{18}. These investigators’ conclusions are strengthened by their comparison to results in volunteers who lacked an established medical diagnosis involving the same body parts. In the study of Margolin et al, however, we cannot draw the same inference as a non-addicted comparison group was not tested\textsuperscript{12}. Although it is generally assumed among clinicians that NADA
acupoints are related to the pathology of substance abuse, it is possible that non-abusers may also have lower electrical resistance at the NADA points compared to control zones on the auricular helix. Nevertheless, based on these two studies, further investigation of auricular acupoints in patients with dysfunction in specific anatomical areas of the body is clearly warranted.

**Do changes in electrical skin resistance or conductance at acupoints correlate with the presence of and/or recovery from disease?**

Yu et al examined the relationship between “qi vacuity”, an acupuncture diagnosis that corresponds with patient complaints of tiredness and low energy, and skin conductance\textsuperscript{13}. They used a four quadrant EAV testing method, which entails recording electrical conductance between both feet, both hands, between right hand and left foot and left hand and right foot\textsuperscript{7}. Measurements were made in patients who met the diagnostic criteria for qi vacuity (QV) established by the Professional Committee for Study of Qi Vacuity Pattern\textsuperscript{13}. To meet this diagnosis, patients must have at least three of the following signs and symptoms: fatigued spirit with decreased energy, shortness of breath on speaking, spontaneous sweating, enlarged tongue with dental impressions, and an empty, weak pulse. The severity of qi vacuity was quantified by scoring each sign or symptom on a scale of 0-4 and summing the scores for each person. The Student's t-test was used to analyse EDA differences between healthy control participants and patients with qi vacuity. Skin conductance in patients with tiredness was lower than in healthy age-matched controls (\( p = .000 \)) and lower skin conductance correlated positively with QV score (\( r \)-coefficient = +0.68, \( p = .000 \)). Skin conductance in the severely tired group was significantly lower than in the mild and moderately tired groups suggesting that lower skin conductance may be closely related to the severity of qi vacuity. This study is particularly important because, rather than correlating EDA findings with a western medical diagnosis, it correlated EDA measurements with an acupuncture diagnosis, the purpose for which EDA testing was originally intended. Limitations of this study are that a large percentage of the patients had co-morbid conditions including diabetes and chronic
hepatitis, there was no blinding of EDA instrument operator or participants, no inter-operator reliability testing and no description of skin preparation prior to measurements.

A study by Ahn et al investigated whether electrodermal measures at the Jing-well acupoints were associated with clinical measures in patients with laparoscopically-confirmed endometriosis. Measuring skin conductance at the Jing-well acupoints on the fingers and toes evolved from the Akabane technique in which the Jing-well acupoints are tested for heat sensitivity. Less heat sensitivity corresponds to greater skin resistance at the acupoint. Fourteen females with endometriosis who were participating in a sham controlled acupuncture trial underwent twice weekly EDA measurements at the 24 Jing-well acupoints over the course of the 8-week intervention. Statistical analysis evaluated the pattern of balance and symmetry (left/right, top/bottom, yin/yang) among the 12 paired acupoints, and clinical outcomes. Standard deviation and Gini coefficient were used to assess statistical dispersion and asymmetry among the 12 paired meridians. Participants who received verum acupuncture had on average a substantial decrease in dispersion and asymmetry compared to the sham treated group. At baseline endometriosis patients had elevated impedance at the Liver, Spleen and Kidney Jing-well acupoints. Abnormal values decreased over time and increased balance in EDA measures corresponded with clinical improvement. The authors concluded that electrodermal measures may be significantly associated with clinical outcomes and acupuncture treatments in adolescent girls with chronic pelvic pain. Limitations of this study include a small sample size, inability to generalise findings to other EDA instruments or to other patient groups, lack of blinding in the acupuncturists and lack of prior inter- and intra-operator instrument reliability testing.

Conclusions: Preliminary evidence from these two studies suggests that skin conductance measurements should be further investigated as a means of quantifying symptom severity and monitoring treatment effectiveness.
Can changes in EDA be detected at acupoints when substances that are either therapeutically beneficial, or toxic to an individual, are placed in the electrical circuit with that individual?

The final three studies assessed whether EDA testing could correctly identify allergic patients, and/or the allergen to which a person was allergic, by testing a variety of allergens in electrical circuit continuity with the patient\textsuperscript{15,16,17}. All three studies used the VEGA test method. A brief description of VEGA testing is provided by Tsuei\textsuperscript{8} and Jeremic and Leung\textsuperscript{9}. During testing a piezoelectric spark generator (producing 400 volts/second), is initially applied to the patient. The patient holds a reference electrode, and a control measurement is made by applying a stylus to points on the patient’s finger or toe. The machine is adjusted until a reading of 80 to 100 scale units is produced. Various extracts are then sequentially placed in the circuit and the measurement repeated. A drop of 15 scale units or more is considered a positive result. The various extracts (homoeopathic doses) in sealed vials, are inserted into a metal honeycomb where current flows around the vials. When a vial containing the homeopathic resonance of something allergic or toxic to an individual is placed in the circuit, VEGA testing purportedly records an increase in skin resistance. Conversely, when appropriate treatments are placed within the circuit, skin resistance reportedly normalises.

Although all three studies employed basic principles of VEGA testing, as shown in Table 2, different patient samples, different allergens and control substances, and different acupoints were evaluated. Only one study, the least rigorous of the three\textsuperscript{15}, reported correct patient discrimination of allergens from non-allergens in 82% of the first group and 96% of the second group of subjects tested. Their measure of discrimination was the percentage of subjects who showed a positive response to mites or histamine as distinct from distilled water or saline. The other two studies concluded that EDA testing could not be used to diagnose environmental allergies\textsuperscript{16} or correctly detect respiratory allergy\textsuperscript{17}. It should be noted however that in the latter study Semizzi et al observed a
significant drop in skin electrical response between two sequential measurements recorded in the allergic group but not in the healthy control group and interpreted this change as somehow associated with pathological status\textsuperscript{17}.

**Discussion**

The analysis conducted here represents a first attempt to test three commonly held assumptions among acupuncturists and practitioners of homeopathy regarding the usefulness of EDA at acupoints. Adequately reported studies that assess the clinical usefulness of EDA measurements at acupoints are few and markedly diverse with regard to the medical conditions assessed, the technical and clinical approaches implemented and outcomes and statistical analyses. Our findings, based on limited available pilot data, suggest that EDA testing at auricular acupoints may be able to distinguish auricular pathology-related acupoints from non-pathology related acupoints in patients with musculoskeletal disorders; that EDA four quadrant testing correlates with the acupuncture diagnosis of qi vacuity and severity of tiredness; and that skin impedance measurements at Jing-well acupoints may be a useful objective outcome for monitoring effectiveness of acupuncture treatment in patients with endometriosis. More controversial are findings to support the diagnostic accuracy of VEGA testing in allergic patients.

This review is limited by both the number and the quality of the existing data, particularly the lack of operator blinding in three of the seven studies. As a research topic, the clinical utility of EDA measurements at acupoints has not been widely investigated, and the quality of reporting in published studies is generally poor\textsuperscript{10}. Furthermore, the large variability in clinical conditions, electrodermal devices and electrical parameters, choice of acupoints, point locations, and criterion for disease has made the establishment of any conclusive assessment about EDA nearly impossible. Nevertheless, this review has a number of salient points worth highlighting.
First, the discrepancy between the relatively widespread use of EDA in clinical settings and the existing research to justify it is noteworthy. EDA measurements recorded in clinical practice are intended to serve as a surrogate means of diagnosing qi activity in specific acupuncture meridians, based on Chinese Medicine diagnoses, theory and principles, yet the majority of EDA research has evaluated EDA findings with reference to western medical rather than acupuncture diagnoses. Although this incongruity may mitigate the interpretation of the results, nonetheless, manufacturers’ claims regarding the clinical utility of EDA devices are not borne out by this narrative review. This does not discount the existence (nor the relevance) of extensive anecdotal evidence but rather points to the relative absence of supporting data within the realm of objective, peer-reviewed literature.

Second, this review underscores the wide-ranging, proposed uses for EDA. Electrodermal devices are used in clinical practice not only for diagnosing but also for evaluating treatment progress and assisting in treatment selection. The use of EDA testing for treatment selection goes beyond the notion that acupoints are passive windows which reveal the homeostatic condition of the body or that EDA testing is able to identify qi deficiency or excess. Rather, it reflects beliefs held by many acupuncturists, homeopaths and kinesthesiologists, that acupoints are interactive, dynamic, responsive skin sites, capable of intelligently communicating which specific substances may bolster or undermine an individual patient’s health. This broader electrophysiological assessment of acupoints counters much of our conventional understanding of human physiology and raises multi-layered questions regarding the mechanisms by which acupoint and meridian-based treatments achieve therapeutic effects. A biologically plausible explanation for this self-healing, intelligent process needs to be identified before widespread acceptance of these concepts is achieved.

Finally, this review highlights the challenges and difficulties in performing EDA studies. For instance, no two studies within this review shared common acupuncture points or diagnoses. Furthermore, the variations in electrical stimuli (constant vs. pulsatile, voltage vs. 

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current, etc), outcome measures (voltage drop vs. instantaneous conductance, normalised or absolute, etc.), and criterion for
disease (e.g. greater than 50 µA or 60 µA) alone present a whole array of possibilities and impart to the future researcher the
unenviable task of defending why a particular set of conditions were chosen. Out of 29 eligible studies, 22 were excluded from this
review – not necessarily because the studies themselves were of poor quality – but because there was simply not enough
information in the published papers for an informed assessment of their quality\(^\text{10}\).

**Conclusion**

There is a discrepancy between the widespread use of EDA testing at acupoints and scientific support for the practice. Evidence
from this review of pilot studies is limited and diverse, but does suggest that EDA testing at auricular acupoints in patients with
musculoskeletal disorders may distinguish pathology-related acupoints from non-pathology related points; that skin conductance
testing can confirm and quantify the severity of qi vacuity (tiredness); and that EDA testing at the Jing-well acupoints should be
further evaluated as an objective outcome for monitoring effectiveness of acupuncture treatment in patients with endometriosis. The
evidence available at this time does not support the use of VEGA testing for allergic status in patients, but investigation of subtle
differences in EDA at acupoints between allergic and non-allergic patients may be justified.

**References**

1. Nakatani Y. A guide for application of Ryodoraku autonomic nerve regulatory therapy. Alahambra, CA: Chan's Books and
Products, 1972.


7. Tsuei JJ. Scientific Evidence in Support of Acupuncture and Meridian Theory

http://www.healthy.net/Health/Article/Scientific_Evidence_in_Support_of_Acupuncture_and_Meridian_Theory_I_Introduction/1087/1

accessed on 24 February, 2011.


