AMERICAN ACADEMY OF OPHTHALMOLOGY
The Eye M.D. Association

COMPLEMENTARY THERAPY ASSESSMENT

MICROCURRENT STIMULATION FOR MACULAR DEGENERATION

MARCH 2004

SUMMARY

INTRODUCTION TO THE TOPIC

Microcurrent stimulation is a technique to apply electrical stimulation to nerve fibers using cutaneous electrodes. Microcurrent stimulation of the macula has been used to treat patients with age-related macular degeneration (AMD), utilizing currents on the order of 50 to 500 microamperes. This procedure is also known as transcutaneous electrical stimulation of the macula (TESMAC®). A primary purpose of electrical stimulation, using higher millicurrents as in transcutaneous electrical nerve stimulation (TENS) treatment, has been to relieve pain. It has also been reported in use for increasing circulation, promoting closure of bone fractures and improving wound healing.

CONCLUSIONS

The Task Force on Complementary Therapies believes that, based on available evidence in the peer-reviewed literature, strong scientific evidence has not been found to demonstrate the effectiveness of microcurrent stimulation for AMD. Long-term studies with larger samples of patients, well-described patient selection criteria, adequate control groups, and standardized follow-up and outcome measures are critical to establishing a base of evidence regarding effectiveness.

BENEFITS

There are two uncontrolled studies published in a non-peer reviewed journal comprising 71 patients with AMD, who were treated with both nutritional supplements and electrical stimulation and one uncontrolled study published in a non-peer reviewed journal of 43 patients with macular degeneration treated only with electrical stimulation. The studies reported that some patients had improved visual acuity after treatment.

RISKS

Overall, the rate of adverse effects from microcurrent stimulation or TENS is reported as low. Adverse incidents are related to electrode placement. There may be a significant financial risk associated with the costs of these treatments over a long period of time.

INFORMATION FOR PATIENTS

Physicians can advise their patients contemplating microcurrent stimulation for AMD to ask the following questions of their provider:

- Is the treatment being provided as part of an FDA-authorized study?
- What are the results and benefits compared to a control group (a group not receiving microcurrent stimulation)?
- What other treatment options are available and how do they compare?
- Is lifelong treatment with microcurrent stimulation necessary to maintain benefits?

REPORT

DESCRIPTION OF THE TECHNOLOGY

Microcurrent stimulation is a technique to apply electrical stimulation to nerve fibers using cutaneous electrodes. Microcurrent stimulation for macular degeneration is described as applying 200 microamperes of electricity from a nine-volt battery to eight points around the eye. This technique utilizes lower currents, on the order of 50 to 500 microamperes. The device controller provides the microcurrent using two different waveforms and four frequencies.

In comparison, transcutaneous electrical nerve stimulation (TENS) is a technique to apply millicurrents to nerve fibers using cutaneous electrodes. Short pulses of electrical current last from 9 to 350 microseconds, and are applied at frequencies of 0.3 to 294 MHz. The device controls provide for adjustment in the pulse parameters. The primary application of TENS in health care has been to relieve pain. Other reported uses include increasing circulation, enhancing closure of bone fractures, and improving wound healing.

MECHANISM OF ACTION

For age-related macular degeneration (AMD), the postulated mechanism is that microcurrent stimulation improves membrane permeability, nerve conduction velocity, protein synthesis, and adenosine triphosphate (ATP) levels. In a very small experimental study (n= 9), microcurrent stimulation was shown to increase microcirculatory blood flow in intact skin and blister wounds, as measured by red blood cell velocity.[1] In an animal study, direct electric currents were shown to increase ATP concentrations in tissues and stimulate amino acid transport into rat skin.[2]

DEFINITION OF THE PROBLEM

Microcurrent stimulation of the macula has been proposed as treatment for patients with AMD. Age-related macular degeneration is the leading cause of irreversible severe central visual loss in Caucasian Americans 50 years and older. Typically, patients who progress to the neovascular form of the disease or have geographic atrophy involving the foveal center tend to develop severe vision loss. Laser photocoagulation, photodynamic therapy with verteporfin, and specific nutritional supplements are treatments that have demonstrated efficacy in randomized controlled trials for certain stages of AMD.

FDA STATUS

Although it has been reported by VisionWorks, Inc. (New Paltz, NY) that the Macular Degeneration Foundation plans to propose an industry-sponsored double-masked, randomized and multisite clinical trial for microcurrent stimulation of the macula for submittal to the U.S. Food and Drug Administration (FDA), this is not confirmed by the Macular Degeneration Foundation website.

Microcurrent stimulation devices currently marketed in the U.S. do not have FDA premarket approval for the indication of macular degeneration. At this time, any research studies in the U.S. using microcurrent stimulation for macular degeneration require FDA authorization and Institutional Review Board approval.[3]

SUMMARY OF EVIDENCE

Search Methods and Study Selection

In August 2000, the Academy searched through MEDLINE and EMBASE in the English language from January 1970 to August 2000 for articles relating to TENS, microcurrent stimulation, and ocular conditions. No articles were identified, but a bibliographic search of related articles identified one study for the application of electrical stimulation in patients with AMD.[4] This article was found in a non-peer reviewed journal.

To update the assessment, in March 2004 a search of MEDLINE and EMBASE was conducted for the period January 1968 through February 2004, with the same search strategy. No new citations were identified. Using the author names from the paper identified earlier, an Internet search using the Google search engine, located another paper in a non-peer reviewed journal.[5] The Internet search found a web site (www.mdsupport.org) which contained a discussion of microcurrent stimulation. Through this source an additional paper was identified.[6]

Statistical Issues and Study Design

Two studies found were case series, one with 25 patients[4] and the other with 46 patients.[5] The treatment in both studies was microcurrent stimulation and nutritional supplements. Another case series was of 43 patients treated with microcurrent stimulation. These studies have the following limitations: small study population, no control population, lack of detailed documentation on patient selection and patients who declined treatment, and lack of standardized outcome measures other than visual acuity. The two studies of microcurrent stimulation and nutritional supplements also have the limitation of insufficient methodology to distinguish between the results of antioxidant supplementation and microcurrent stimulation.

Information about the effect of an intervention should be obtained by comparing a treated group with an untreated control group similar in all the important respects. One way to assure similarity between the two groups is to use randomization. Because case series have no control group and do not use randomization, there is no way to estimate how an intervention might have changed an outcome. In addition, case series usually describe a small number of patients. Small sample sizes can lead to patient-selection bias as well as a higher likelihood that the observed effect was a result of chance. Properly documented case series can provide important insights into the potential utility of a new treatment and be valuable for those designing appropriate controlled clinical trials. Necessary documentation includes details about the patient selection criteria, the number of patients who declined surgery, and how the enrolled patients compared to the patients who refused treatment. Use of standardized follow-up intervals and outcomes assessment would further improve the quality of information, as would comparisons to the natural history of the remaining, untreated patient population. There should be appropriate study controls, such as using sham microcurrent stimulation treatment or using the fellow eye as a control.

BENEFITS

The proposed benefits are that visual acuity is improved. In order to maintain the effects, microcurrent stimulation therapy is presumed to be ongoing or lifelong, although maintenance intervals are proposed to be less frequent than the initial treatment phase.

One study of 25 patients with AMD, aged 48 to 79 years, reported the results of both nutritional supplementation and electrical stimulation.[4] Patients were treated for varying intervals, from 2 years to 7 years with a daily multivitamin and mineral supplement, and a monthly administration of electrical treatment of 200 microamperes on the closed eyelid for 7 minutes for each eye. There was no control population for comparison purposes.

The study reported the following results: 15 patients improved their visual acuity, and 10 patients had reduced acuity. The overall group lost an average of 0.30 letters of visual acuity over an average treatment period of 4.0 years.[4]

A second paper reported on two series of patients.[5] One series of 12 patients with AMD, aged 60 to 89 years, were followed for up to 6 years and treated with nutritional supplements and microcurrent stimulation once a week for 6 weeks. The second series of 34 patients with AMD, aged 61 to 87 years, were followed for

up to 6 years and treated with nutritional supplements and microcurrent stimulation several times a week. There was no control population in either series for comparison purposes. The machines used delivered 200 microamperes at ±9 volts of alternating, square wave current. The series of 12 patients showed an average loss of 3 letters of visual acuity over a 2-year period. The series of 34 patients had an average gain of 8.5 letters of acuity per eye.[5]

A third paper reported on a series of 43 patients (65 eyes) with macular degeneration treated with direct microcurrent of 200 microamperes for 20 minutes for 36 sessions.[6] The treatment was applied for 10 minutes per eye three to four times a week. No details of patients' ages or length of time of follow up was given. Thirty-five of 65 eyes (54%) had a 1 to 4 line improvement in visual acuity, 35% had no improvement, and 8% had a decline.

Risks

The overall rate of adverse effects from electrical stimulation appears to be low. In the studies of AMD and microcurrent stimulation, there were no reported adverse effects from the electrical stimulation. Adverse effects could include: electrical burns if electrodes are not coupled to conductive gel, dermatitis, and skin irritation at the electrode sites with repeated application. Some materials reviewed during the Internet search indicate that patients may self-apply the electrical stimulation, in which case there may be risks of incorrect application. There may also be risks if the current applied is higher than what has been studied. There may be a significant financial risk associated with the costs of these treatments over a long period of time.

Questions for Scientific Inquiry

- What is the biological basis for microcurrent stimulation for treating AMD?
- Does microcurrent stimulation reduce visual loss caused by AMD, using randomized controlled clinical trials in larger, well-designed studies with adequate statistical analyses, standardized outcome measures and sufficient follow-up intervals?
- How effective is microcurrent stimulation compared to standard therapies for AMD, i.e., laser surgery and photodynamic therapy?

Information for Patients

Physicians can advise their patients contemplating microcurrent stimulation for AMD to ask the following questions of their provider:

- Is the treatment being provided as part of an FDA-authorized study?
- What are the results and benefits compared to a control group (a group not receiving microcurrent stimulation)?
- What other treatment options are available and how do they compare?
- Is lifelong treatment with microcurrent stimulation necessary to maintain benefits?

Conclusions

Based on available evidence in the peer-reviewed scientific literature, the Task Force on Complementary Therapies believes that strong scientific evidence has not been found to demonstrate the effectiveness of microcurrent stimulation treatment of AMD compared to standard therapies. Long-term studies with larger samples of patients, well-described patient selection criteria, adequate control groups, and standardized follow-up and outcome measures are critical to establishing a base of evidence regarding effectiveness.

Development of Complementary Therapy Assessments

Complementary, or alternative therapies, are a growing part of health care in America. Americans spend an estimated $14 billion a

year on alternative treatments. Mainstream medicine is recognizing a need to learn more about alternative therapies and determine their true value. Most medical schools in the United States offer courses in alternative therapies. The editors of the *Journal of the American Medical Association* announced that publishing research on alternative therapies will be one of its priorities. The National Institutes of Health National Center for Complementary and Alternative Medicine has broadly defined complementary and alternative medicine as those treatments and health care practices not taught widely in medical schools, not generally used in hospitals, and not usually reimbursed by medical insurance companies. More scrutiny and scientific objectivity is being applied to determine whether evidence supporting their effectiveness exists.

In the fall of 1998, the Board of Trustees appointed a Task Force on Complementary Therapy to evaluate complementary therapies in eye care and develop an opinion on their safety and effectiveness, based on available scientific evidence, in order to inform ophthalmologists and their patients. A scientifically grounded analysis of the data will help ophthalmologists and patients evaluate the research and thus make more rational decisions on appropriate treatment choices.

The Academy believes that complementary therapies should be evaluated similarly to traditional medicine: evidence of safety, efficacy, and effectiveness should be demonstrated.[7,8] Many therapies used in conventional medical practice also have not been as rigorously tested as they should be. Given the large numbers of patients affected and the health care expenditures involved it is important that data and scientific information be used to base all treatment recommendations. In this way, we can encourage high-quality, rigorous research on complementary therapies.[9-11]

Ideally, a study of efficacy compares a treatment to a placebo or another treatment, using a double-masked controlled trial and well-defined protocol. Reports should describe enrollment procedures, eligibility criteria, clinical characteristics of the patients, methods for diagnosis, randomization method, definition of treatment, control conditions, and length of treatment. They should also use standardized outcomes and appropriate statistical analyses.

The goal of these assessments is to provide objective information of complementary therapies and provide a scientific basis for physicians to advise their patients, when asked.

To accomplish these goals, the assessments, in general, are intended to do the following:

- Describe the scientific rationale or mechanism for action for the complementary therapy.
- Describe the methods and basis for collecting evidence.
- Describe the relevant evidence.
- Summarize the benefits and risks of the complementary therapy.
- Pose questions for future research inquiry.
- Summarize the evidence on safety and effectiveness.

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Approved by the Quality of Care Secretariat September 15, 2000
Approved by the Quality of Care and Knowledge Base Development Secretariat March 31, 2004