

Magnets applied to acupuncture points as therapy – a literature review

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Abstract

Objectives To summarise the acu-magnet therapy literature and determine if the evidence justifies further investigation of acu-magnet therapy for specific clinical indications.

Methods Using various search strategies, a professional librarian searched six electronic databases (PubMed, AMED, ScienceDirect College Edition, China Academic Journals, Acubriefs, and the in-house Journal Article Index maintained by the Oregon College of Oriental Medicine Library). English and Chinese language human studies with all study designs and for all clinical indications were included. Excluded were experimental and animal studies, electroacupuncture and transcranial magnetic stimulation. Data were extracted on clinical indication, study design, number, age and gender of subjects, magnetic devices used, acu-magnet dosing regimens (acu-point site of magnet application and frequency and duration of treatment), control devices and control groups, outcomes, and adverse events.

Results Three hundred and eight citations were retrieved and 50 studies met our inclusion criteria. We were able to obtain and translate (when necessary) 42 studies. The language of 31 studies was English and 11 studies were in Chinese. The 42 studies reported on 32 different clinical conditions in 6453 patients from 1986–2007. A variety of magnetic devices, dosing regimens and control devices were used. Thirty seven of 42 studies (88%) reported therapeutic benefit. The only adverse events reported were exacerbation of hot flushes and skin irritation from adhesives.

Conclusions Based on this literature review we believe further investigation of acu-magnet therapy is warranted particularly for the management of diabetes and insomnia. The overall poor quality of the controlled trials precludes any evidence based treatment recommendations at this time.

Keywords

Acu-magnet therapy, static magnetic field, dosimetry, permanent magnet, acupuncture points.

Introduction

As part of clinical practice, acupuncturists often apply magnets to acupuncture points as either an adjunct to needling or as a stand alone therapy.¹⁻⁴ Magnets (gold plated or non-plated 800 Gauss magnets) are often left on key acupuncture points after an acupuncture needle treatment with the intention of prolonging the therapeutic effect. Stronger magnets (3000 Gauss) may be used with or without an electromagnetic device as the primary treatment in lieu of needling.⁵ Practitioners of magnetotherapy teach patients to apply magnets to various body parts as a self care intervention for a

number of conditions.⁶⁻⁸ Although site of magnet placement is presumably an important therapeutic consideration, a recent critical review of static magnetic field (SMF) dosing parameters found that the optimal site for magnet placement on the body has not been determined.⁹ However, in 5 of 56 studies reviewed, when magnets were explicitly placed on tender points or trigger points,¹⁰⁻¹⁴ positive outcomes were consistently reported, whereas mixed outcomes were reported in studies in which magnets were simply applied to 'where it hurts'. Like myofascial trigger points, acupuncture points are believed to be responsive to physical or electrical inputs such as

needling,¹⁵ transcutaneous electrical stimulation,¹⁶ ultrasound and digital massage,¹⁷ moxibustion,¹⁵ laser treatments,¹⁸ and other electromagnetic therapies.¹⁹

Paralleling the growing popular use of magnets, biological mechanisms including influences on blood flow,²⁰ microvascular remodelling,²¹ oedema reduction²² and blockade of sensory neurons²³ have been identified as providing biological plausibility for the potential therapeutic benefits of static magnetic fields. If the application of permanent magnets does exert a physiological effect, especially when applied to electromagnetically active sites such as acupuncture points or trigger points, it seems appropriate to evaluate the practice of acu-magnet therapy and begin relevant research to determine its effectiveness.

Our two goals in conducting this literature review are to summarise the acu-magnet therapy literature and determine if current evidence justifies further investigation of acu-magnet therapy for particular clinical indications. We define 'acu-magnet therapy' as stimulation of an acupuncture point with a static magnetic field (SMF) that is generated by a permanent magnet.

Methods

We surveyed the journal literature to identify clinical studies involving the use of magnets applied to acupuncture points in humans. A professional librarian (NH) searched six electronic databases, including PubMed, AMED, ScienceDirect College Edition, China Academic Journals, Acubriefs, and the in-house Journal Article Index maintained by the Oregon College of Oriental Medicine Library. Each database was searched from inception. All searches occurred in December 2007, with two exceptions. Acubriefs was searched in January 2008. The China Academic Journals search was conducted in February 2006 for a closely-related study and could not be re-run in December 2007 due to loss of database access.

We employed various search strategies depending on the size and scope of the database. In one case, a simple keyword search using the term 'magnet' was sufficient to retrieve relevant articles with reasonable precision and recall. In most cases, a more sophisticated strategy involving multiple synonyms for permanent magnet- and acupuncture-related concepts, subject headings, truncation, and excluded terms was required (details available from author).

The primary author examined the resulting 308 references to identify articles for analysis, screening by title, abstract when it was available, and full text where necessary.

Inclusion and exclusion criteria

We selected studies for inclusion using the following criteria. *Study design* – clinical trials, case series and case reports were all included because our goal was to summarise as much of the clinical literature as possible. *Clinical indication* – we included studies involving any clinical diagnosis or medical condition in humans. *Type of magnetic field therapy* – only studies involving the stimulation of acupuncture points by application of permanent magnets were included. Studies reporting on electroacupuncture and transcranial magnetic stimulation were excluded. We also excluded experimental and animal studies. *Publication type* – duplicate publications were excluded. Editorials and letters were excluded because they fail to provide sufficient information with which to evaluate acu-magnet treatment parameters. Only English and Chinese language articles were included. Eighteen additional articles in Chinese met our inclusion criteria but were ultimately excluded from analysis either because the full text article could not be obtained or due to our limited resources for full and accurate translation.

Data extraction and synthesis

Six acupuncture researchers extracted data from the final 42 studies on: clinical condition, study design, number, age and gender of subjects, magnetic devices used, acu-magnet dosing regimen, control devices and/or control groups, outcomes, and adverse events. The authors summarised the extracted data. A synthesis of the controlled trials and observational studies is provided in Tables 1 and 2.

Results

Of the 42 articles reviewed,²⁴⁻⁶⁵ 31 were published in English and 11 in Chinese. Thirty four studies were conducted in China, five studies in the USA and three in Finland. All studies were published between 1986 and 2007. Five of the total 34 authors contributed more than one article. Articles appeared in 12 journals, 10 of which were Chinese medicine or acupuncture journals. The remaining two were Western medical journals.

Table 1 Summaries of case series

| Author/s year | Diagnosis | N | Magnetic device | Method of application | Site of magnet application | Duration of application | Results |
|--------------------------------|---------------------------------|------|--|--|--|-----------------------------------|--|
| Chen 1994 ²⁵ | Postpartum urine retention | 34 | Magnetic beads | Taped | Ear points: BL, KI, Urethra, Ureter, Ext & Int genital organs | Not specified | Overall 82.4% effective rate |
| Chen et al 1994 ²⁶ | Hypertension | 121 | 4mm x 2mm 300-500G | Taped x 1 week then changed | Ear points: <i>Chiangyaku</i> +/- <i>Shenmen</i> , HT, <i>Naogan</i> , <i>Shen</i> | 1 week each side x 2 weeks | Total effective rate on lowering BP was 83.2% |
| Colbert 2000 ²⁸ | Depression | 10 | Neodymium disks 1/8" x 1/16" | Sewn into headgear | Positioned over GV20 and 4 <i>Sishencong</i> points on scalp | 6 weeks – 116 weeks | Significant improvement in depression in 7 of 10 subjects |
| He 1993 ²⁹ | Various conditions | 456 | Rare earth magnets | Electroacupuncture instrument | Various points indicated in sample cases | 30 minutes | 77% cured, 22% improved, 1% failed |
| Hou et al 1990 ³⁰ | Periarthritis | 65 | Magnetic blunt-tip needles | Perpendicular needle insertion | Pain point of arthritis + one of LI4, SI4, SI3, TB5 | 1-3 minutes per pain point | Total effective rate was 100%. No measure for 'no improvement' |
| Jiang et al 1995 ³³ | Anaesthesia for thyroid surgery | 422 | Permanent magnetic pearls | Taped | Ear points: Neck, <i>Shenmen</i> , Lung, Secretory glands | Throughout the surgical procedure | Excellent (62.3%), good (25.6%), acceptable (6.9%), failure (5.2%) |
| Jin et al 1996 ³⁴ | Labour pains | 462 | Magnetic pearls | Not described | Ear points: <i>Shenmen</i> , Uterus | During labour | Excellent or good in 74% |
| Li et al 36 2003 | TMD | 66 | Magnetic tapes | Taped | <i>Xia Guan</i> , <i>Jia Che</i> , <i>Ting Gong</i> , <i>Yi Feng</i> plus <i>ah shi</i> points | Magnets changed every 48 hours | Total effectiveness: 93.9% |
| Li et al 2005 ⁴⁰ | Peripheral facial paralysis | 1500 | Magnetic needle, 25mT | Bipolar needling | 6 points on face plus <i>Qianzheng</i> , ST4, LI 4 | 20 minutes (inferred) | 1385 cases recovered. Total effective rate was 99.93% |
| Ma et al 1999 ⁴⁶ | Diabetes mellitus | 30 | 25mT | Not described clearly | Body points: <i>Yi Shu</i> , KI <i>Shu</i> , CV12 | 30 minutes | 25/30 (83%) patients had significantly decreased fasting blood with magnet glucose associated treatment P<0.05 |
| Mao et al 1996 ⁴⁷ | Soft-tissue injury | 54 | Iron sheet 8000G magnetic flux | Fixed with adhesive plaster | Pain site | Not described | 88.9% obtained excellent therapeutic effect, 11.1% were improved |
| Petterson 2004 ⁴⁹ | Congenital nystagmus | 1 | Acu-band 800GP | Taped first, then ear pierced | Oculomotor point on ear | Several days to years | Nystagmus controlled, visual acuity improved for 4-10 days |
| Shan 1986 ⁵⁰ | Neurasthenia | 160 | Magnetic wafers + rotating device | Flexible tape Rotating heads over acupoint | Acupuncture points chosen according to TCM syndrome | Intermittent placement x >30 days | Magnetic wafers effective for 72%; rotating magnet: effective for 62.5%; wafers + rotating magnet: effective for 85% |
| Smith et al 2004 ⁵¹ | ADHD and ADD, Bipolar | 13 | Magnetic beads | Not described | Posterior ear <i>Shenmen</i> + other undefined acupuncture points | 6 weeks | Eight of 10 completers show decrease in Conners score at least 5 points. Effects last >1 yr |
| Suen et al 2002 ⁵² | Insomnia in elderly | 60 | Magnetic pearls | Taped | Ear points: <i>Shenmen</i> , HT, KI, LR, SP, Occiput, and Subcortex | 3 weeks | Significant improvement in sleep time and sleep efficiency |
| Toysa 1995 ⁵⁸ | Migraine | 9 | 5mm diameter, 2.5mm thickness, 700-800G | Not described | Unilateral or bilateral GB 34 (in some patients BL57) | 1-2 weeks to several weeks | 8 of 9 patients responded positively to magnet therapy. Relapses also responded well |
| Toysa 1997 ⁵⁹ | Headache | 13 | 5mm diameter, 2.5mm thickness, 700-800G | Not described | GB34 | 1-2 weeks or more | 7/13 dropped out due to poor results or adverse events, 6 reported improvement |
| Toysa 1998 ⁵⁷ | Phantom limb pain | 10 | Ferromagnets 5mm diameter, 2.5mm thickness, 700-800G | Not described | Proximal endpoints of the arm and leg meridians | 2 weeks | Majority of patients reported relief of pain, but only when wearing magnets |
| Wang et al 2007 ⁶¹ | Obesity | 100 | Magnetic needles | Needling | Body acupuncture points according to TCM syndrome diagnosis | Needles retained for 30 minutes | 97% were markedly effective or improved, 3 cases failed. Average weight loss for men 9.5kg, 7.3kg for women |
| Wang et al 1997 ⁶⁰ | Breech presentation | 45 | Magnetic beads | Not described | Ear points | 3 days | Successful foetal correction in 84%, no change in 16%. |
| Zhao et al 2002 ⁶³ | Auricular pseudocyst | 35 | 1.5cm magnetic piece | Not described | On pseudocyst | 1 week per course | 17 cases: the pseudocyst (<2cm) disappeared in 1 week, 12 cases in 2 weeks and 3 cases in 3 weeks |

N – number of subjects; TMD – temporomandibular dysfunction; ADHD – attention deficit hyperactivity disorder; ADD – attention deficit disorder

Table 2 Summaries of controlled trials

| Author/s year | Diagnosis | N | Magnetic device | Method of application | Site of magnet application | Control | Results |
|------------------------------------|-------------------------------|-----|--|---------------------------------------|--|---|---|
| Carpenter et al 2002 ²⁴ | Hot flashes in breast cancer | 11 | Magna-bloc alternating polarity | Double stick tape | Acupuncture points, not named | Not clearly identified | Significantly more hot flashes in magnet group |
| Chen 2002 ²⁷ | Diabetes | 1 | 2500G magnet discs | Not described | Ear pts: Pancreas point, thalamus point, decrease-pressure point | Placebo disk | Decrease in fasting glucose 194±15mg/dl (while wearing sham) and 136±10mg/dl (while wearing active magnet) (p<0.005) |
| Huang et al 1997 ³¹ | Hiccup | 84 | Magnetic needles | Needle insertion | Ear pts: Diaphragm, ST, SP, Sympathetic, <i>Shenmen</i> , LV | Stainless needles at same acupuncture points | Treatment group: effective rate 98.2% Control group: effective rate 18.7% |
| Jiang et al 2003 ³² | Hypertension | 60 | Magnetic needle | Needle insertion | LI11, ST40, LR3 | Captopril | Treatment group: effective rate 93.3% Control group: effective rate 86.% (P>0.05) |
| Lian et al 2003 ³⁸ | Stroke | 100 | Magnetic beads | Not described | Scalp motor area | Magnetic electronic apparatus | Treatment group effective rate: 90.0% Control group effective rate 74.0% (P<0.05) |
| Liang et al 1994 ³⁵ | Chronic ulcers in lower legs | 50 | Ferrite magnetic block | Taped | Local: surface of the ulcers | Topical antibiotics | Wound healing in significantly shorter time than in control group |
| Li et al 1999 ³⁹ | TMD | 240 | Magnetic tapes | Taped | <i>Xia Guang, Jia Che, Ting Gong, Yi Feng</i> | Regular occlusive splint therapy | Significant improvement in both groups, but no difference between groups |
| Li et al 1998 ⁴² | Gall bladder evacuation | 73 | Permanent (Ru-Fe-B) magnets | Taped | GB <i>Shu</i> , 2 spots where the GB ultrasonic imaging was taken | Vitamin C tablets | Magnet group: volume reduced by half, contraction increased 29.69%; no change in control group |
| Li et al 2000 ⁴¹ | BPH | 64 | Permanent (Ru-Fe-B) magnets | Taped | CV4, CV1 | Vitamin C tablets | Magnet group: blood flow rate increased 35.3% and blood flow volume increased 1.43 times |
| Li et al 2003 ³⁷ | Mental fatigue with driving | 40 | Magnetic tip of needle | Attached by negative pressure | GV14, PC6 | Non-acupoints 1.5 cm away | Significant pre to post decrease in LF power and increased in HF power (p<0.05). No significant pre to post differences in control group |
| Li et al 2004 ⁴³ | Driving fatigue | 40 | Magnetic tip needle | Attached by negative pressure | GV14, PC6 | Non-acupoints | Significant difference in psychophysiological and subjective changes |
| Liu et al 1991 ⁴⁵ | Nausea and vomiting | 206 | Strontium-calcium containing ferrite | Metal disk in cotton band | <i>Neiguan</i> (PC6) unilaterally | Group 2: iron disk Group 3: steel ball | Treatment group effective rate 89%; Group 2 effective rate 21.7%; Group 3: effective rate 0% |
| Liu et al 1997 ⁴⁴ | Chemotherapy induced vomiting | 510 | Magnetic plate (two different strengths) 120mT n=184, 60mT n=161 | Magnetic plate embedded in cloth belt | <i>Neiguan</i> (PC 6) | Five control groups: iron plate at PC6 n= 23; steel bead at PC6 n=22; magnetic plate (2000mT) at ST36 n=25; magnetic plate (120mT) at ST 36 n=25; drugs only n=70 | Overall effectiveness Experimental groups: 120mT at PC6 92.4%; 60mT at PC6 89.4% Control groups: iron plate at PC6 21.7%; steel bead at PC6 0%; 2000mT at ST36 28.0%; 120mT at PC6 32%; drugs = 47.2% |
| Mao et al 1996 ²⁷ | Cholelithiasis | 491 | Rotary magnetic field | Head of device held over gall bladder | Over gall bladder plus ear pts: <i>Shenmen</i> , Sympathetic, GB, LR, ST, Duodenum, Subcortex, & Eye | Vaccaria seed | Treatment group effective rate on symptoms 90.9% Control group effective rate on symptoms 96.4% Stone removal: treatment group 80.6% vs 26.2% (P<0.01) |
| Suen et al 2002 ⁵⁴ | Insomnia in elderly | 120 | Group C: magnetic pearls | Taped to ear pts | Ear pts: <i>Shenmen</i> , Heart, Kidney, Liver, Spleen, Occiput, Subcortex | Group A <i>Junci medulla</i> stem n=30; Group B Vaccaria seed n=30 | Group C: Significant improvement in sleep behaviours compared to control especially in females |
| Suen et al 2003 ⁵⁵ | Insomnia in elderly | 15 | Magnetic pearls 6.58G | Not described | Ear pts: <i>Shenmen</i> , HT, KI, LR, SP, Occiput, and Subcortex | <i>Junci medulla</i> stem & <i>semen vaccariae</i> seed | Significant difference of nocturnal sleep immediately after therapy and at 1, 3 and 6 months |
| Suen et al 2007 ⁵³ | Low back pain in elderly | 60 | Magnetic beads/pellets | Taped | Ear pts: <i>Shenmen</i> , buttock, BL, KI, lumbosacral vertebrae, LR, SP | <i>Semen vaccariae</i> | Improvement on pain VAS; difference between groups was significant (P<0.001); peak effect immediately after treatment; gradual increase in pain at 2 weeks |
| Tong et al 1994 ⁴⁶ | Obesity | 356 | Ear ball | Taped to ear pts | Ear Pts: <i>Shenmen</i> , ST, LI, KI HT, LU, SP, TW, Endocrine | Needle acupuncture | >15kg weight loss in 97.2% with needle treatment and 93.8% with magnet treatment |
| Wu 1989 ⁶² | Ascariasis in children | 114 | 8 magnets worn on undergarments | Magnets + oral magnetized water | Magnets on body points: CV12, ST25, CV6, CV4, CV8 | Piperazine citrate or distilled water | Treatment group effective rate: 95.2%; piperazine group 77.1%; distilled water group 4% |
| Zhang et al 2004 ⁶⁴ | Mental depression | 89 | Magnetised plate: neodymium | Not described | BL15, PC6 | Fluoxetine 20-40mg qd | Treatment group: effective rate 93.33%; control group effective rate 72.7% (P<0.01) |
| Zhang et al 2006 ⁶⁵ | Hyperlipidaemia | 60 | Magnet on needle handle | Needle insertion | ST40 and PC6 | Non magnetic needling | Blood lipid levels: no difference between groups |

N – number of subjects

Thirty two clinical indications were evaluated in the 42 studies. Three studies were conducted on insomnia in the elderly.^{52;54;55} Two studies each were conducted on diabetes,^{27;46} obesity,^{56;61} hypertension,^{26;32} temporomandibular joint disorder,^{36;39} depression,^{28;64} chemotherapy induced vomiting,^{44;45} headache^{58;59} and gallbladder disease.^{42;47} Single studies were conducted on stroke,³⁸ facial paralysis,⁴⁰ benign prostatic hyperplasia,⁴¹ hyperlipidaemia,⁶⁵ hiccup,³¹ pinworms,⁶² chronic leg ulcers,³⁵ phantom limb pain,⁵⁷ pseudocyst,⁶³ magnets as an adjunct anesthetic,³³ and various psychiatric and neurological disorders,^{37;43;49-51} musculoskeletal,^{30;48;53} and women's health conditions.^{24;25;34;60}

Study designs

We included all research study designs in this review because our intent was to provide a comprehensive summary of the available literature and generate hypotheses for further research. We identified an equal number of case series (or case reports) and controlled trials. The controlled trials were of consistently poor quality as defined by the Jadad scale.⁶⁶ The only Jadad criterion met by the studies was the use of words such as 'random', 'randomly' or 'randomised.'

Demographics

The total number of subjects reported in the 42 studies was 6453, with 3101 males, 2791 females, and 561 subjects whose gender was not described. Age of study participants varied from 7 years to greater than 82 years. The majority of the studies (30 out of 42, or 71%) involved fewer than 100 subjects: 16 studies had 50 or fewer subjects, and 14 had between 51 and 100 subjects. Only two studies (both case series) were of a large scale. Li et al reported on 1500 patients with peripheral facial paralysis,⁴⁰ and He et al²⁹ described the results of acupuncture needling in 808 subjects (the majority were paediatric patients) with a wide variety of conditions. Except for gender specific disorders (eg labour pain,³⁴ prostate disorders⁴¹) studies included participants of both genders.

Outcomes

The majority of studies (37 out of 42, or 88%) reported positive outcomes. Only one study reported no benefit.²⁴ Patients in that study experienced no

improvement or a worsening of hot flush symptoms associated with magnet application. The results of another study involving patients with migraine headache were inconclusive because of a high dropout rate; 7 of 13 participants dropped out because of poor outcomes or adverse reactions.⁵⁹ In three controlled trials, that studied the effects of magnets on high blood pressure,³² temporomandibular joint disease,³⁹ and hyperlipidaemia,⁶⁵ improvement was observed in both the active and control groups, with no significant difference between groups.

Magnets: devices, materials, strengths, polarities and methods of application

Forty of the 42 studies provided at least partial descriptions of the magnetic devices applied, which included three types of magnets: flat rectangular or circular discs, beads or pellets, and magnetic acupuncture needles. Many studies neglected to report material composition of magnets and/or magnetic field strengths. In other studies there was ambiguity as to whether the reported strength was the *manufacturer's Gauss rating* (the internal core strength of the magnet) or the *surface field strength*. *Surface field strengths* of therapeutic magnets usually range between 300G to 2500G. In two instances,^{48;65} the magnetic intensities were reported respectively as 8000G and 5000G, which we assume were the *manufacturer's Gauss ratings* rather than the *surface field strengths*.

Of 20 studies using plates or discs, 14 reported dimensions and magnetic strengths. Seven studies used circular discs ranging from 1.5 to 7mm in diameter and 1–2.5mm in thickness. Seven studies used rectangular or square plates varying between 8–50mm in length and 2–7mm in thickness. Magnetic beads or pellets were used in 12 studies, of which eight provided dimensions and six provided magnetic field strengths. Diameters ranged from 0.3–13mm and magnetic strengths ranged from 50G to 3000G. Eight studies used magnetic acupuncture needles made of rare earth metals. Tip dimensions were not given but were assumed to be similar to typical Chinese acupuncture needles. Five studies reported magnetic needle strengths of 180G to 5000G.

Only 7 of 42 studies mentioned which pole of the magnet faced the skin. Terms such as 'alternating pole magnets'²⁴ or 'disparate poles'³⁸ or 'north pole'^{31;35;44;64} were used without a precise definition

Table 3 Methods of magnet application

| | |
|--------------------------------------|----|
| Taped | 14 |
| Magnetic needles | 6 |
| Sewn into a garment | 4 |
| Handheld in place for treatment time | 2 |
| Drink magnetised water | 1 |
| Not described | 18 |

Table 4 Sites of magnet application

| | |
|--|----|
| Auricular acupuncture points | 20 |
| According to acupuncture diagnostic theory | 15 |
| Local points | 8 |
| Distal points | 2 |
| Scalp/head points | 2 |
| Unspecified or not described | 1 |

Note: some studies used combinations of the above sites of application

Table 5 Comparison interventions

| | |
|------------------------------------|---|
| Non-magnetic needles or ear seeds | 9 |
| Non-magnetic object | 3 |
| Herbs or vitamins | 2 |
| Applied to an non-acupuncture site | 2 |
| Usual care | 1 |
| Electrical acupuncture | 1 |

Note: some studies used combinations of the controls listed above

of terms. A commonly held belief among clinicians is that different magnetic pole applications lead to different outcomes, but this belief has not been tested in any clinical trials. Furthermore there is no established naming convention among clinicians for defining north and south poles.

Methods of magnet application were not described in 18 of 42 (43%) of studies (Table 3). When reported, discs, plates and beads or pellets were most often attached to the skin with adhesive tape. In two cases, the disc or beads were rotated above the skin without physical contact.^{47,50} Magnetic acupuncture needles were either inserted 0.5–1.5 cun depending on location,^{31,61,65} or simply touched the skin without penetration.^{30,43} In four studies, magnets were sewn into garments and worn at the desired

location.^{28,44,45,62} In one instance, children drank magnetised water to treat ascariasis.⁶²

The sites for magnet application also varied (Table 4). Many researchers (48%) applied magnets to auricular (ear) acupuncture points. The ear acupuncture points most often used were Shenmen, Kidney, Liver, and Occiput. Body and scalp acupuncture points were also stimulated, as were local and distal points in accordance with acupuncture diagnostic theory. The choice of acupuncture points varied depending on clinical indication.

Frequency and duration of magnet application

There was no standard protocol for frequency or duration of magnet application in the studies reviewed. In the case series, durations of application varied from 1–3 minutes³⁰ to near continuous wear for several years.^{27,49} In the controlled trials, frequency of application varied from a continuous 72 hour wear to continuous 30 day wear with removal and replacement of magnets every 2–3 days.

Control devices and control groups

The most common sham control device used in the controlled trials was a non-magnetic needle or ear seeds, applied to the same points as the magnetic needles or magnets. Non-magnetised metal objects were also used as controls as were herbs and vitamins. Magnetic devices were sometimes applied to non-acupuncture sites or non-magnetised discs to non-acupuncture sites.

Magnets as adjunct to standard care

Although not always specifically described as such, in more than half the studies, magnets appear to have been used as an adjunct to standard care. In some cases magnets were applied in addition to acupuncture needling, moxibustion or Chinese herbs. Magnets on acupuncture points served as an adjunct to standard care for diabetes management,^{27,46} antihypertensive therapy,²⁶ antiemetic therapy^{44,45} and antipsychotic therapy.⁵¹ In studies of insomnia in the elderly, magnets served as a stand alone therapy.^{52,54}

Adverse events

Adverse events included an exacerbation of hot flushes²⁴ and skin irritation due to the adhesives that held the magnets to the body.⁵²

Discussion

Our goals in conducting this literature review were: 1) to summarise the outcomes and techniques of various acu-magnet intervention studies that have been published to date, primarily in English; and 2) to identify clinical conditions with positive outcomes, and assess whether a rigorous investigation of acu-magnet therapy for specific conditions is warranted. The most striking observation from this review was the overwhelmingly positive outcomes reported. A note of caution is that 34 of the 42 studies evaluated were conducted in China where there is a significant bias toward publishing positive trials.⁶⁷ In addition, the studies were either case series or poor quality controlled trials, so no claims for the efficacy of acu-magnet therapy can be made at this time. Nonetheless, the large number of subjects (a total of 6453) in these studies suggests that many patients are treated with acu-magnet therapy in clinical practice, particularly in China, and report meaningful clinical improvement.

The single N of 1 study warrants special comment.²⁷ When evaluating clinical benefit for an individual patient, the N of 1 randomised controlled trial ranks highest in terms of evidence based hierarchy for that individual. An N of 1 controlled trial, involves the use of a crossover design to treat a single patient. In random order, the patient receives one period of active therapy and one period of placebo. The patient is kept blind to allocation, and treatment outcomes are monitored. In her N of 1 study, Chen used ear acu-magnet therapy, as an adjunct to standard care, to treat a patient with long standing diabetes mellitus.²⁷ The study looked at fasting blood glucose levels as the primary outcome measure. For seven days placebo discs were applied to the pancreas point of the left ear and the thalamus points of both ears. Then after a three day washout period, 2500G magnetic discs were applied to those same auricular acupuncture points. Results of this trial showed that fasting blood glucose during the placebo week was 194 ± 15 mg/dL. During the active magnet week, fasting glucose dropped to 136 ± 10 mg/dL. Having determined that auricular magnets applied to this patient using this dosing regimen were effective, the clinician researcher then used magnetic ear clips for ongoing treatment as an adjunct to standard diabetes management. At four year follow up, evaluation of this patient showed a

persistent decrease in fasting blood glucose and HbA1C with no further progression of the patient's diabetic neuropathy.

We believe that the preliminary evidence for two conditions, insomnia in elderly patients^{52:54} and glucose control in diabetics,²⁷ justify further clinical trials to evaluate the effectiveness of acu-magnet therapy. The studies of Suen et al^{52:54} and Chen²⁷ should be replicated as the first step in this program of research on acu-magnet therapy.

Information gained from this review will help to guide protocol development for future studies. Of particular relevance to future trials is the fact that adverse reactions associated with acu-magnet therapy were reported in only two studies. In one study, high intensity magnets (surface field strength ~2000G) were left on six clinically 'powerful' acupuncture points for 72 hours, to treat hot flushes.²⁴ Participants in this study had an exacerbation of their hot flush symptoms. An important lesson learned is that dosing parameters such as number of acupuncture points to treat simultaneously, the strength of the magnet and duration of magnet application should be tested and optimised prior to conducting a clinical trial. Skin irritation associated with the adhesive securing the tape may need to be considered when adverse reactions are encountered.

Acu-magnet therapy research shares many of the methodological challenges faced by acupuncture research in general. At a minimum, a rationale for acu-point selection and style of acupuncture used, need to be justified. Acupuncture points might be selected for a number of reasons including: following traditional Chinese medicine theory or Japanese style acupuncture or treatment of *ah shi* or trigger points, or using one of the acupuncture microsystems such as Korean hand acupuncture, scalp acupuncture or auriculotherapy. The acupuncture points should be described with the standard nomenclature of the World Health Organisation.⁶⁸

Specifics of treatment, including the magnetic device itself (material composition, strength, dimensions and polarity) and the SMF dosing regimen should be detailed. The exact dosing regimen should include the site and method of magnet application, and frequency and duration of application. The dosing regimen should be pretested, optimised and precisely documented. We discovered in this review that the most lasting beneficial effects

were associated with long term magnet use.^{27:28-49:55}

When magnets are applied for a prolonged time period or when patients self-apply magnets, the small magnetic discs may be secured to the skin via earrings or clips (in the case of auricular points) or sewn into a garment to be worn over the acu-point. If, on the other hand, high intensity magnets are applied during an in-office treatment, the method of application may be a needle, a stronger magnet or perhaps an electromagnetic device.

Polar configuration of the magnet(s) used is a special concern in the acupuncture paradigm as acupuncturists may use north and south poles on a pair of acupuncture points to either 'tonify' or 'disperse'. Terminology used to describe the poles of magnets is confusing in the literature. The term *bionorth* is used by some clinicians to describe what physicists denote the *south pole* of a magnet, ie the side of the magnet that attracts the south seeking needle of a compass. For clarity of meaning and consistency of reporting, we recommend that authors state which pole faced the skin and then define that pole with reference to a compass and/or a geographic pole. For example, one might report 'we applied the 'north' pole of the magnet to the skin and we define the 'north pole' as that side of the magnet that attracts the north seeking compass needle.' Or researchers might also report, 'When suspended by a string, the side of the magnet that faced the skin orients itself to face the earth's geographic south pole'.

Blinding subjects in acu-magnet therapy trials is problematic because magnetic properties are

readily detected, making it easy for trial participants to deliberately or unintentionally discover whether their device is magnetised or not. We may not be able to use low strength magnets as sham controls because we still do not know the minimal effective dose of SMF therapy. Effects have been reported with magnets having field strengths as low as 66G.⁵⁵ Another potential control device used in some studies is *semen vaccariae*, a small seed which the investigators assumed to have no therapeutic effect as long as no pressure was applied to it, *semen vaccariae*, however, is considered a significant blood 'vitaliser' by Chinese herbalists, which may preclude its use as a sham control. Non-acupuncture sites may also be used as sham controls; however, many so-called 'sham points' have a physiological effect when stimulated with a needle. It is unclear whether or not a SMF placed anywhere on the skin might also have an effect.

Strengths and limitations of this review

The primary strength of our literature review is that it organises and summarises the available literature on acu-magnet therapy. No previous reviews of the acu-magnet literature have been conducted. Another strength is our sampling of related Chinese language literature. The limitations pertain to being unable to access other language literature, especially Japanese. Acu-magnet therapy is commonly practised in Japan. We also acknowledge the limitation of having no access to EMBASE, an electronic database where much of the European literature is found. We consider

Table 6 Questions to be addressed in future research on acu-magnet therapy

1. For what conditions should acu-magnet therapy be evaluated?
2. Should acu-magnet therapy be used as an adjunct to standard care?
3. What is the optimal site of magnet placement? Body, scalp, or ear acu-point?
4. Should the acu-points be *ah shi* points or acu-points specific to a symptom, disease or Chinese medicine differential diagnosis?
5. What is the optimal magnetic field strength for use on acu-points, if there is one?
6. Do different magnetic poles have distinct dispersing or tonifying effects?
7. Should magnets be applied in pairs, using north and south poles alternately?
8. How long should the magnet remain on the acu-point?
9. How often should a patient be treated with acu-magnet therapy?
10. Is there an optimal number or a limit to the number of acu-points that should be treated a treatment session?
11. What type of sham control is appropriate for a clinical trial of acu-magnet therapy?
12. Do we need to control for contact/pressure when identifying appropriate sham controls?
13. Are there any co-treatments or additional methods that increase or decrease SMF effectiveness such as stimulating the affixed magnet through massage or tapping?

this project a first step toward developing a more rigorous program of research into acu-magnet therapy.

Future directions

This review has generated a number of questions to be answered in future clinical trials. These questions are summarised in Table 6. We recently initiated a small pilot study in an attempt to replicate Chen's findings of improved glucose control in diabetic patients with the use of ear acu-magnets.²⁷ Our study intends to evaluate the use of non-magnetized pellets as sham controls. We will assess a dosing regimen of between 3-5 magnets (800G surface field strength, north pole facing the skin) applied for a one week period. If our findings show promise we will move forward with a full scale randomised controlled trial using magnets and sham controls to assess the efficacy of acu-magnet therapy as an adjunct to standard care for Type 2 diabetes mellitus. If our findings are negative we will conduct another pilot study using an alternate SMF dosing regimen.

Conclusions

In the absence of any consistent terminology we coined the term *acu-magnet therapy* to describe the application of magnets on acupuncture points as a distinct modality. We believe that further investigation of acu-magnet therapy as an adjunctive treatment for diabetes and for insomnia in the elderly is warranted based on findings from this review. Future trials should be rigorously conducted according to STRICTA⁶⁹ and CONSORT⁷⁰ guidelines, while paying special attention to the unique methodological and dosimetry issues associated with static magnetic field therapy.⁹ The overall poor quality of the studies in this review precludes any evidence based treatment recommendations at this time.

Conflict of interest

The authors report no conflict of interest with any of the material presented in this manuscript.

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Summary box

Many practitioners apply magnets to acupuncture points as therapy

This study systematically reviewed all the available clinical trials

37 out of 42 studies reported therapeutic benefit of magnets

The quality of the evidence is not sufficient to make treatment recommendations

The positive findings are sufficiently interesting to justify further research

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