

SPECIAL ARTICLES

Faradization for insomnia: a sleep neurology history

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Insomnia is highly prevalent and challenging to treat. We typically regard insomnia as a disorder of the modern world, but physicians and patients have been struggling with this malady for millennia. Here we present the curious historical practice of using electrization or faradization to treat insomnia. We present methods of application, hypotheses regarding mechanism of action, and historical case reports and case series to better understand this phenomenon. We put faradization for insomnia in the context of the modern use of electrical therapies to support and facilitate human health in multiple different health care arenas. Last, we examine current efforts to use these antiquated concepts to address insomnia through transcranial direct current stimulation and cranial electrical stimulation.

Keywords: history; insomnia; faradization; electrization; treatment

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BRIEF SUMMARY

Current Knowledge/Study Rationale: This sleep neurology history addresses the curious phenomenon of using faradization to treat insomnia in the late 19th and early 20th centuries. We place this treatment into historical context, including the implications of the meaning of this treatment approach for current insomnia therapies.

Study Impact: This study provides perspective on faradization used by previous generations of physicians attempting to ameliorate insomnia in their patients. By understanding where we have gone, we can better plot our successful path to the future.

INTRODUCTION

For as long as humans have slept, problems with consistent sleep achievement have undoubtedly been present. However, it was not until 1623 that the term insomnia (eg, want of sleep) was first coined in the third known English Language dictionary, from the Latin roots “in” (meaning “not”) and “somnus” (meaning “sleep”). For millennia, alcohol and opiates were used to facilitate sleep onset. Then in the mid-19th century, the discovery of chloralhydrate, followed in the mid-20th century by the discovery of barbiturates, provided additional treatment options (along with sulfonil, trional, paraldehyde, and bromides) for those afflicted with sleeplessness. With the emerging development and accessibility of electricity in the late 19th century, a different, nonmedicinal treatment for insomnia emerged as physicians and researchers explored the therapeutic effects of electrical current applied to the body.

THE EMERGENCE OF FARADIZATION/ELECTRIZATION FOR INSOMNIA: EARLY PROPONENTS

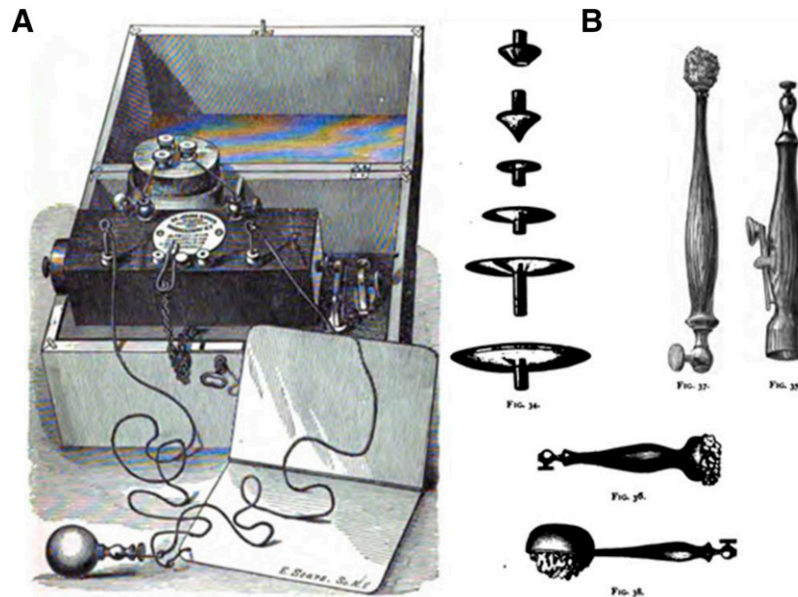
Electrization of the human body in the 19th and early 20th centuries was accomplished using both faradic and galvanic currents (**Figure 1**). Faradic current is interrupted direct current with a frequency of 50–100 Hz and pulse duration of 0.1–1 ms.

Galvanic current is also an interrupted direct current but with a slower frequency (~30 Hz) and longer pulse duration (>1 ms) than faradic current.¹ Generally speaking, faradic current stimulates innervated muscles, whereas galvanic current stimulates denervated muscles. As such, faradic current or faradization was the method of choice to treat insomnia by applying the electrical current directly to innervated muscles of the individual’s head (**Figure 2**) and occasionally to other areas of their body.

Drs. George Beard and A. D. Rockwell, in their 1871 treatise on the medical and surgical uses of electricity,² describe in detail the “permanent and tonic effects” of applied electricity on human health. They describe their treatment regimen as follows:

“Either galvanization of the sympathetic or the head, or faradization of the head and spine, or better than all, general faradization. Indeed, simple peripheral galvanization or faradization, without touching the person’s body often did the trick.” They then claim electrization causes, “Improvement in sleep, increase of appetite and improvement in digestion, regulation of the bowels, improvement in the circulation, relief of nervousness and mental depression, relief of weariness and pain, increase in the size and hardness of the muscles and in the weight of the body, increased disposition and capacity for labor of the muscles and of the brain. After each séance (e.g., electrization session) some people experience a feeling of enlivenment and exhilaration for several hours while others experience a disposition to sleep after treatment, quite similar to that which is felt after a bath in the surf.”

Drs. Beard and Rockwell then provide the first description of successful use of faradization to treat insomnia:

Figure 1—Faradic apparatus and metallic electrodes.

(A) Kidder's faradic apparatus, with copper plate and brass ball used in general electricization, and (B) metallic electrodes, of various sizes, for faradization and galvanization.²

"Ms. A, aged 30, of a highly nervous organization,...for 5 days and nights she was unable to close her eyes in sleep. Her condition was most distressing and resisted all efforts in the way of medication. It was agreed that a mild application of the faradic current should be applied to the head and down the spine. The result was most decided and gratifying, since a sleep of several hours, deep and refreshing, immediately followed. It is proper to say that subsequent application did not have the same desired effect, although they evidently strengthened the nervous system of the patient and greatly aided in dissipating the condition of insomnia." They proceed to note the variable nature of the positive clinical effect, "In some patients these effects are only felt so long as they are under treatment—they become, in a measure, dependent on it. In other cases the effects are not appreciated in their fullness until long after the treatment is abandoned."

Of the 18 total cases of insomnia they treated with faradization, only one was "not benefitted." Based on these positive results, Drs. Beard and Rockwell keenly state the following:

"Insomnia is an affliction of such an indefinite variety and complexity of pathological conditions that it is manifestly impossible to treat it with anything like uniform success by any one form of conceivable medication; but of all the remedies that have yet been tried, there is, we believe, no one which permanently relieves the symptoms in so large a proportion of cases as electricization. There is little doubt that if electricity could be given in the form of pills or powders as successfully as it is now employed, its use would be increased one-thousand fold."

Despite this enthusiasm, the practice of treating insomnia with faradization did not take off, perhaps because of the lack of widespread availability of electricity in the late 19th century (it took until 1925 for half of all homes in the United States to get electric power).

Some 28 years after Drs. Beard and Rockwell's treatise, Dr. J. L. Howard noted the potential of "static electricity" for treatment of sleep maladies.³ Although the exact details of Dr. Howard's process of faradization is unstated, we assume this is

similar to that described by Drs. Beard and Rockwell. In his 1899 monograph published in *International Clinics*, Dr. Howard states the following:

"Static electricity has a powerful psychical effect, and in the hands of the unscrupulous practitioner is greatly abused, and lends itself to quackery. At the same time, the static battery is the most useful single instrument now enjoyed in general practice for the relief of non-operative and non-septic conditions.... When over-work, mind-strain, worry and the like produce an exhausted mental state, two necessities are demanded, disordered nutrition must be restored and sleep produced. In static electricity, we have an agent which promotes both of these. Its effect is an immediate sedative tonic which is very refreshing to the fatigued nerve centers."

Dr. Howard proceeds to report a case of a 45-year-old man unsuccessfully treated for several weeks for chronic insomnia through various hypnotics by his family physician who then underwent experimental treatment with "daily sparkings and the positive head breeze" for his insomnia:

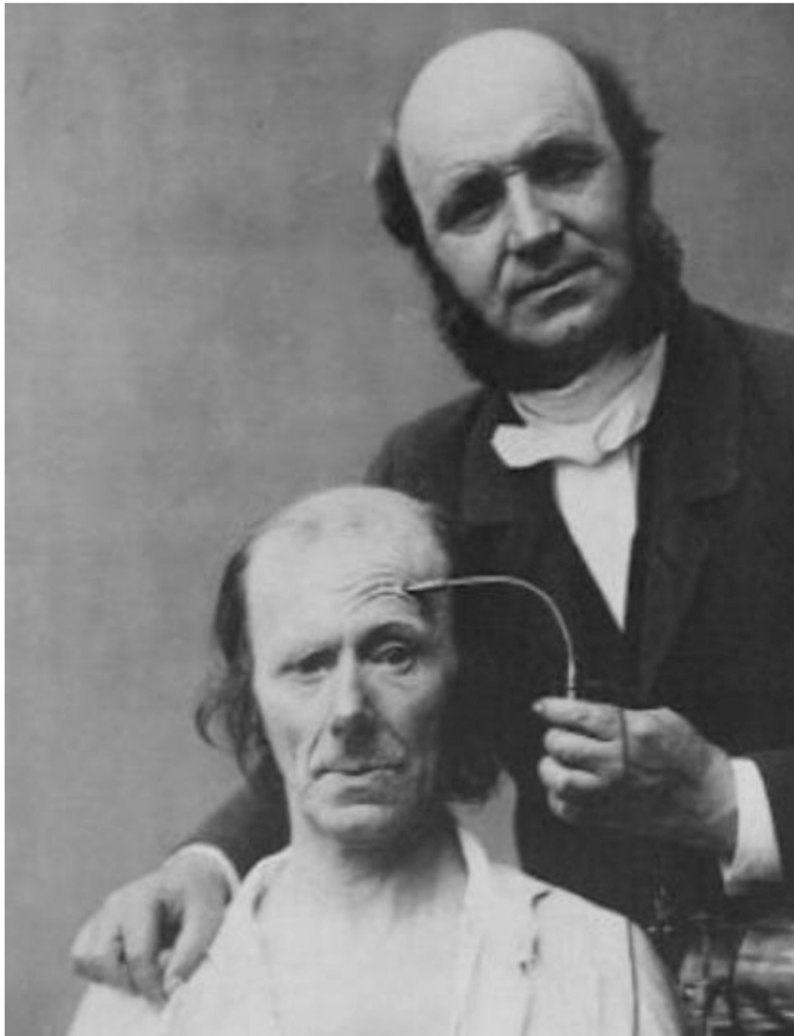
"Positive electrification for 10 minutes...in the morning and immediately before retiring...over five daily treatments and he was sleeping 8 hours and longer each night." After describing two additional cases Dr. Howard asserts, "In the ordinary curable cases of insomnia, static electricity should be placed in the front rank as a curative agent."

By August 1901, Dr. Samuel Sloan observed that faradization hastened sleep after researching the impact of electricization on other maladies. He describes his initial experience with faradization for the treatment of insomnia as follows:

"My first experience of sleep arising from the application of electricity came to me as a surprise. I had observed that when applied to other parts of the body the patients sometimes volunteered the remark that it made them sleepy. I thought if this were the case that I might get more benefit in this direction by applying it to the head."

Sloan proceeded to study 46 additional patients with insomnia treated with faradization, which, at the time, was the

Figure 2—Famed French neurologist Guillaume Benjamin Amand Duchenne demonstrating the technique of faradization of the head.²⁹



definitive research on the topic. He reported this case series in the *Glasgow Medical Journal* (Figure 3),⁴ where his “electrotherapeutic” approach involved the following:

“One milliampere of faradic current applied via a 9000 turn coil over 15 minutes to the patient’s brow and nape of the neck.” He states he, “Generally applies the current three times a week for two weeks.”

Of his 46 cases, Sloan indicates 75% were either “cured” of their insomnia or “sufficiently relieved to have made the treatment an undoubted success. . . . I think I am free to state that there is no remedial measure at present known to the profession, other than a prolonged holiday, which will give such immediate and more or less prolonged benefit [for insomnia].”⁴

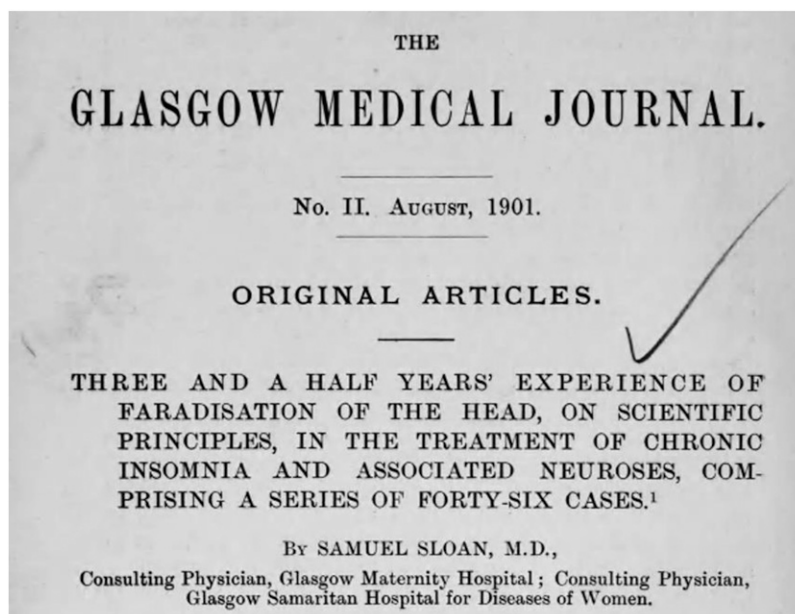
PLACEBOS AND QUACKERY?

Drs. Beard and Rockwell best sum the enthusiasm for faradization for insomnia, present throughout these historical documents, when they state, “electrization (is) a tonic of

remarkable efficacy.” Yet little was understood at the time regarding the specific physiologic mechanism of the effect. Dr. Sloan, in his keenness for faradization for insomnia, volunteers elaborate theories about the mechanism of this treatment:

“Regarding the probable modus operandi of this treatment, I believe that the influence is only temporarily due to the action of the current on the vessels of the brain. As in the case of shampooing of the head, however, the action of the current on the scalp would, I think, cause some transient contraction of the vessels, and thus induce a sleepy feeling whilst the faridisation was in operation. I believe that the real influence arises from the restful action induced in each molecule of the brain substance by the gentle rhythmic impulses of the current, reckoning these at over 100,000 during each sitting, and resembling the calm cerebration following change of scene and of occupation. These impulses are numerous enough to produce more than a mere transient improvement in the metabolism of the molecules; and the alternations are slow enough to give time for this trophic action to take place, by which the finer nutrition of the brain is improved.”

Drs. Beard and Rockwell took a more humble approach and acknowledged the shortcomings of their knowledge regarding the mechanism of faradization:

Figure 3—Dr. Samuel Sloan's original monograph describing faradization for insomnia.⁴

“So profound is our ignorance of the chemical composition of the body; of the molecular and other changes that incessantly take place in health and disease; of the modifications which these changes undergo by the infinite and varying influences of climate, temperament, diet and mode of life; and so limited and uncertain is our knowledge of the nature and notion of medicines, that we may well resign the hope of reducing therapeutics to an exact science to distant generations.”

Furthermore, they allude to the possibility of the placebo effect as the cause of their positive treatment effect observations, without stating it explicitly:

“The permanent or tonic effects of faradization...may be so rapidly manifested at the commencement of the treatment as to cause us to suspect them to be more the result of mental impression than of the applications.”

Insomnia therapy is commonly influenced by the placebo effect. For many current US Food and Drug Administration–approved medications for insomnia, the improvement in the placebo group is similar to the difference in the level of improvement between the active drug and placebo groups.^{5–8} This phenomenon extends beyond pharmaceuticals as studies have shown perceived sleep quality, as opposed to objective sleep quality, affects cognitive functioning. To wit, previous night’s sleep quality was reported by 164 individuals who were then randomly assigned to a sleep quality or control condition. Those in the above average assigned sleep quality condition were informed that they had spent 28.7% of their total sleep time in rapid eye movement sleep, whereas those in the below average sleep quality condition were informed that they had only spent 16.2% of their time in rapid eye movement sleep (irrespective of their actual time in rapid eye movement sleep or their actual sleep quality). Assigned sleep quality but not self-reported sleep quality significantly predicted participants’ scores on the Paced Auditory Serial Addition Test and Controlled Oral Word Association Task.⁹

Thus mindset influences cognitive states in both positive and negative directions, suggesting a means of controlling one’s health and cognition. When it comes to sleep, perception is reality.

The hyperbole in the description of the effect, the lack of modern scientific approaches (case series and not clinical trials), a lack of understanding of the cause of the effect, and the desire for professional and financial success created an environment ripe for potential quackery around insomnia and faradization in the 19th and early 20th centuries. However, even in 2020, we still do not know the exact mechanism of action of many common therapeutics, yet this does not dissuade us from prescribing these treatments. Indeed, in the practice of medicine, today’s treatment standards can become tomorrow’s quackery, a phenomenon born of medical progress and improved understanding of pharmacology and physiology as much as an indictment of the actions of an unscrupulous medical profiteer. Dr. Allan Hamilton, in his contemporaneous book entitled *Electro-therapeutics, Medical and Surgical: A Handbook for Physicians in the Treatment of Nervous and Other Diseases*, published just 2 years after Drs. Beard and Rockwell’s 1871 treatise, provides the following perspective on this issue:

“Great improvements have been made in instruments since the days of quackery, and we now have scientific apparatus, electrodes, batteries, and machines. It is our object to treat special parts—nerves, muscles or other organs—with some definite purpose, and we should avoid the examples of charlatans of other times, whose only ideas were derived from the use of two tin handles, or the indiscriminate ‘pawing’ or aimless sponging of all parts of the body.”¹⁰

We could just as easily apply this harsh assessment, generated through the perspective of time, to Hamilton’s work today. Yet all medical knowledge is an iterative process, and we all stand on the shoulders of giants, so we refrain.

ELECTRIZATION EVOLVES IN THE LATE 20TH AND EARLY 21ST CENTURIES

What have we learned about the electrization of human health in the intervening 150 years since the publication of Drs. Beard and Rockwell's treatise? Modern medicine, with access to reliable current, batteries, and the advent of more complex circuits, deploys electrization in many forms to improve human health. Pacemakers¹¹ and implanted defibrillators¹² support and maintain healthy cardiac conduction and contraction. Electroconvulsive therapy is used to address treatment refractory depression,^{13,14} schizophrenia,¹⁵ and obsessive compulsive disorder,¹⁶ with a current nearly 1000 times stronger than that used by Dr. Sloan in his early investigations. Electroconvulsive therapy reduces cortisol levels, produces marked postictal slowing akin to N3 sleep, precipitates sleepiness after treatment,¹⁷ and has recently been used to treat severe, treatment refractory paradoxical insomnia.¹⁸ Vagal nerve and responsive brain stimulators treat epilepsy¹⁹ and deep-brain stimulators treat Parkinson's disease.²⁰ Transcutaneous electric nerve stimulation is used to treat pain and facilitate muscle health.²¹ Could faradization's potential effects on insomnia occur through similar mechanisms?

Scientists and physicians are still investigating and deploying faradization of the head and brain to attempt to address insomnia. Transcranial direct current stimulation of the bifrontal head appears to improve aspects of sleep architecture and sleep efficiency^{22,23} but may reduce total sleep time²⁴ and has uncertain or no effect on the self-reported experience of insomnia.²⁵ Cranial electrical stimulation is another noninvasive method of applying low-intensity electrical current to the head. Studies assessing efficacy have been inconclusive, with a recent meta-analysis indicating the quality of evidence was insufficient to recommend it to treat insomnia.²⁶ Despite the generally negative results, the research of faradization for insomnia continues much to the likely posthumous delight of Drs. Sloan, Beard, Rockwell, and Howard.

Although not specifically an insomnia treatment per se, the hypoglossal nerve stimulator is used to treat sleep-disordered breathing,^{27,28} once again showing the benefits of electrization to human health. Perhaps hypoglossal nerve stimulator therapy in 2020 brings us full circle with the work of previous generations seeking to remedy sleep with electricity? We know patients undergoing electroconvulsive therapy develop sleepiness after the procedure, and although the works of Beard, Rockwell, Sloan, and Howard centuries ago represents very low level evidence, positive effects of electrization on sleep were observed. This begs the following question: do we really know whether or not faradization is effective for insomnia? We think not, based on the limitations of the studies done to date.²⁶ Regardless, at present, the savvy patient knows the power of positive thinking, among other things, is perhaps the best way to address insomnia. Maybe distant generations will develop a machine to incept this thinking into the mind of the chronic insomniac? Until then, we proceed with scientifically proven therapies such as cognitive behavioral therapy and the medications at our disposal to help these afflicted individuals.

As we gaze through the lens of time with amusement at the progress and folly of our predecessors, credit must be given where credit is due. Although Drs. Beard and Rockwell fell far short of proving faradization effectively treated insomnia, they provide one of the earliest descriptions of the importance of sleep to overall health:

"In a wide range of diseases sleep, to a certain extent and with exceptions, may be regarded as a thermometer of health. When all other bodily functions are well performed, the sleep is usually calm, sound, and refreshing; when it becomes painfully and persistently disturbed by dreams, or is long absent, we may suspect actual or approaching disease."

It seems we have been aware of the importance of sleep for at least 150 years, and yet sleep still suffers the indignity of widespread deprioritization. As shocking as this is, current efforts continue to plug away casting light on this issue to change perceptions of sleep as we charge into the 21st century.

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DISCLOSURE STATEMENT

All authors have seen and approved the manuscript. Work for this study was performed at the University of Washington Medicine Sleep Center; Department of Neurology, University of Washington School of Medicine; Seattle VA Puget Sound Healthcare System; and Swedish Medical Center. The authors report no conflicts of interest.