Effect of laser acupuncture in mild benign hypertensive female patients
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Abstract

Background: Recent studies have found that acupuncture treatments lower blood pressure. Acupuncture is a traditional Chinese medical technique of inserting needles at particular points on the body to balance the opposing forces of yin and yang and the smooth flow of qi. Laser acupoint technique is considered as saving time because it is performed in less time than needles acupuncture.

Purpose: The aim of this study was to study the effect of laser acupuncture on lowering the primary type of hypertension in old female adults.

Materials and Methods: Thirty female mild hypertensive patients with ranged age 50-59 years were enrolled in the study. Systolic and diastolic blood pressure evaluated by Mercury sphygmomanometer. Baseline blood pressure measured for each subject prior to the initiation of the treatment and after enrollment in the treatment program. The anthropometric data including age, duration of hypertension, height, weight and body mass index (BMI) was collected for both experimental and six weeks control groups.

Results: After treating hypertension patients by the laser acupuncture for 6 weeks (twice per week session), both the systolic blood pressure (SBP) and diastolic blood pressure (DBP) decreased significantly ($P < .01$). The mean SBP in experimental group (Group I) was $155.9 \pm 4.33$ mm Hg before the treatment and was reduced to $134.1 \pm 2.33$ mm Hg ($P < .001$) after treatment. While the mean SBP in control group (Group II) was $156.2 \pm 3.88$ mm Hg before the treatment and was reduced to $152.9 \pm 2.85$ mm Hg ($P < .002$) after treatment. The mean DBP in Group I was $91.5 \pm 2.55$ mm Hg before treatment and was reduced to $82.6 \pm 2.12$ mm Hg ($P < .001$), While the mean DBP in Group II was $91.1 \pm 2.85$ mm Hg before the treatment and was reduced to $89.2 \pm 2.1$ mm Hg ($P < .002$) after treatment.

Conclusion: We concluded that low-level laser acupuncture treatment resulted in lower blood pressure by stimulating these points LI 4 LI 11, Sp 6 and P 6

Keywords: laser, acupuncture and hypertension.
INTRODUCTION
Hypertension is considered as a main risk factor for coronary artery disease and stroke.\(^1\) Traditional treatment for hypertension includes sodium restriction, pharmacologic management, and lifestyle modifications such as stress management and exercise.\(^2\) As most of these methods of treatment are generally need permanent lifestyle modifications, thus, poor patient compliance is common. Also, the side effects of antihypertensive medication that include fatigue, electrolyte imbalance, and impotence, which often result in patient intolerance.\(^3\)

Primary hypertension affects up to one billion individuals worldwide and is attributable each year for more than 7 million deaths and loss of 64 million disability-adjusted life years. Hypertension still a major public health challenge in both developed and developing countries despite all the progress in prevention and management of hypertension.\(^4\)

LASER is an acronym for ‘light amplification by stimulated emission of radiation’ is a form of electromagnetic radiation. High coherence, monochromaticity, and polarization are the basic physical properties of laser.\(^5,6\) Low-intensity-level laser (LLL) has potency ranging from 1 to 100 mW and has been used for therapeutic purposes without major damage of the tissues.\(^7\) Its effects are considered to be associated with biostimulation or biomodulation of the synthesis of DNA, RNA, and proteins, as well as the release of anti-inflammatory factors.\(^8\)

Low intensity level laser therapy at low energy has been utilized to treat some diseases due to the biostimulative effect of this electromagnetic radiation.\(^9\) In laser acupoint treatment, the wavelengths of the laser used are usually between 405 nm and 904 nm; laser acupoint has been used to treat various clinical conditions, such as blood pressure and body weight.\(^10\)

The acupoint laser technique benefits include that it is not invasive technique and is suitable for patients who have fear of needles. Moreover, it is tolerable for children. In contrast to needles technique there are low risks of local bleeding and infections such as myositis and cellulitis.\(^11\) Laser acupoint technique is considered as saving time because it is performed in less time than needles acupuncture.\(^12\)

Acupuncture is a traditional Chinese medical technique of inserting needles at particular points on the body to balance the opposing forces of yin and yang and the smooth flow of qi.\(^13\) Recent studies have found that acupuncture treatments lower blood pressure.\(^14-16\) The mechanism of acupuncture that lowers blood pressure is not clear, but it is believed that acupuncture works to alter central nervous system neurotransmitter activities by stimulating acupoints.

Cold laser or soft laser is a laser device for medical uses were fabricated in particular manner in which both power and energy densities of laser were lowered to the limit of no photo-thermal effects occurred; but the photo-osmotic, photo-ionic and photo-enzymatic effects of LASER were still operative. The modern laser devices are designed with infrared wavelength combined with high-frequency pulses that allow the photons to penetrate deep into tissue without heat effect.\(^2\)

Few studies have used laser to treat acupuncture point for clinical conditions. By using the database of searching in the website of PubMed on 1 August 2016 found 791 publications with the keyword ‘laser
laser acupuncture in mild benign hypertensive

acupuncture’ and 25,036 publications with the keyword ‘acupuncture’. This indicates that it is necessary to increase the investigations of laser acupuncture using different experimental models. Considering the limited number of publications in the PubMed database with investigations in laser acupuncture, and due to the importance of this technique in children and patients with the fear of needles, the aim of this study was to analyze the effect of the exposure to the laser with a wavelength of 560 nm in the acupoint (LI 4, LI 11, Sp 6 and P 6) on lowering the systolic and diastolic blood pressure.

The main aims of the study were to test the effectiveness of laser acupuncture on specific acupuncture points LI 4, LI 11, Sp 6 and P 6 on both systolic and diastolic blood pressure. The hypothesis was that the stimulation of a pattern of acupoints with the laser was effective in reducing blood pressure. This research is designed to study the effects of laser acupuncture on blood pressure by stimulating certain acupuncture points and meridians on nursing staff members in national heart institute.

Research Design and Methods

Subject characteristics:
30-hypertensive female with blood pressure stage I (mild) systolic 140-159 mm Hg and diastolic 90-99 mm Hg was participated in this study. They were randomly selected from the nursing stuff at national heart institute in Cairo. Their ages Ranged from 50-59 years. The study was conducted to investigate the effect of laser acupuncture in hypertension women. We took informed consent form participated women after description of the procedure had been explained and they understood that they might withdraw their consent and discontinue participation in this research at any time without prejudice to me.

The participants were divided randomly into 2 equal groups. Experimental group received laser acupuncture therapy (group I) and Control group received placebo treatment (group II).

Inclusion criteria:
1) All participants age was ranged from 50 to 59 years old.
2) The systolic blood pressure was ranged from 140-159 mm Hg
3) The diastolic blood pressure was ranged from 90-99 mm Hg
4) All participants had primary hypertension.
5) The duration of hypertension not less than five years.
6) They took their dose of anti-hypertensive drugs.
7) They were stable clinically and medically.
8) All participants BMI were ranged from 30 to 34.9.

Exclusion criteria:
1) Patients had systolic blood pressure more than 159 mm hg and
2) Patients had diastolic blood pressure more than 99 mm hg. 
3) Patients had metabolic disease.
4) Patients who suffered from mental or psychological disorders.
5) Patients with secondary hypertension.
6) Smoking Patients.
Each subject signed informed consent form before participate in this study.

**Study description**

**Evaluative equipment:**

A) **Weight and height scale:**

The scale was national made 7031 with max weight 160 kg and max height 2 meters to measure BMI (Body Mass Index) which is the most commonly used indicator of obesity and is determined from height and weight. In this trial (weight in kg) per height in m².

B) **Mercury sphygmomanometer:**

It was desk model CE 0123 made in Germany. It was used to measure the systolic and diastolic blood pressure before and after each session and the end of the study.

**Therapeutic equipment’s: - Laser**

The parameters of laser equipment:

The laser unit was a small hand held machine AS laser, class 3 B laser. It manufactured by gymna. Model combi 2000 made in Brazil. Selo de garantia atencao. Lasermed 650 nm. Main supply 100-230v. Frequency 50-60 Hz. Power consumption 30 va.fuses: 1,0-250v. The machine offers two types of laser therapy (continuous and pulsed). Continuous laser therapy is of a common use and many studies had found it effective. In this study 10 mw probe was used and connected, wave length 905 nm wave length and energy density 2J session beam diameter was 4mm
Procedure:

(A) Evaluation procedures:
1- Measurement of weight and height
Every patient was asked to get out her shoes and let out the heavy clothes; the readings were taken before the program.

The BMI was calculated according to the following equation, the body weight (kg) divided by the height (m²) to exclude patient out of class one obesity:

\[ \text{BMI} = \frac{\text{weight (kg)}}{\text{height (m²)}} \]

2- The measurement of blood pressure was obtained according to the following steps before and after six weeks of the study: The auscultator method of blood pressure measurement with a properly calibrated and validated instrument was used. The subject was asked to relax and not perform any physical activity before the measurement for 3 minutes; patients was seated quietly in a chair rather than on an examination table, an appropriate-sized cuff encircling at least was used around her left arm from sitting position.

The sphygmomanometer was placed on table beside the sitter at the level of subject.

- Blood pressure was evaluated before and after six weeks of treatment. The blood pressure reading was taken twice during date collection, and the average was used for data analysis.
- Precautions to obtain correct blood pressure reading: the ideal way to measure blood pressure through:
  1. Choose the correct cuff size.
  2. Avoid placing the cuff over clothes.
  3. Arm must be at heart level.
  4. Patient should rest quietly for 3-5 minutes before measurement in a quiet room with comfortable temperature.
  5. Avoid talking during measurement.
  6. No caffeine or cigarette smoking at least 1 hour before procedure.
  7. Bladder should be evacuated carefully.
  8. Do not deflate the cuff too quickly (2 mm Hg/beat).
  9. Do not re-inflate the cuff to repeat measurements before it has fully deflated.
  10. Take more than one measurement and have the mean value.
  11. If there is a difference of more than 10 mmHg between two measurements

(B) Therapeutic procedure

Group I:

Patients were received laser acupoint sessions twice weekly for 6 weeks, the patients were putted in a comfortable long sitting position. Laser was applied three minutes for each point by two rotation of the points, each rotation for 90 seconds.

Patient preparation

1- The patient was bare skin.
2- The sites of acupuncture points were cleaned by alcohol.
3- The points were detected firstly by tape measurement or fingers.
4- The patients and the therapist were protective glasses.

Laser apparatus operation

1- The apparatus was turned on.
2- The time adjusted at 90 sec for each point.
3- Total session time is 12 min.
4- The power was adjusted automatically.
5- The head was applied perpendicular at each point then pressed the start button.
Laser – acupuncture points are:

1- (LI 4) Large Intestine 4
Location: It is situated in the web between the forefinger and the thumb on the posterior aspect of the hand and may be located when the forefinger and the thumb are adducted at the highest point of the muscles on the back of the hand.

![Figure (1) Location of large intestine 4 point](image1)

Figure (1) Location of large intestine 4 point

2- (LI 11) Large Intestine 11
Location: At the outer end of the elbow crease when the elbow is semi flexed.

![Figure (2) Location of large intestine 11 point](image2)

Figure (2) Location of large intestine 11 point.

3- (Sp 6) Spleen 6 Location:
3 cun (It is Chinese inch which equal to width of thumb across the inter phalangeal joint. Two cun equal the width of middle three fingers) directly above the tip of the medial malleolus, on the medial border of the tibia.

1- (p6): pericardium 6
Location: 2 cun proximal to the midpoint of the palmer wrist crease between the tendons of the flexorcarpi radialis and palmaris longus.
Nei Guan (P6 or PC6) is commonly used to help relieve nausea, upset stomach, motion sickness, carpal tunnel syndrome, and headaches. Nei Guan (P6) is located three finger breadths below the wrist on the inner
To find and use this acupressure point, (1) locate the point by turning your hands over so the palm is facing up then (2) apply downward pressure between the two tendons, massaging and stimulating the area for 4-5 seconds.

![Figure (4) Location of pericardium 6 point.](image)

**Group (II):**

**Control group.**

Participants will take placebo treatment of LASER with their regular anti-hypertensive medications.

**Statistical design and data analysis:**

Descriptive statistics and paired t test to compare the changes will take place (pre and post treatment) with treatment group. Compare between the two group by unpaired student t test.

All variables will be expressed as well, standard deviation and the accepted level of statistically significant difference will be at \( p \) value less than 0.05.

**Results**

Thirty hypertension patients participated in this study. They were divided into two groups. Group I (experimental group) consists of fifteen patients and group II (control group) consists of fifteen patients, with duration of hypertension not less than five years, they have been selected from nursing stuff at national heart institute in Cairo. The data concerning the students’ age, duration of hypertension, weight, height, body mass index (BMI) had been collected at the start of the study. The hemodynamic variables including systolic blood pressure and diastolic blood pressure had been measured, before and after acupoint laser treatment.

The recorded data from twenty patients who completed the procedure of the study have been collected; statistically analyzed, descriptive statistics and paired t test to compare the changes would take place (pre and post treatment) within each group. Compare between the two groups by unpaired student t test (for comparing post treatment result of both groups). All variables would be expressed as well, standard deviation and the accepted level of statistically significant differences would be value less than 0.05.
Table (1): Demographic and Clinical characteristics of participants at the start of the study. X=Mean, SD=Standard deviation, $t=t$ test, $p=$ probability value, NS= not significant

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Group</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>Group I</td>
<td>52.4</td>
<td>2.07</td>
<td>0.10</td>
<td>0.92</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>52.3</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (Kilogram)</td>
<td>Group I</td>
<td>90.7</td>
<td>2.00</td>
<td>-0.32</td>
<td>0.76</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>90.9</td>
<td>2.18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (Meter)</td>
<td>Group I</td>
<td>162.9</td>
<td>2.81</td>
<td>-0.20</td>
<td>0.85</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>163.1</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Mass Index(BMI)(Kg/m$^2$)</td>
<td>Group I</td>
<td>34.21</td>
<td>1.62</td>
<td>0.03</td>
<td>0.98</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>34.2</td>
<td>1.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of hypertenion</td>
<td>Group I</td>
<td>7.4</td>
<td>1.8</td>
<td>0.09</td>
<td>1.04</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>7.2</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1- Patients’ demographic data: group I was (52.4±2.07), with maximum value of 58 years old and minimum value of 50 years old and the mean value of patient’s age for group II was (52.3±2.00), with maximum value of 59 years old and minimum value of 51 years old. The mean duration of hypertension for group I was (7.4 ± 1.8 years), with maximum value of 10 years and minimum values of five years, and the mean duration of hypertension for group II was (7.2 ± 1.7 years), with maximum value of 9 years and minimum values of five years. As noticed from table (1) and figure (5) the mean value of patient’s age for both group

Fig. (5): Anthropometric data of participants at the start of the study
II- **Hemodynamic variables:**

Systolic Blood Pressure (SBP): The mean value of SBP measured before treatment for group I was (155.90±4.33mmhg) and for group II was (156.20±3.88mmhg). The mean values of SBP revealed that there is a significant (P<0.05) changes in SBP after treatment.

**Table (2):** The pre and post blood pressure data the mean and stander deviation for both groups I and II.

<table>
<thead>
<tr>
<th>Blood pressure data</th>
<th>X</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I Systolic blood pressure( Pre)</td>
<td>155.90</td>
<td>4.33</td>
</tr>
<tr>
<td>Group I diastolic blood pressure( Pre)</td>
<td>91.50</td>
<td>2.55</td>
</tr>
<tr>
<td>Group I Systolic blood pressure (Post)</td>
<td>134.10</td>
<td>2.33</td>
</tr>
<tr>
<td>Group I diastolic blood pressure (Post)</td>
<td>82.60</td>
<td>2.12</td>
</tr>
<tr>
<td>Group II Systolic blood pressure( Pre)</td>
<td>156.20</td>
<td>3.88</td>
</tr>
<tr>
<td>Group II diastolic blood pressure( Pre)</td>
<td>91.10</td>
<td>2.85</td>
</tr>
<tr>
<td>Group II Systolic blood pressure (Post)</td>
<td>152.90</td>
<td>2.85</td>
</tr>
<tr>
<td>Group II diastolic blood pressure (Post)</td>
<td>89.20</td>
<td>2.10</td>
</tr>
</tbody>
</table>

**Table (3):** The pre and post blood pressure data the *t* and *p* values and significance for both groups I and II.

<table>
<thead>
<tr>
<th>Paired Samples Test</th>
<th>t</th>
<th>p</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp Systol Pre - Exp Systol Post</td>
<td>15.975</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Exp Diastol Pre - Exp Diastol Post</td>
<td>12.329</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Con Systol Pre - Con Systol Post</td>
<td>4.423</td>
<td>.002</td>
<td>S</td>
</tr>
<tr>
<td>Con Diastol Pre - Con Diastol Post</td>
<td>3.943</td>
<td>.003</td>
<td>S</td>
</tr>
<tr>
<td>Exp Systol Pre - Con Systol Pre</td>
<td>-.176</td>
<td>.864</td>
<td>NS</td>
</tr>
<tr>
<td>Exp Diastol Pre - Con Diastol Pre</td>
<td>.303</td>
<td>.768</td>
<td>NS</td>
</tr>
<tr>
<td>Exp Systol Post - Con Systol Post</td>
<td>-15.789</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Exp Diastol Post - Con Diastol Post</td>
<td>-9.000</td>
<td>.000</td>
<td>S</td>
</tr>
</tbody>
</table>

**Table (4):** The pre and post systolic and diastolic blood pressure intra groups I and II.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>SBP prec</th>
<th>X</th>
<th>SD</th>
<th>T</th>
<th>p</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>155.90</td>
<td>4.33</td>
<td></td>
<td>-.176</td>
<td>.864</td>
<td>NS</td>
</tr>
<tr>
<td>Group II</td>
<td>156.20</td>
<td>3.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP post</td>
<td>Group I</td>
<td>134.10</td>
<td>2.33</td>
<td>-15.789</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Group II</td>
<td>152.90</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBP prec</td>
<td>Group I</td>
<td>91.50</td>
<td>2.55</td>
<td>.303</td>
<td>.768</td>
<td>NS</td>
</tr>
<tr>
<td>Group II</td>
<td>91.10</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBP post</td>
<td>Group I</td>
<td>82.60</td>
<td>2.12</td>
<td>-9.000</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Group II</td>
<td>89.20</td>
<td>2.10</td>
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</table>
Discussion

This study was designed to evaluate the efficacy of laser acupuncture on both systolic and diastolic blood pressure (SBP and DBP), this through comparing (Pre-treatment) values with that of the (Post-Treatment) in both groups (Group I & II) after 6 weeks of laser acupoint stimulation for the points (LI 4, LI 11, Sp 6 and P 6) in patients with mild hypertension.

The results of the current study revealed that there was significant (P<0.05) decrease in the mean values of SBP in the experimental group which was changed from (155.90±4.33 mmHg), to (134.10±2.33 mmHg) with mean percentage of improvement equal to (13.98 %).

While the results of the current study revealed that there was significant (P<0.05) decrease in the mean values of SBP in the control group which was changed from (156.20±3.88 mmHg), to (152.90±2.85 mmHg) with mean percentage of improvement equal to (2.11 %), however this still lie within hypertension range.

The results of the current study revealed that there were significant (P<0.05) decrease in the mean value of DBP in the control group which was changed from (91.50±2.55 mmHg) to (82.60±2.12 mmHg), with mean percentage of improvement equal to (9.73 %).

The results of the current study revealed that there were significant (P<0.05) decrease in the mean value of DBP in the experimental group which was changed from (91.10±2.85 mmHg) to (89.20±2.10 mmHg), with mean percentage of improvement equal to (2.1 %).

The results of our study confirmed with results of Zhang et al., (2008) who found After the 12 laser treatment sessions twice a week for 45 patients with average age of the subjects was 25±5 years old. The youngest subject was 20 years old, and the oldest was 56 years old, both the systolic and diastolic blood pressures decreased significantly. The mean systolic blood pressure was 129.6±14.7 mm Hg before the treatment started and was reduced to 122.9±15.2 mm Hg (P < .001).

These results of our study were supported by the work of Hong et al., who found that the blood pressure decreased significantly after treatment in group A and group B (all P<0.01), and the decrease in systolic blood pressure was more significant in group A (P < 0.05). The total effective rate was 90.5 / (38/42) in group A, which was superior to 71.4 (30/420) (P < 0.05) in group B and 19.1% (18/34) (P<0.01) in group C. They concluded that the clinical effect of multi-mode audio frequency pulse photoelectric therapeutic apparatus for treatment of grade I essential hypertension is reliable. Meanwhile, it has the advantages of a non-invasive and simple operation.

Zhang et al., describes the regular use of acupuncture treatments for a patient with hypertension who could not tolerate the side effects of the antihypertensive agents. The patient received 60 acupuncture treatments in the course of 12 weeks, during which time his overall wellbeing improved, his blood pressure reduced and the
side effects of antihypertensive drugs were removed. Although acupuncture plus the drug appeared to have a substantial synergistic effect that was weakened when the drug was discontinued, acupuncture may still play a role in the management of hypertension, especially for patients who cannot tolerate the side effects of antihypertensive agents.19

Çevik et al., demonstrated significant reduction (p <001) in both systolic (from 163.14 ± 19.33 to 129.49 ± 18.52) and diastolic (from 94.37 ± 19.70 to 79.31 ± 7.87) blood pressures of 24 male and 10 female patients. Ki 3 (Taixi), Liv 3 (Taichong), Sp 9 (Yinlingquan), L.I. 4 (Hegu), Ht 7 (Shenmen), St 36 (Zusanli), Sp 6 (Sanyinjiao), Ki 7 (Fulio), Lu 9 acupuncture points were needled. After being treated with acupuncture for one month in every two days for a total of 15 sessions, they found significant reductions in both systolic and diastolic blood pressure and they concluded that acupuncture should be in the hypertension treatment guidelines and widely used for blood pressure regulation.20

On other hand Brien et al., found that laser acupuncture stimulation does not affect the symptoms of hypertension.21

The work of Macklin, who found that acupuncture laser are unlikely to achieve clinically meaningful reduction in systolic blood pressure or diastolic blood pressure for the average patient with mild to moderate hypertension22.

Conclusion

In conclusion, although further investigations are needed to clarify the mechanism by which the Laser acupuncture acts, it is possible to conclude that the Laser acupuncture treatment lead to reduction of both systolic and diastolic blood pressure.

Conflict of Interest: No conflict of interest

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