

**SOUTH BAYLO UNIVERSITY**

**A Narrative Review of the Effectiveness of Acupuncture for Macular Degeneration**

**By**

**Jessica Moore**

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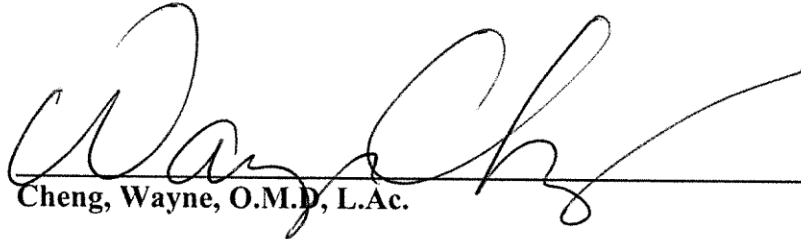
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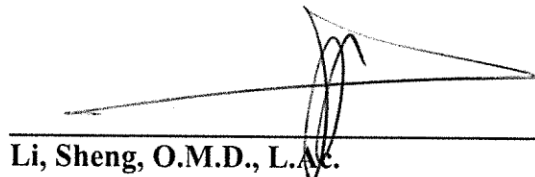
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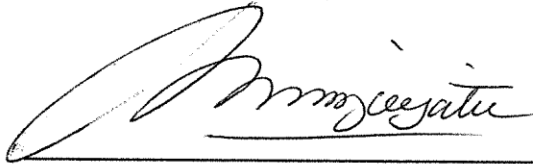
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# **A Narrative Review of the Effectiveness of Acupuncture for Macular Degeneration**

**SOUTH BAYLO UNIVERSITY at ANAHEIM, 2018**

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## **ABSTRACT**

The Center for Disease Control and Prevention reports that 3.4 million Americans are legally blind and one in ten people will be diagnosed as legally blind each year. The National Eye Institute identifies age-related macular degeneration as one of the most common eye diseases in Americans over age 40; it is the leading cause of blindness among Americans, accounting for 54% of all blindness. The objective of this research is to focus on the effectiveness of acupuncture as a viable alternative for people suffering with degenerative eye disease. Degenerative eye conditions, including age-related macular degeneration, are conditions where acupuncture has been identified as a complementary and possible alternative treatment to traditional Western treatments. A search for published articles related to treating eye diseases with acupuncture was undertaken with the purpose of finding recent pilot studies and case studies published between 2000 and 2018, including studies using animal subjects. Studies not written in English and not published in recognized journals were excluded. Electronic databases including the Web of Science, Medline, Embase, Pubmed, Google Scholar and ProQuest were searched, resulting in the identification of thirteen (13) relevant works. Results

documented in the thirteen studies have found that acupuncture can improve sight, visual acuity, and both near and distance vision, and adverse effects of acupuncture are minimal. However, studies using randomization, blinding and control groups are rare indicating that more long-term studies that can replicate these findings are required to determine whether acupuncture can effectively treat age-related macular degeneration.

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## I. INTRODUCTION

ARMD is the most common cause of severe and irreversible loss of central vision in people over the age of 50. More than seven million people in the U.S. have early-to-moderate ARMD. Severe ARMD affects 1.8 million people in the U.S. and the number suffering from ARMD is expected to increase by 50% in 2020 (Georgiou, Neokleous, Nicolaou, & Sears, 2013).

Age related macular degeneration (ARMD) is a common, painless degeneration of the macula resulting in central, and/or detail and color vision loss that is usually bilateral. There are two types, dry macular degeneration that accounts for 90% of cases, and wet macular degeneration that accounts for 10%. Dry macular degeneration (MD) is when drusen, protein waste from photoreceptor sites is deposited on the macula. Wet MD is when blood vessels break and bleed. The treatments for age related macular degeneration are Lucentis, an intraocular injection for wet MD that stops bleeding, Avastin, an intraocular injection for wet MD that stimulates vessel growth, and Eyelea, an intraocular injection for wet MD that stimulates vessel growth. Laser cauterization of leaking vessels is another treatment for wet MD. The factors contributing to this disease are lifestyle, diet, smoking, family history and genetics. (Virgili, Michelessi, Parodi, Bacherini, & Evans, 2015).

Research has shown that juvenile macular degeneration, or Stargardt disease causes a serious vision loss problem which ranges from 20/50 to 20/200 on the standard



eye chart (Chung, 2014). In the U.S. legal blindness is normally defined as a visual acuity of 20/200 or worse and this calls for corrective glasses. Western medicine has clinical trials that are currently testing gene replacement, and stem cell therapy to treat degenerative eye disease. It remains too early to know whether stem cell transplants, or gene therapy will be possible or not because the clinical trials are still in the early stages and their results are yet to be conclusive.

The American Macular Degeneration Foundation treats macular degeneration with a laser (Virgili et al., 2015), however there are three major limitations of laser photocoagulation treatments. First, not more than 10-15% of choroidal neovascularization (CNV) lesions are small enough and sufficiently delineated by fluorescent angiography to be eligible for laser treatment. Second, even if laser treatment is initially successful, there is at least 50% chance that leakage will recur during the next two years. Many such recurrences are amenable to additional treatment if detected early, which means that patients need careful monitoring after the first treatment. Finally, at least half of patients' post-treatment with sufficiently well-circumscribed CNV lesions still have some leakage beneath the center of the fovea. Laser treatment leads to immediate reduction in central vision in these patients with leakages, but with sufficient follow-up treatments, the extent of visual loss is less in laser treated eyes than in untreated eyes. Nevertheless, these existing laser therapies are limited in their effectiveness and may also lead to scarring of the macula and additional vision loss. The critically serious side effects of these injections may include serious eye infection

involving eye pain, light sensitivity, and vision change, increased eye pressure, retinal detachment, and vitreous floaters (Friedman et al., 2015).

Because of the limitations of laser treatment, researchers and physicians are in search of macular degeneration treatment breakthroughs that allow patients to maintain vision longer without repeated laser use. Likewise, researchers are also looking for new therapies are effective for all types of wet MD. The lack of treatment options makes it pertinent to explore whether acupuncture can be an effective complimentary approach for patients with eye disease.

In traditional Chinese medicine (TCM), the eyes are most closely related to the kidney and liver systems. The *Huang Di Nei Jing*, an ancient Chinese medical text, claims that the most important function of the kidney is to store essence. Essence is the most basic substance of life. Levels of essence usually lower with advancing age. The consumption of essence can increase with exhaustion, stress, and chronic illness. Visual clarity is improved when the eye is well nourished by the essence. The *Huang di Nei Jing* describes how the liver is the only sense organ that runs directly to the eye and that the function of the liver is to store blood and regulate the circulation of qi. The common TCM patterns for macular degeneration are deficiencies in kidney essence and liver blood deficiency, along with kidney and liver yin deficiency, spleen qi deficiency, and irregular heart patterns (Grossman & Swartwout, 1999; Scott, 2005; Wei, Rosenfarb & Liang, 2011; Fatrai & Uhrig, 2015).

The purpose of this narrative review is to study the effectiveness of acupuncture as an appropriate method for treating macular degeneration. Millions of people in the U.S. are affected by ARMD every year and the numbers continue to grow, making it a significant health problem. Currently the available treatments for ARMD are limited and an investigation of available published evidence is undertaken to determine whether there is sufficient evidence that acupuncture is a viable treatment for macular degeneration.

## II. LITERATURE REVIEW

There were thirteen articles found which studied acupuncture and the use of acupuncture for treatment of various eye diseases. Seven articles were published in the past five years. Five articles were published in the last 20 years and one article was 30 years old.

A study on acupuncture and its effectiveness as a treatment for dry eye found that acupuncture was not more effective than the conventional treatment, but acupuncture had no side effects as compared to the eye drops which have some side effects (Blechsmidt, Krumsiek, & Todorova, 2017). A study of the acupuncture point Gall Bladder 37 (GB37), suggests that acupuncture at GB37 can induce complex brain activity in the vision cortex (Liu et al., 2013).

Another study done in Switzerland found that after acupuncture treatment there was improvement in the visual function of the patients who had inherited retina diseases (Blechsmidt, Krumsiek, & Todorova, 2016). This pilot study examined the short-term effect of acupuncture on visual function for patients with retinal disease. Ten half-hour sessions over ten weeks studied the effects of GB37, Urinary Bladder 1, Liver 3, and the eye point on the ear. All the patients showed general improvement of visual functions, visual acuity, widening of the temporal radius of visual field. Patients reported better day time color vision, better visual focus and less visual tiredness. The long-term effects of this complementary therapy remain to be evaluated.

The practitioners at the Boel Acunova Acupuncture School in Denmark claim that it is leading the way in ophthalmologic acupuncture (Boel, 2013). Boel, the founder of this school claims that more than 8000 eye patients have received this treatment and the treatment has produced over 70% successful cases (Boel, 2013). Boel published a pilot study project with ARMD research. The pilot project had 27 ARMD patients who were split into three distinct groups. Different eye-specialists diagnosed each of these patients who suffered from dry ARMD. The patients were given extensive treatment over a period of four weeks using a new method of acupuncture referred to as Acupuncture 2000, which is different from Chinese acupuncture. In the third test group, 60% of these patients experienced a 15.6% improvement in their sight. In the second test group, 70% of the patients got a 28.5% improvement in their sight. Finally, in the first test group, 80% of these patients got a 15-40% improvement in their sight. The average improvement for all the three groups was 27% (Boel, 2013).

The review of articles was expanded to less recent research due to a lack of recent material. The aim of a study by Pagani and colleagues was to investigate the effect of electro-acupuncture (EA) on the progression of retinal degeneration of rats affected by inherited retinitis pigmentosa (Pagani, Manni, & Aloe, 2006). The Royal College of Surgeons (RCS) exposed thirty-day-old mice to 25 one-minute-long daily sessions of low-frequency EA for eleven consecutive days. Data revealed that daily sessions of low-frequency EA for eleven days to RCS rats during a critical developmental stage of retinal cell degeneration cause an increase of retinal nerve growth factor (NGF) and NGF high-

affinity receptor (TrkA) expression, an increase of outer nuclear layer (ONL) thickness, and enhanced vascularization. These findings suggest the possible beneficial effects of EA treatment in the development of inherited retinitis pigmentosa (IRP) and IRP-like retinal degeneration of RCS rats. The findings also suggest that the mechanism through which EA might exert its action on the regulation of NGF and brain-derived neurotrophic factor (BDNF) and/or their receptors in retinal cells (Pagani et al., 2006). While this research is compelling, the obvious problem is that there has yet to be a similar study created that could test these findings on humans.

The effects of acupuncture on fifty patients suffering from myopia, glaucoma, retinitis pigmentosa (*degeneratio retinae pigmentosa*), optic nerve atrophy, ages five to 71 has also been studied (Dabov, Goutoranov, Ivanova & Petkova, 1985). All the patients were treated with acupuncture at these bilateral points: Extra 2, BL 2, GB 14, 4, TH 17, St 1. In cases of optic nerve atrophy, the authors also needled points TH 15 and BL 60. By indirect electro-acupuncture (by Chinese apparatus WQ 10), points BL 2 and St 1 were also stimulated. In all the patients, a subjective improvement of visual acuity was observed. In children with myopia, relative accommodation was enlarged. In patients with retinitis pigmentosa, an enlargement of the borders of the visual field, investigated by perimetry and isopter perimetry was observed, as well as light difference sensitivity established by static perimetry. Electrooculograms showed a reduction of the basic values and of Arden's ratio (the ratio of light and dark potentials). Three of the patients with glaucoma had a decrease in pressure of the eye, measured by Maklakow's tonometer.

This study had positive results, but it studied many different eye diseases. Individualized studies focused on each symptom separately need to be developed to prove the effectiveness of acupuncture (Dabov et al., 1985).

A study in 2004 in Austria performed acupuncture using laser needles (Litscher et al., 2004). This treatment is a new and entirely painless stimulation method which was described for the first time in this research. The paper presents an experimental double-blind study in acupuncture research in healthy volunteers using an optical stimulation method. Eighteen volunteers that were in good health consisted of eleven females and seven males between 21 and 30 years of age. The study was in a randomized controlled cross-over trial using functional multidirectional transcranial ultrasound Doppler sonography. Stimulation of vision-related acupoints resulted in an increase of mean blood flow velocity in the posterior cerebral artery. Optical stimulation using properly adjusted laser needles has the advantage that the stimulation cannot be felt by the patient (painless and no tactile stimulation) and the operator may also be unaware of whether the stimulation system is active. Therefore, true double-blind studies in acupuncture research can be performed (Litscher et al., 2004).

Another Austrian study in 2002 found aimed to investigate the effect of laser acupuncture on cerebral activation (Siedentopf et al., 2002). Using functional magnetic imaging, cortical activations during laser acupuncture at the left foot (Bladder 67) and dummy acupuncture, were compared employing a block design in ten healthy male volunteers. During laser acupuncture, they found activation in the cuneus corresponding

to Brodmann Area, and the medial occipital gyrus of the ipsilateral visual cortex. Placebo stimulation did not show any activation. This demonstrated that laser acupuncture of a specific acupoint, empirically related to ophthalmic disorders, leads to activation of visual brain areas, whereas placebo acupuncture does not. These results indicate that laser acupuncture has the potential to elucidate effects of acupuncture on brain activity. The study design did not explain why and how the different acupuncture methods can affect the brain and the eye, however it showed that acupuncture can provide scientifically measurable effects. Given that acupuncture can affect the brain and the eye is a reason more studies are needed to determine how specific acupuncture points can be used to treat eye disease.

A study by the Zhejiang People's Hospital treated early ARMD with the emayaoling acupuncture technique. They used a randomized controlled trial to compare the differences in the clinical therapeutic effects on early ARMD in the treatment between emayaoling acupuncture technique and regular acupuncture. A total of 110 patients of ARMD were randomized into an observation group (55 cases, 73 eyes) and a control group (55 cases, 76 eyes). In the observation group, acupuncture was applied at Cuanzhu (BL 2) and Yiming (EX-HN 14). The needles were retained for 30 minutes. Additionally, Ganshu (BL 18), Pishu (BL 20) and Shenshu (BL 23) were stimulated with the quick needling technique. The emayaoling needling technique was applied. The needle was rotated with the thumb and index finger of the puncture hand, forward and backward. The strong and large amplitude were given when the thumb moved forward,



and the week and small amplitude were applied when moving backward. The gentle movement was required throughout the procedure. In the control group, the point selection was same as the observation group. The points were stimulated with regular technique and the needle retaining time was same as the observation group. The treatment was given once every two days in the two groups and for three months continuously. Patients were given follow up treatments for three months. Before and after treatment, as well as at follow-up, the eyesight, the effect on macular area and the macular retinal structure were evaluated separately. This included the macular nerve fiber layer (MNFL), retinal neurepithelium layer (RNL), pigment epithelium and choroid capillary composite lay (PECCL). After treatment and a follow-up evaluation, there were improvements in the eyesight of patients. There was a larger amplitude of improvement in the in the observation group as compared with the control group. The total effectiveness rates on the macula were 83.6% in the observation group and and 61% in the control group. The emayaoling acupuncture technique achieved better therapeutic effects on treatment of early ARMD as compared with regular acupuncture.

A study by Gene Bruno, the past president and current director of the American Association of Oriental Medicine (AAOM), tested the treatment of macular degeneration with microcurrent stimulation (Bruno, 2018). Results of clinical studies indicate that microcurrent stimulation can enhance the cellular adenosine triphosphate (ATP) synthesizing capabilities, specifically in the retina, and thus provide a means to improve visual acuity for ARMD patients. Microcurrent stimulation of acupuncture points is

currently the only viable option for those suffering from ARMD. August Reader, MD, a neuroretinologist, and Grace Halloran, PhD, completed a double-blind study that indicated positive results from micro-current stimulation for patients with ARMD, retinitis pigmentosa, Stargardt's disease, and other retinal diseases. Damon P. Miller, M.D., has published the clinical results of the first 120 patients he treated for ARMD using microcurrent therapy that showed significant improvement (Bruno, 2018).

Over a one-year period, 42 patients were trained in the use of self-treatment with microcurrent stimulation of acupuncture points for the treatment of ARMD (Bruno, 2018). Treatment involved the use of a microcurrent stimulator to treat acupuncture points surrounding the eyes. The microstimulator that was used was the MicroStim 100. The stimulator was used to deliver micro-current at 250 to 700 microamps for five minutes. Patients were also educated in the use of nutritional supplements considered supportive for ocular conditions. Forty-two patients used microcurrent stimulation to treat acupuncture points near the eye where the average age of patients was 77.6 years. Treatment occurred two to three times per day, every day. Visual acuity and Visual Function Index (VF-14) tests were performed every three months. Of these initial 42 patients, 36 (85.7%) showed improvement in visual acuity of two lines or more. Three patients showed improvement of one line of visual acuity. Two patients showed no improvement and one patient lost one line of visual acuity. The average change in visual acuity for all patients was +2.88 lines. The VF-14 test results showed a positive change of an average of 35 points. Research and clinical studies have validated the effectiveness of

using microcurrent stimulation to treat macular degeneration. ARMD and other similar retinal diseases are otherwise untreatable by any means, making electrical acupuncture the only current viable option for those suffering from this devastating disease.

A preliminary report on the treatment of ARMD using auricular acupuncture and electrical acupuncture was issued by Alston Lundgren, MD (Lundgren, 2003). This study involved only ten individuals, but also showed significant improvement for most patients. All microcurrent was delivered to the retina via acupuncture points. Ten women and men (age range, 52-90 years) were seen at a single private practice in the United States. The visual acuity of patients ranged from 20/50 to 20/1205. The intervention was acupuncture combining ear points, direct ocular nerve stimulation, and electroacupuncture applied to each patient two times weekly until no further improvement in acuity was noted. An increase in visual acuity was measured by an eye chart. Eight of the ten patients experienced improved visual acuity as measured on MNRead Eye Charts or Optec Vision Screen Machine. There was no degradation of acuity during follow-up, even up to six months later. It was shown that the visual acuity in ARMD may be significantly improved by acupuncture.

A second study by Alston C. Lundgren tested an acupuncture protocol for the treatment of age-related macular degeneration (Lundgren, 2005). The objective was to evaluate the efficacy and safety of acupuncture to treat ARMD and to explore treatment parameters. One hundred and eight patients (56 women/52 men, with an age range of 47-96 years), were seen at a single private practice in New Mexico in 2003-2004. All

patients were diagnosed by their ophthalmologist as having macular degeneration. Thirty-two percent (32%) of patients' eyes had wet ARMD, 50% dry, and 18% were not specified. The intervention was acupuncture, combining periorbital electrical stimulation; ear acupuncture was applied to each patient. The outcome was measured by an increase in visual acuity measured by Early Detection and Treatment of Diabetic Retinopathy Studies (EDTRS) charts. The overall results were 69% of patients improved in distance vision and 69% improved in near vision. Patients with both wet and dry forms of ARMD benefited equally. Half of patients had subjective vision improvement, 33% of patients gained more than two lines on EDTRS charts, 20% reported lessening or disappearance of scotomas, 7% of patients noted improved color vision. The conclusion was that visual acuity in ARMD may be improved by acupuncture.

Jiao (2011) studied the therapeutic effect of acupuncture, and auriculotherapy on ARMD. Eighty-four cases (90 affected eyes) with ARMD were randomly divided into an acupuncture group (56 cases, 60 eyes) and a medication group (28 cases, 30 eyes). In the acupuncture group, Guangming (GB 37), Jingming (BL 1), Cuanzhu (BL 2), Taiyang (EX-HN 5), Sibai (ST 2), Yangbai (GB 14), Tongziliao (GB 1), Fengchi (GB 20), Ganshu (BL 18), Shenshu (BL 23) and Fenglong (ST 40) were punctured. The medication group was treated by oral administration of Vitamin C and Vitamin E and intramuscular injection of Entodon. The therapeutic effects were evaluated after treatment. The total effective rate was 88.3% (53/60) in acupuncture group which was

better than that of 60.0% (18/30) in medication group ( $P < 0.05$ ). The conclusion from this study was that acupuncture has a good clinical effect on ARMD.

The studies show that there may be benefits by using acupuncture as a treatment for various eye diseases. A summary of the literature presented in this literature review is shown in Table 1. The findings are generally positive for the use of acupuncture to treat various eye diseases however studies carried over a longer term with more patients and more detailed studies are required to determine whether acupuncture can effectively treat eye disease.

**Table 1: Summary of the Literature**

<b>Disease</b>	<b>Findings</b>	<b>Author</b>
Dry Eye	Acupuncture not more effective than drops but no side effects	Blechschiidt, Krumsiek, & Todorova, 2017
Dry Eye	Induce complex brain activity in vision cortex	Liu et al., 2013
Inherited retina diseases	Improvement of visual functions, visual acuity, widening of the temporal radius of visual field, reported better day time color vision, better visual focus and less visual tiredness	Blechschiidt, Krumsiek, & Todorova, 2016
ARMD	Acupuncture resulted in sight improvements	Boel, 2013
Retinitis pigmentosa (in rats)	Electro-acupuncture increased retinal NGF and NGF high-affinity receptor (TrkA) expression, ONL thickness, and enhanced vascularization	Pagani, Manni, & Aloe, 2006
Myopia, glaucoma, retinitis pigmentosa, optic nerve atrophy	Improvement of visual acuity, enlarged relative accommodation in children (myopia), enlargement of the borders of the visual field and light difference sensitivity (retinitis pigmentosa), reduction of Arden's ratio, decrease in pressure of the eye (glaucoma)	Dabov, Goutoranov, Ivanova & Petkova, 1985
None, subjects were healthy volunteers	Acupuncture with laser needles increased mean blood flow velocity in the posterior cerebral artery	Litscher et al., 2004
None, subjects were healthy volunteers	Acupuncture can lead to activation of visual brain areas	Siedentopf et al., 2002
ARMD	Emayaoling acupuncture technique resulted in improvements in the eyesight of patients	Zhejiang People's Hospital Bruno, 2018
ARMD	Microcurrent stimulation can enhance the cellular ATP synthesizing capabilities, and improve visual acuity	
ARMD	Acupuncture improved visual acuity, distance vision, near vision, and colour vision	Lundgren, 2003; Lundgren, 2005
ARMD	Acupuncture more effective than Vitamin C, Vitamin E and intramuscular injection of Entodon	Jiao, 2011

### III. MATERIALS AND METHODS

A key element of this narrative review is that the search strategy is predetermined, rigorous and transparent. The search process for this research was conducted on the following electronic databases - Web of Science, Medline, Embase, Pubmed, Google Scholar and ProQuest. The keywords consisted of combinations of two or more terms from the following:

- Narrative review,
- Efficacy,
- Acupuncture,
- Eye disease,
- Age related macular degeneration,
- Retinitis Pigmentosa,
- Glaucoma,
- Myopia,
- Dry Eye,
- Astigmatism,
- Cataract,
- Coloboma,
- Kera Conjunctivitis Sicca,
- Lazy Eye,
- Color Blindness,

- Uveitis,
- Presbyopia, and
- Nonarteritic anterior ischemic optic neuropathy (NAION)

The resulting citations were separated into peer-reviewed articles, articles, books, dissertations, and others. Finally, more than 120 relevant sources were reviewed and thereafter each paper was read for inclusion and exclusion criteria as well as for assessing the qualities of the papers and 27 papers were chosen. These are considered the primary articles to study for this research.

### **Inclusion Criteria**

A consistent method of evaluating search results for inclusion is developed and applied to avoid bias. The criteria designed for including papers is listed in Table 2.



**Table 2: Inclusion Criteria**

1	Papers written in English.
2	Nature of papers reviewed are pilot studies and case studies
3	Papers ranging between 2000- present (2018) except for some papers that recorded earlier documentation of academic research in acupuncture
4	Searching the right keywords and finding the relevant papers related to the research question.
5	Only published journal papers, peer-reviewed articles, articles, books, dissertations will be reviewed.
6	The papers come from the standard data sources or databases.
7	Animal studies papers were also reviewed
8	Papers must be related to research.

**Exclusion Criteria**

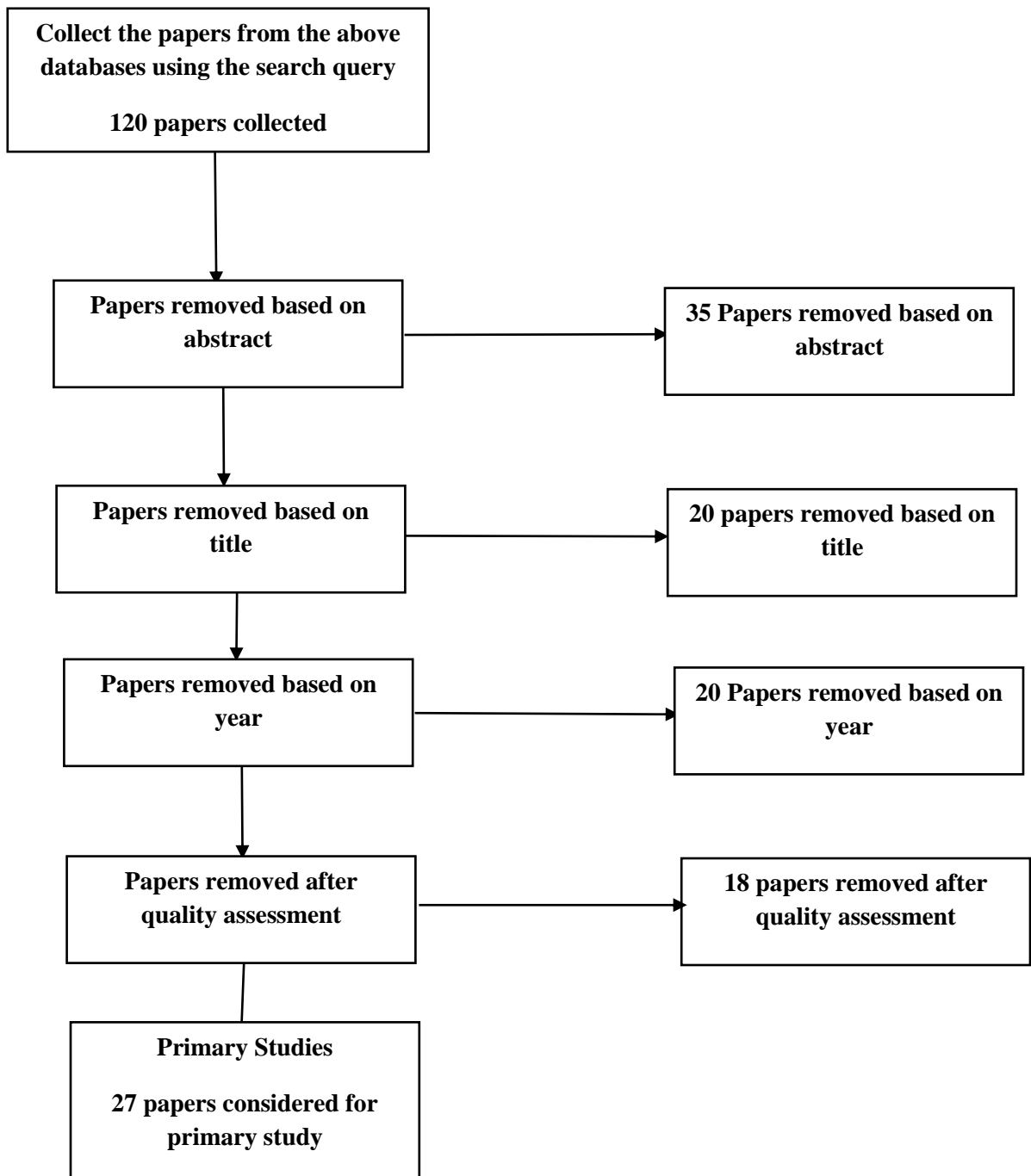
The exclusion criteria for excluding some papers from this primary study are listed in Table 3.

**Table 3: Exclusion Criteria**

1	Papers not written in English.
2	Papers or articles which are not from recognized journals.
3	Papers based on relevant key words that use different methodologies are excluded.
4	Papers only available in the form of abstracts of Power Point presentations.
5	Exclusion based on title.

### **3.3 Data extraction**

The data extraction is principally coordinated towards finding published papers (archival journals, conference proceedings or technical reports) from the already established six electronic databases, albeit each recognized primary source has been checked for other important references. Various search strings were developed utilizing pertinent terms in view of the research questions and the search was confined to papers published within the last 20 years. Highly referenced and important works published prior to the year 2000 were also included. The selection of primary sources was initially based on a review of title, keywords, and abstracts although this was extended to include the conclusions section in the cases where the title, keywords and abstract provided insufficient information. All selected studies were then reviewed against a detailed set of inclusion criteria designed to identify whether the studies could help with the problem statement. The data extraction process is shown in Figure 1.



**Figure 1: Data extraction process**

## IV. RESULTS AND DISCUSSION

Age-related macular degeneration is a leading cause of serious, irreversible vision damage in developed nations. Roughly 1.75 million individuals in the United States have precocious ARMD while 7 million may have intermediate ARMD. In spite of the fact that an expected 80% of ARMD patients have the non-neovascular form, the neovascular form is related to approximately 90% of the serious visual misfortunes (visual sharpness 20/200 or worse) because of ARMD. The predominance, incidence, and progression of ARMD and most related features (e.g., extensive drusen) increase with age.

### **Discussion**

One contention for utilizing acupuncture for the treatment of eye diseases may be that it causes few adverse effects. One study (Grönlund., Stenevi, & Lundeberg, 2004) discovered an adverse effect as a result of acupuncture treatment and another five studies (Nepp et al., 1998; Pang et al., 2003; He et al., 2004; Wang et al., 2005; Tseng et al., 2006) did not. No extreme adverse effects of acupuncture were noted. With respect to those of standard medication medicines, the adverse effects of acupuncture are mellow, rare and maybe even immaterial.

Accepting that acupuncture was helpful for treating eye diseases, possible systems of action might be of intrigue. It has been proposed that acupuncture can impact synthesis

and emission by the lacrimal organ (Gong & Sun, 2007). Others have hypothesized that acupuncture can diminish pressure and lighten pain intensity (Nepp et al. 2002).

The selected research papers from the literature review that included studies on humans are shown in Table 4. The population included in the study, the number of participants over the age of 50, the intervention (treatment) detail and the outcome related to the impact on ARMD (if specified) are shown for each study along with the study reference.

**Table 4: Research Studies, Treatments and Results**

<b>Study</b>	<b>Boel, 2013</b>	<b>Dabov et al., 1985</b>	<b>Litscher et al., 2004</b>
<b>Disease</b>	ARMID	Myopia, glaucoma, retinitis pigmentosa, optic nerve atrophy	Subjects were healthy, mix of male and female
<b>Outcome</b>	Average 27% sight improvement of ARMID patients	Improved visual acuity, enlarged visual field, decrease in eye pressure	Increased mean blood flow velocity in posterior cerebral artery
<b>Treatment Duration</b>	Four weeks	Not specified	Not specified
<b>Treatment</b>	Acupuncture 2000	Acupuncture, Extra 2, BL 2, GB 14, 4, TH 17, St 1, TH 15 and BL 60	Acupuncture with laser
<b>Population Age 50+</b>	Not specified	Not specified, ages 5-71	Not specified
<b>Study Size</b>	27	50	18

<b>Study</b>	Siedentopf et al., 2002	Zhejiang People's Hospital
<b>Disease</b>	Subjects were healthy, all males	ARMID
<b>Outcome</b>	Activation of visual brain areas	Emayaoling acupuncture produced more improvement in eyesight of early ARMID, 83.6% vs 61% in control group
<b>Treatment Duration</b>	Not specified	Three months
<b>Treatment</b>	Acupuncture with laser, Bladder 67	Emayaoling acupuncture compared to traditional acupuncture, Cuanzhu (BL 2), Yiming (EX-HN 14), Ganshu (BL 18), Pishu (BL 20) and Shenshu (BL 23)
<b>Population Age 50+</b>	Not specified	Not specified
<b>Study Size</b>	10	110

<b>Study</b>	Bruno, 2018	Lundgren, 2003	Lundgren, 2005
<b>Disease</b>	ARMID	ARMID	ARMID
<b>Outcome</b>	86% of ARMID patients showed improvement in visual acuity, average 35-point improvement on VF-14	80% of ARMID patients showed improved visual acuity	69% of ARMID patients improved distance vision, 69% improved near vision
<b>Treatment Duration</b>	One year	Twice weekly until no further improvement	Not specified
<b>Treatment</b>	Microcurrent stimulation - acupuncture	Auricular acupuncture	Acupuncture
<b>Population Age 50+</b>	Not specified – average age was 77.6 years	Age range 52-90	Age range 47-96
<b>Study Size</b>	42	10	108



<b>Study</b>	Jiao, 2011	Maria et al., 2004	Kurusu et al., 2005
<b>Disease</b>	ARMD	Keratoconjunctivitis sicca (KCS)	Glaucoma
<b>Outcome</b>	Acupuncture more effective than medication for ARMD	Patients with KCS receiving acupuncture felt better	Patients with glaucoma showed improved visual acuity, intraocular pressure improved
<b>Treatment Duration</b>	Not specified	Ten sessions	Five weeks
<b>Treatment</b>	Acupuncture compared to Entodon/Vitamin C and E, Guangming (GB 37), Jingming (BL 1), Cuanzhu (BL 2), Taiyang (EX-HN 5), Sibai (ST 2), Yangbai (GB 14), Tongziliao (GB 1), Fengchi (GB 20), Ganshu (BL 18), Shenshu (BL 23) and Fenglong (ST 40)	Acupuncture	Acupuncture, Pucan (BL 61) and Shenmai (BL 62)
<b>Population Age 50+</b>	Not specified	Not specified	Not specified
<b>Study Size</b>	84	25	11

The results from several of the studies indicated improvements in visual acuity (Dabov et al., 1985; Bruno, 2018; Lundgren, 2003; Kurusu et al., 2005). Improvements in sight were also identified (Boel, 2013; Zhejiang People's Hospital) as well as improved intraocular pressure in glaucoma patients (Kurusu et al., 2005). In Litscher et al. (2004), there was an increase of the mean blood flow velocity in the posterior cerebral artery and Jiao (2011) found that acupuncture was more effective than Vitamin C and Vitamin E combined with an intramuscular injection of Entodon for treating ARMD.

For the studies that were specifically related to using acupuncture to treat ARMD, a more critical examination was performed for risk and bias. The research studies related to ARMD along with associated potential bias and potential risks are shown in Table 5.

**Table 5: ARMD Research Studies, Bias and Risk**

<b>Study</b>	<b>Potential Bias</b>	<b>Potential Risk</b>
Boel, 2013	Boel is the founder of an acupuncture school and the publisher of the study, randomization of participants is not discussed	Small sample size, n=27, does not describe how improvement was specifically measured, study is not replicated
Zhejiang People's Hospital	Age and health of patients is not specified however the selection of participants was randomized	This is the only study describing the emayaoling needling technique, the study does not give measurements on improvement in ARMD, study is not replicated
Bruno, 2018	Bruno is associated with AAOM, no control group or randomization	Patients were self-treated, n=42, study is not replicated
Lundgren, 2003	There was no control group and patient selection was performed by Lundgren, not randomized selection	Small sample size, n=10, study is not replicated
Lundgren, 2005	There was no control group and patient selection was performed by Lundgren, lack of randomization of patients	Patient improvement is partially based on subjective improvement, there is no replicated study
Jiao, 2011	Age and health of patients is not specified, randomization was performed, but not clear if the patient characteristics are similar for acupuncture and medication groups	This is the only study comparing acupuncture to medication, study is not replicated

This review evaluated the viability of acupuncture for the treatment of macular degeneration. The results above demonstrated suggestive proof for the viability and effectiveness of acupuncture on various eye diseases, for example, dry eye, glaucoma,

nearsightedness, age-related macular degeneration and so forth. In any case, the number of trials, their total sample size, and their methodological quality is too low to reach firm conclusions.

In some cases, the studies were performed on patients treated at a private practice where randomization of patients was not performed. There is a potential for bias when a clinician performs such treatments and publishes results that may serve to improve their business practice. The methodological quality of these studies could be improved perhaps if the study was performed independent of the private practice. Some studies employed randomization, but others did not. Incorporating randomization balances patient characteristics between the study groups. Blinding in a study implies that the personnel involved in a study do not know which patients received which treatments. Blinding was not mentioned in the studies however blinding may not be possible with a technique such as acupuncture.

For evaluating the results of the studies, a consistent measurement was not established for the discussion of the level of improvement. For some studies, visual acuity using EDTRS charts was used along with VF-14 tests, but other studies were somewhat vague in the discussion of results. A consistent measure to describe the improvement of the control group relative to an experimental group should also be incorporated. The availability of literature was scant for the use of acupuncture to treat ARMD, resulting in a lack of studies that replicated prior studies and validated those results.

After reviewing the current studies on acupuncture and macular degeneration, there is substantial evidence that acupuncture can stimulate the visual cortex, but more large-scale studies are needed to study the long-term benefits of acupuncture. In my personal clinic, I have had great success with treating macular degeneration. I have traveled to Denmark to observe Dr. Boel successfully treating macular degeneration. In addition to my personal experience, the findings in the literature suggest a need for further investigations into the use of acupuncture for treating ARMD. The study performed by Jiao (2011) is particularly compelling where an 88.3% effective rate was identified for ARMD patients. This study did include a relatively large sample size and randomization, exhibiting less potential bias than some of the other studies. Improvements in vision of 27% to 86% have been reported in other studies, providing additional support to the possibility of acupuncture as a treatment. I believe acupuncture will prove to be a safe and effective alternative to combatting the epidemic of blindness from age related macular degeneration. The benefits to vision discussed in this literature review should put acupuncture at the forefront of research for treating macular degeneration.

## V. CONCLUSION

This research has examined the literature for specific studies where eye disease, and more specifically ARMD has been treated using acupuncture. Acupuncture can serve as a complementary, and possibly an alternative treatment to traditional Western treatments such as medication and laser treatments. Results from studies indicate that acupuncture can improve sight, visual acuity, and both near and distance vision. Multiple studies indicate that adverse effects associated with acupuncture are minimal. However, studies using randomization, blinding and control groups are rare and there are other potential biases found in the studies related to using acupuncture to treat ARMD. More long-term studies that can replicate these findings are required to determine whether acupuncture can effectively treat eye disease.

A specific study that focuses on the Acu Nova acupuncture points that are on the hands and feet is needed. These points need tested to see if the visual cortex lights up when the point is stimulated. This would help prove the effectiveness of these individual acupuncture points. Another study should be done following the vision acuity of a large group of Acu Nova patients (100 people) over a 10-day treatment period, and then four follow-ups during a one-year period to recheck the vision. This would help determine if there is permanent change to the vision over the one-year period. Another study should be done following children with Stargardt disease, or juvenile macular degeneration. The disease is degenerative, and it would be beneficial to develop a treatment for children early on before the disease becomes chronic. The study would perhaps follow children

with an eye specialist and the acupuncturist for a year of treatment. These more specific, year-long studies with intermittent check-ins will help to determine if there are long term benefits to acupuncture for macular degeneration and if the specific micro system acupoints proposed are proved to be effective by a scientific community. These new studies will strengthen the validity of acupuncture research in the future.

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