The effects of auricular acupuncture on smoking cessation may not depend on the point chosen – an exploratory meta-analysis

Adrian White, Russell Moody

Abstract

Introduction Auricular acupuncture is given as a treatment for drug dependence. Points are usually chosen on the assumption that the body is represented somatotopically in the ear, although there is no anatomical basis for this. In clinical trials, sham treatment is often given at points that are supposedly ‘incorrect’ for the condition, in the belief that they are inactive. The aim of this study was to explore whether there is any difference in the effectiveness of auricular acupuncture at ‘correct’ and ‘incorrect’ points.

Methods Controlled trials of semi-permanent auricular acupuncture or acupressure for smoking cessation were systematically located, and the results combined in exploratory meta-analyses which took into account the study quality.

Results Thirteen studies were included. Combining ten studies showed auricular acupuncture at ‘correct’ points to be more effective than control interventions, odds ratio 2.24 (95% CI 1.61, 3.10), a result which is confirmed in the four high validity studies. Other analyses showed inconsistent results between all studies and higher quality studies. Comparisons of three higher quality studies suggest that ‘correct’ and ‘incorrect’ point acupuncture is no different (odds ratio 1.22, CI 0.72, 2.07); and two studies showed that ‘incorrect’ point acupuncture may be more effective than other interventions (odds ratio 1.96, CI 1.00, 3.86).

Conclusion Auricular acupuncture appears to be effective for smoking cessation, but the effect may not depend on point location. This calls into question the somatotopic model underlying auricular acupuncture and suggests a need to re-evaluate sham controlled studies which have used ‘incorrect’ points. Further experiments are necessary to confirm or refute these observational conclusions.

Keywords

Ear acupuncture, smoking cessation, meta-analysis.
After this chance observation by Nogier in the 1950s (Paul Nogier, British Medical Acupuncture Society scientific meeting presentation), Nogier knew that local healers often cauterised a particular part of the ear (on the inferior crus of the anti-helix) in order to treat back pain; one day, the rays of the sun slanted across the ear that he was examining, and highlighted the contours of the underlying cartilage. The cartilage appeared to be divided up into segments that reminded Nogier of the appearance of the spinal column. In examining patients with other conditions, he explored the idea that parts of the body might also be represented, and subsequently drew up a chart showing the body somatotopically represented, upside down, on the auricle. The chart has subsequently become more detailed, it was standardised in 1990, and it is recommended for use in diagnosis and treatment of a range of conditions.

While chance observations have, of course, occasionally proved to be the source of useful therapeutic advances (e.g., the discovery of penicillin), they should not be accepted uncritically, particularly when there is no known mechanism for them. It seems reasonable to hypothesise that stimulation of the auricle can have physiological effects because it has an extensive supply of nerves and blood vessels, but rather less likely that these effects would be limited to specific parts of the body. We decided therefore to review the literature on smoking cessation systematically to explore whether it was compatible with the concepts that a) auricular acupuncture has an effect when compared with other interventions; b) the effects of the correct and incorrect points are not different; and c) incorrect points are active when compared with other interventions.

**Methods**

We performed a systematic literature review with exploratory meta-analysis to compare the effectiveness of auricular acupuncture at correct and incorrect points, and other interventions for smoking cessation.

**Search and study selection**

Searches have been conducted cumulatively for the Cochrane Review of acupuncture for smoking cessation since it was first published in 1997. The latest search was conducted in January 2005 by the Tobacco Addiction Group specialised register, and included searches of the Cochrane Controlled Trials Register (Issue 4, 2004), Medline (Webspirs, to January week 2, 2005), Embase (Webspirs to 2004/12), BIOSIS Biological Abstracts (Webspirs, to 2004/10), PsycINFO (Webspirs, to 2004/12), Science and Social Sciences Citation Index (ISI Web of Science updated 12/1/2005) and AMED (Webspirs to 2004/12). The CISCOM database was last searched in 2001. The Medical Acupuncture Research Foundation Acubriefs website was searched for the first time in January 2005. The free text or keyword search strategy was (acupuncture OR acupressure OR electro?acupuncture) AND (tobacco OR smoking).

We hand-searched all reports obtained from these searches, and considered all prospective controlled trials for inclusion in this review, not just prospective randomised trials. In this way we increased the quantity of data at the cost of reducing quality. We included trials in adults in which the experimental group received a semi-permanent acupuncture needle or device (needle, bead or suture) placed in the ear at the time of smoking cessation and left in situ for more than one day. We excluded studies that used individual, discrete sessions of either ear acupuncture or body acupuncture as the experimental intervention, on the basis that these interventions could have only a temporary effect on withdrawal symptoms; if this kind of treatment was used as an adjunct to auricular acupuncture, we noted it but did not consider it to be active. Studies could have any control intervention, including psychological therapy or sessions of body or ear acupuncture but we excluded ‘no treatment’ or ‘waiting list’ as these would have minimal expectation. The decision on which studies to include was made by the first author.
Data extraction
The two authors extracted the data independently, including: group sizes, site and duration of indwelling acupuncture or acupressure treatment, other treatment given, details of control intervention, timing of outcomes, and numbers not smoking. We labelled all control arms using auricular acupuncture as ‘incorrect’ points, without taking any account of whether they were thought to be ‘incorrect’ for smoking cessation or thought not to be points at all. We included outcome data from the earliest time point available after treatment as this would be likely to show the greatest effect of treatment (and the least influence of relapse). The outcome denominator was the initial group size, and we recalculated quit-rates from the reported percentage success, if necessary, counting all dropouts as failures. We assessed the internal validity of each study by awarding one point each for randomisation, concealment of allocation, subject blinding, assessor blinding, control for co-interventions, either full accounting of withdrawals and follow-ups or including of all dropouts as relapsed, and biochemical validation of cessation eg with expired carbon monoxide measurement. Criteria had to be positively reported to qualify (eg for control of co-interventions, all other anti-smoking interventions had to be either given to both groups, or recorded and then accounted for statistically in the analysis).

Analysis
We compared auricular acupuncture at correct points with other control interventions, auricular acupuncture at correct points with incorrect points, and auricular acupuncture at incorrect points with other interventions. In each case, individual study results were combined in a meta-analysis, using the fixed effect methods because all studies measured the same outcome. We used the inbuilt analysis software in Review Manager 4.2.7 (The Cochrane Collaboration, 2005). Results are expressed as an odds ratio, ie the ratio of quitters to non-quitters in the treatment group divided by the same ratio in the control group, which has a value of 1.0 when treatment has no effect and is expressed on a logarithmic scale. Heterogeneity was assessed by the I² method, considering values over 50% as heterogeneous.

Each analysis was performed twice to take account of the effect of quality; the second analysis included only studies scoring at least five points for validity.

Results
We located 13 controlled studies, 10–13 the main characteristics of which are presented in Table 1. In all studies that used semi-permanent needles, the experimental and control groups had the same duration of treatment. We used the measurement at the end of treatment, except the study by Machovec and Man where the only results reported were at six months.14 The internal validity of studies varied, as shown in Table 2.

The study by Martin and Waite was conducted in a sequence of three phases: phase one, continuous auricular acupuncture; phase two, continuous acupuncture at an ‘incorrect’ point in the ankle; phase three, comparison of cut-off needles (ie acupressure) at ‘effective’ and ‘incorrect’ points in the ear.13 Results for the separate arms in the third phase were not reported and therefore we had to exclude this phase.

There were discrepancies in two reports: in one,15 60 smokers were enrolled but the results table states 50 (we used 60, conservatively) and in another we used data from text and figure in preference to the table.16

In the study by Man,17 patients were allocated to treatment groups according to where they lived – within the city of Winnipeg or in the neighbouring country. Since this introduces significant allocation bias, we debated whether to exclude this study. We finally decided to include it in the main analysis, but exclude it from the sensitivity analysis that was restricted to high quality studies.

The results of the comparisons of all studies and those of higher quality are presented in Figure 1 and summarised in Table 3. Firstly, acupuncture at ‘correct’ points is more effective than other interventions (P=0.0001) but there is considerable heterogeneity between the studies. However, the effect is robust because the four high quality studies also show a significant difference (P=0.006) with no heterogeneity. Secondly, in an overall analysis, acupuncture at correct points is more effective than at incorrect points (P=0.01), but the three largest (therefore most heavily weighted) studies show no effect, and restricting the analysis to the higher quality studies shows no difference between the two forms of acupuncture (P=0.47), though the studies still show heterogeneity.
Thirdly, incorrect point acupuncture is no different from other interventions (P=0.28) but the two high quality studies show a strong trend in favour of the acupuncture (P=0.05), without any heterogeneity.

**Discussion**

The results of this review suggest that auricular acupuncture is more effective than a range of other interventions for smoking cessation, but that treatment at 'correct' points is probably no different from treatment at 'incorrect' points. This finding relies on the higher quality studies. These results may be a significant challenge to the concept of somatotopic representation of the body on the auricle. It is important to recognise that the methodology of this analysis is exploratory and not hypothesis-testing because it combines data from studies that have different settings and methods. To confirm these findings, we would have to compare correct point, incorrect point, and another intervention in a single study. As it happens, two studies in this review did that: both show no difference between the effects of

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**Table 1** Continuous auricular acupuncture or acupressure for smoking cessation: characteristics and results of controlled trials

<table>
<thead>
<tr>
<th>Number and names of points used* (days applied), any other intervention</th>
<th>Control group interventions (ear points unless stated)</th>
<th>Control group n/N</th>
<th>Measurement points, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circo et al, 1985</td>
<td>3 Respiratory, Aggression, Sensory (15), psychotherapy</td>
<td>a) psychotherapy + illustrations</td>
<td>12/30</td>
</tr>
<tr>
<td>Gilbey &amp; Neumann, 1977</td>
<td>2 bilateral Lung (7)</td>
<td>2 studs, 'incorrect' point (Kidney) bilateral</td>
<td>16/48</td>
</tr>
<tr>
<td>Gillams et al, 1984</td>
<td>1 Lung (28)</td>
<td>a) 1 stud, 'incorrect' pt</td>
<td>8/27</td>
</tr>
<tr>
<td>He et al, 1997</td>
<td>6 seeds (21), body EA, ear acupuncture</td>
<td>6 seeds in 'incorrect' points plus 6 sessions of ear acupuncture and body EA; to 'incorrect' points</td>
<td>0/20</td>
</tr>
<tr>
<td>Leung, 1991</td>
<td>4 bilateral Lung, Shenmen (7)</td>
<td>a) behaviour therapy</td>
<td>18/32</td>
</tr>
<tr>
<td>MacHovec &amp; Man, 1978</td>
<td>1 suture &amp; bead, earlobe (?)</td>
<td>a) suture 'incorrect' point</td>
<td>0/12</td>
</tr>
<tr>
<td>Man, 1975</td>
<td>2 sutures &amp; beads, Lung and Shenmen (up to 365)</td>
<td>b) hypnosis, individual</td>
<td>6/12</td>
</tr>
<tr>
<td>Martin &amp; Waite, 1981</td>
<td>2 Lung, Hunger (21)</td>
<td>a) 2 'incorrect' pts</td>
<td>12/69</td>
</tr>
<tr>
<td>Parker &amp; Mok, 1977</td>
<td>2 Lung, Shenmen (21)</td>
<td>a) 2 'incorrect' points</td>
<td>2/9</td>
</tr>
<tr>
<td>Steiner, 1982</td>
<td>2 Lung, Stomach (14), body acupuncture</td>
<td>body acupuncture to 'incorrect' points (no press needles), and one session of ear acupuncture</td>
<td>1/16</td>
</tr>
<tr>
<td>Tian &amp; Chu, 1996</td>
<td>4 seeds Mouth, Lung, Subcortex, Shenmen (30, 60 or 90)</td>
<td>advice</td>
<td>2/60</td>
</tr>
<tr>
<td>Vibes, 1997</td>
<td>a) Zero (?12)</td>
<td>a) body acupuncture</td>
<td>14/45</td>
</tr>
<tr>
<td>Waite &amp; Clough, 1998</td>
<td>1 seed Lung (unlimited, mean 5), counselling, EA</td>
<td>Seeds to 'incorrect' points on knee (mean duration 7 days)</td>
<td>7/45</td>
</tr>
</tbody>
</table>

* Acupuncture needles unless otherwise stated
† n/N = number of quitters at first time point/total number treated
‡ Points used were Shenmen, Mouth, Lung, Trachea, Hunger, Endocrine; control points were Knees, Lumbar vertebra, Neck, Shoulder, Shoulder joint, Buttock

Abbreviations: EA – electroacupuncture; pt – point; ? – our best estimate from the report
Another theoretical limitation to the result is that the superiority of acupuncture to other controls could be due to acupuncture's greater psychological impact compared with interventions such as hypnosis or psychotherapy. Given these limitations, the results could support the idea that auricular acupuncture does have physiological effects but that these effects do not depend on treating any specific 'correct' point. If that is the case, then studies that use needles in an 'incorrect' point in the ear as the control are unlikely to show any effect because the control intervention is also active. They will be likely to produce false negative results.

The concept of somatotopic representation has a certain attraction, seemingly providing a way of making sense out of clinical observations that small areas of the auricle do become tender and show skin changes and altered electrophysiological properties, and that patients seem to respond to needle stimulation of the auricle. Nogier believed that the internal organs were represented in the part of the auricle known as the concha because it is innervated by the sensory vagus nerve. However, it should be noted that the sensory fibres from the concha that
travel with the vagus nerve principally synapse in the trigeminal nucleus rather than the solitary nucleus, and therefore probably provide limited input into autonomic control. One diagnostic study has provided some empirical support for the concept of somatotopic representation, 24 but the lack of negative studies may be due to publication bias. Finally, the connection between body representation on the ear and traditional Chinese acupuncture is tenuous: somatotopic representation is not a common feature of traditional Chinese medicine, and if such a representation truly existed, it would be surprising

**Figure 1a** Success of smoking cessation; auricular acupuncture at ‘correct’ points compared with non-auricular control interventions.

**Figure 1b** Auricular acupuncture at ‘correct’ points compared with ‘incorrect’ (sham) points for smoking cessation.

**Figure 1c** Auricular acupuncture at ‘incorrect’ points compared with non-auricular control interventions.
that Chinese physicians – who were plainly very astute observers - did not discover it. Nogier appeared to use the organs in an anatomical sense rather than in the conceptual sense of Zang and Fu organs, and it seems far-fetched to argue that the Liver point (for example) of the ear can be part of the same paradigm that uses Liver meridian points in the body for specific energetic indications.

It seems very much more probable that the concept of somatotopic representation is an erroneous distraction. This means that much research into auricular acupuncture could be invalid because the control groups have received active treatment. In several cases, large, definitive studies that hoped to replicate promising results of initial small studies in alcohol and cocaine dependence were negative, but used auricular needling in the control group.25-28

Researchers have used two approaches to defining a suitable sham procedure: either conjecture or empiricism. In the first, they have simply assumed that any ‘incorrect’ point is inactive, by what Margolin memorably termed a ‘flat’. For example, Bullock chose non-points that were within 5mm of the ‘correct’ point in his studies of alcohol dependence,29 and Gilbey and Neumann used an ‘incorrect’ point, Kidney. In the second method, by contrast, Margolin, Avants and colleagues conducted a series of pilot studies to explore the subjective effects of different stimulation sites.30-31 The final single-blind comparison of different possible control sites suggested that points on the helix had least systemic effects and generated least confidence in the addicts about any effect on withdrawal symptoms.32 Loci close to the ‘correct’ points had the highest systemic effects of all locations tested. This preliminary work to define inactive control is clearly the best approach, but we doubt whether these studies were large enough (n=12 for the study on systemic effects) to be definitive.

In conclusion, auricular acupuncture appears to be effective for smoking cessation, but the effect may not depend on point location. This indirect evidence seems to question the somatotopic model underlying auricular acupuncture. Sham-controlled studies which have used ‘incorrect’ points for control groups may have been comparing two active treatments, and their conclusions may need to be reconsidered. Further experiments should be conducted to confirm or refute these conclusions directly.

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Mike Cummings contributed to several aspects of this study and commented on the text. Adrian White was supported by the DH-National Co-ordinating Centre for Research Capacity Development (NCC RCD)

Summary points
Acupuncture is widely used to treat people with problems of substance misuse

Auricular acupuncture appears to be effective for smoking cessation, but the effect may not depend on point location

This seems to question the somatotopic model underlying auricular acupuncture

Reference list


**Editorial handling**

In view of the first author’s conflict of interest as Editor of this journal, all editorial handling of, and decisions about, this article were carried out independently by David Grant on behalf of the editorial board.
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