

Reiki Improves Heart Rate Homeostasis in Laboratory Rats

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ABSTRACT

Objectives: To determine whether application of Reiki to noise-stressed rats can reduce their heart rates (HRs) and blood pressures.

Rationale: In a previous study, we showed that exposure of rats to 90 dB white noise for 15 minutes caused their HRs and blood pressures to significantly increase. Reiki has been shown to significantly decrease HR and blood pressure in a small group of healthy human subjects. However, use of humans in such studies has the disadvantage that experimental interpretations are encumbered by the variable of belief or skepticism regarding Reiki. For that reason, noise-stressed rats were used as an animal model to test the efficacy of Reiki in reducing elevated HR and blood pressure.

Design: Three unrestrained, male Sprague-Dawley rats implanted with radiotelemetric transducers were exposed daily for 8 days to a 15-minute white noise regimen (90 dB). For the last 5 days, the rats received 15 minutes of Reiki immediately before the noise and during the noise period. The experiment was repeated on the same animals but using sham Reiki.

Setting/location: The animals were housed in a quiet room in University of Arizona Animal Facility.

Outcome measures: Mean HRs and blood pressure were determined before Reiki/sham Reiki, during Reiki/sham Reiki, and during the noise in each case.

Results: Reiki, but not sham Reiki, significantly reduced HR compared to initial values. With Reiki, there was a high correlation between change in HR and initial HR, suggesting a homeostatic effect. Reiki, but not sham Reiki, significantly reduced the rise in HR produced by exposure of the rats to loud noise. Neither Reiki nor sham Reiki significantly affected blood pressure.

Conclusion: Reiki is effective in modulating HR in stressed and unstressed rats, supporting its use as a stress-reducer in humans.

INTRODUCTION

Reiki is a Japanese technique for stress reduction and relaxation that also promotes healing. It is administered by a trained practitioner placing their hands on or above the patient and is based on the idea that energy flows through us and can be used to stimulate the healing process. The use of Reiki as an alternative therapy is growing rapidly and is now being used in many hospitals in the United States and Europe to help relieve pain and increase recovery rates. A small selection of the hospitals using Reiki is listed on the

Reiki in Hospitals website (www.reikiinhospitals.org/HospitalList.aspx).

Although Reiki is growing in popularity, there is very little rigorous scientific evidence to support the claims of practitioners and receivers regarding its beneficial effects on physical, emotional, and mental health. This deficit is partly due to the fact that most Reiki practitioners are not scientists and also that only a small minority of scientists considers Reiki worthy of scientific investigation. One response to stress reduction as a test of efficacy of Reiki that is easy to monitor is the accompanying fall in heart rate (HR) and

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mean arterial blood pressure (BP). Wardell and Engebretson¹ measured the biological effects of a 30-minute Reiki treatment on 23 healthy people and found a significant reduction in systolic BP. However, the experimental design did not include sham controls. In a placebo-controlled study, Mackay et al.² demonstrated in 15 human subjects that a Reiki treatment could significantly reduce HR and BP compared to control subjects. However, the difference was small and the validity of the data was moderated by an uncertainty in the integrity of the tonometric BP measurement system. Testing of this technique has shown in some cases that the measurements obtained are only moderately accurate and are unpredictable.³ In addition, the use of humans in such studies has the disadvantage that experimental interpretations are encumbered by the variable of belief or skepticism regarding Reiki.

The current study was designed to avoid both of these problems by using as experimental subjects Sprague-Dawley rats that had been implanted with radiotelemetry transmitters to noninvasively measure their cardiovascular responses. This technique is highly accurate and predictable. Many researchers have used radiotelemetry systems to investigate the cardiovascular effects of routine procedures (e.g. restraint, handling, weighing, cage changing, subcutaneous and tail-vein injections) on laboratory rodents.⁴⁻⁸ This process involves the use of a radiotransmitter, implanted in the abdomen of the rat, which produces a signal from which HR, BP, and HR variability can be obtained. The primary advantage of using a telemetry system is that it allows investigators to measure physiological data in conscious, unrestrained laboratory animals and thus provides a more efficient, accurate, and humane alternative to other techniques in which the animals are sedated and/or tethered.

Although some previous measures have been made of the effects of Reiki on HR and BP,^{1,2} both studies were limited to subjects who were not deliberately stressed. A more useful test of Reiki as a method for reducing stress would be to start with stressed subjects. Our previous studies have shown that when rats are exposed to excess daily 90-dB noise (controlled amplitude and frequency spectrum) for 15 minutes,⁹ this produces a transient increase in HR and BP. In the present study, the noise-stressed rats were used as an animal model to test the hypothesis that Reiki reduces stress-induced increases in HR and BP.

MATERIALS AND METHODS

Animals

Six (6) male Sprague Dawley rats weighing 375 to 400 g were obtained from Charles River Laboratories (Portage, MI). Three of the rats had been implanted with PhysioTel[®] C50-PXT telemetry transmitters (Data Sciences International (DSI), St. Paul, MN) at Charles River Laboratories

(Fig. 1). After giving the implanted animals 8 days to recover from surgery, all 6 animals were shipped to Tucson, Arizona. Upon arrival, each implanted rat was pair-housed with a nonimplanted rat in wire mesh cages (16 × 12 × 12 inches) with plastic bottoms. No data were collected from the 3 rats that were not implanted with telemetry transmitters; they served only as cage-mates for the implanted rats. Each cage contained a ramp leading to a wire mesh shelf (16 × 4 inches) and a piece of polyvinylchloride tubing (length = 8 inches, diameter = 4.5 inches) for enrichment. The rat diet consisted of Harlan Teklad 7001 rat chow (Harlan Teklad, Madison, WI) and water that was deionized and chlorinated to 10 parts per million. Fresh food and water were available *ad libitum*. The same investigator performed all measurements throughout the whole experimental procedure, and the only other people who entered the room were the animal caretaker, who was instructed to perform his duties gently and quietly, and the 2 Reiki and sham Reiki practitioners. All research procedures and animal care were reviewed and overseen by the University of Arizona's institutional animal care and use committee (IACUC).

Experimental protocol

For each experimental series, the implanted radiotelemetric transmitters were turned on by gently swiping a small bar magnet longitudinally down the chest. Cardiovascular data were recorded from the 3 implanted animals starting at 8:45 AM. At 9:00 AM, the animals were subjected to 30 minutes of 90-dB white noise. Data were recorded during the noise period. This procedure was repeated for the next 2 days. On the fourth day, the Reiki treatment was introduced; after the initial, quiet 15-minute period of data collection, each of the 2 Reiki practitioners performed Reiki for 15 minutes on a pair of rats. Next, they both treated the remaining pair of rats simultaneously for 15 minutes. The rats were then subjected to 30 minutes of white noise. For the first 15 minutes each Reiki practitioner performed Reiki on the same pair of rats they had treated first previously; for the second 15 minutes both practitioners treated the remaining pair of rats. Data were recorded continually during this process. The whole noise and Reiki procedure was repeated for 4 more



FIG. 1. X-ray showing placement of telemetric transducer in abdomen of rat.

days, making sure that the same practitioner did not treat the same pair of rats on subsequent days. After a 2-week rest, the whole 8-day procedure was repeated except that the 2 Reiki practitioners were replaced by 2 students who were not trained in Reiki. The students imitated the physical movements of the Reiki practitioners, and this procedure was termed sham Reiki.

Methodologies

The key experimental methodologies were as follows: (1) generation of white noise, (2) application of Reiki, (3) acquisition and analysis of cardiovascular data. These techniques have been described in detail elsewhere^{9,10} and are outlined briefly here.

1. *Generation of white noise*—The white noise was generated from an audio recording (90 dB) that was played in a looped mode using a CD player. Loudspeakers were selected that reproduce frequencies in the range of 50 Hz to 10 kHz, and the noise level was adjusted to 90 dB averaged over those frequencies.
2. *Application of Reiki*—Reiki and sham Reiki were performed for 15 minutes per cage, both rats in a given cage receiving the treatments simultaneously. Both Reiki practitioners were trained to Level 3, following the traditional lineage of the Usui System of Natural Healing. The sham Reiki practitioners had no knowledge of Reiki or of any other healing modality. Each Reiki and sham Reiki practitioner positioned the palms of his or her hands, facing the cage, about 4 feet from the front of the cage. There was no direct contact or talking to the animals.
3. *Acquisition and analysis of cardiovascular data*—Telemetric data were acquired using a radiotelemetry system from Data Sciences International (DSI, St. Paul, MN). Handling of the animals was not required. The implanted transmitters were switched on and off by passing a small magnet over the abdomen of each animal and listening to the emitted tones with an AM radio. After the tone was established, the radio was switched off. Data were transferred from the transmitters to receivers under the cages using radio waves at a frequency of 455 kHz. The analog signal was transmitted from the receivers to the data exchange matrix where it was digitized and transferred to the computer for analysis.

RESULTS

Application of Reiki to rats after the initial quiet period significantly reduced HR by 5.8% from 293 ± 8 (standard error of the mean [SEM]) beats per minute (bpm) to 276 ± 7 (SEM) ($p < 0.05$, Wilcoxon signed-

rank test), whereas sham Reiki made no significant difference (from 288 ± 7 to 293 ± 10). These trends were also seen with each individual rat. Mean arterial pressure (MAP) was not significantly affected by Reiki (from 90.3 ± 4.1 [SEM] mm Hg to 88.4 ± 3.3 mm Hg) or by sham Reiki. An example of the data collected from 1 rat is shown in Figure 2. A Pearson product-moment correlation (Fig. 3) showed that the percent change in HR produced by Reiki was negatively correlated with the initial HR (correlation coefficient = -0.68), whereas no correlation was seen with sham Reiki (correlation coefficient = -0.08). Thus, when rats showed a higher initial HR, they usually experienced a greater reduction in HR following Reiki, consistent with a homeostatic effect. These data support the hypothesis that Reiki reduces systemic sympathetic nervous activity.

When rats were subjected to 15 minutes of noise, their mean HR increased by $8.98\% \pm 1.90\%$ (SEM) compared to the value averaged over the preceding 15-minute time period. Typical HR and MAP responses to noise measured each minute in 1 rat are shown in Figures 4A and 4B. The changes in HR and MAP on 3 different days, measured in 1 rat, are shown in Figure 5. When the rats were treated with sham Reiki before and during the noise, they showed an increase in HR of $3.07\% \pm 2.64\%$ (from 296.0 ± 9.8 [SEM] bpm to 305.1 ± 10.7 bpm) compared to the value before the treatment was started. When the rats were treated with Reiki before and during the noise, there was no increase in HR ($-0.61\% \pm 2.10\%$; from 296 ± 12.0 to 294.2 ± 13.4). One-way analysis of variance showed that the difference in mean values among the 3 groups (noise alone, sham Reiki + noise, Reiki + noise) was greater than would be expected by chance ($p < 0.05$). All pairwise multiple comparison pro-

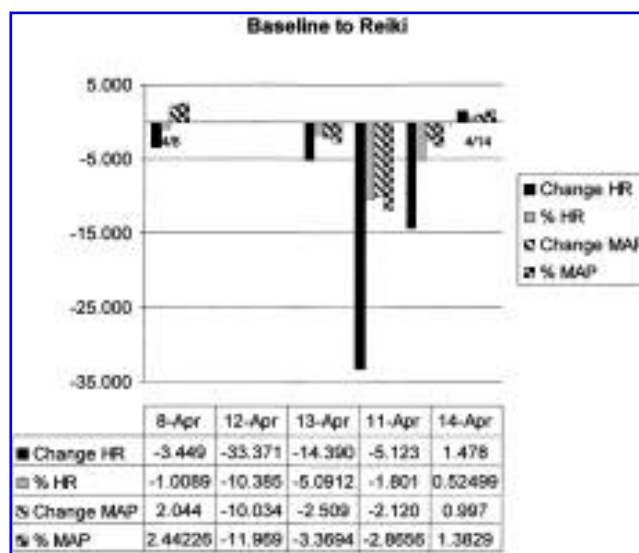


FIG. 2. Changes in heart rate and mean arterial pressure of 1 resting rat in response to 15 minutes of Reiki on 5 different days.

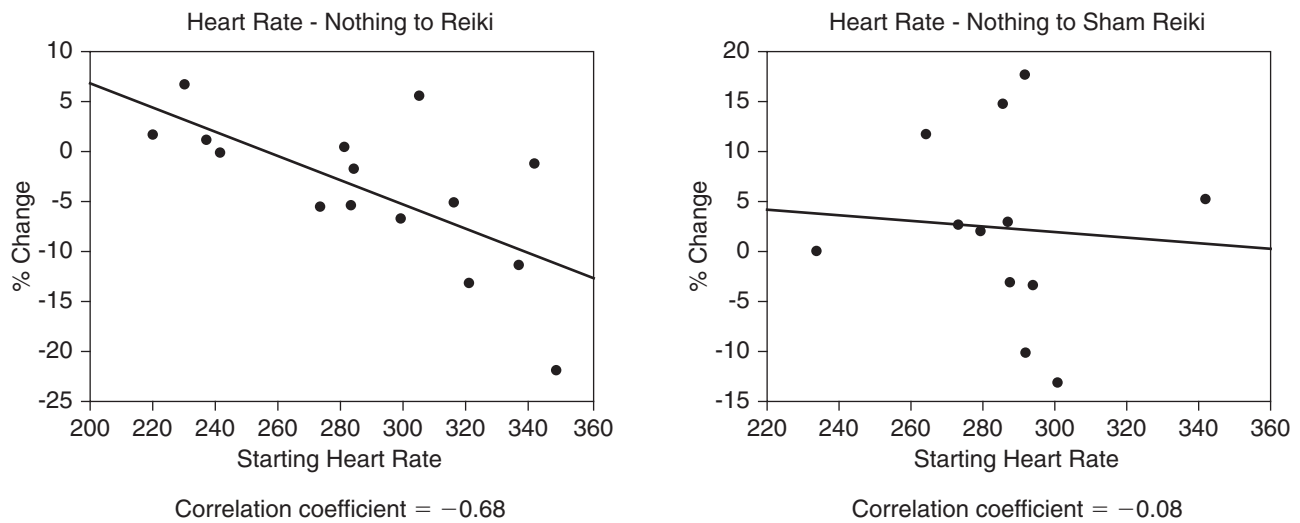


FIG. 3. Correlation between initial heart rate and change in heart rate in response to 15 minutes of Reiki (left panel) or sham Reiki (right panel) for all 3 resting rats (data taken over 5 sessions).

cedures (Holm-Sidak method) showed that the percentage increase in HR after noise alone was significantly greater than the value after Reiki + noise ($p < 0.01$) but not greater than for sham Reiki + noise. In the case of sham Reiki + noise, the change in HR showed very little correlation with the initial HR (correlation coefficient = -0.056); however, with Reiki + noise, the correlation was somewhat higher (correlation coefficient = -0.27). The change in HR after noise alone showed no correlation with the initial HR (correlation coefficient = -0.03).

When the rats were subjected to noise alone, the MAP increased by $11.04\% \pm 2.26\%$. When the rats were treated with Reiki or sham Reiki before and during the noise, the MAP increased by $7.06\% \pm 2.05\%$ and $4.34\% \pm 2.11\%$, re-

spectively, which was not significantly different from the noise alone value.

DISCUSSION

Statement of principal findings

Reiki, but not sham Reiki, significantly reduced the average resting HR in rats. With Reiki, there was a high correlation between change in HR and initial HR: those with the highest initial HR showing the greatest reduction, consistent with a homeostatic effect. In addition, Reiki, but not sham Reiki, significantly reduced the rise in HR produced

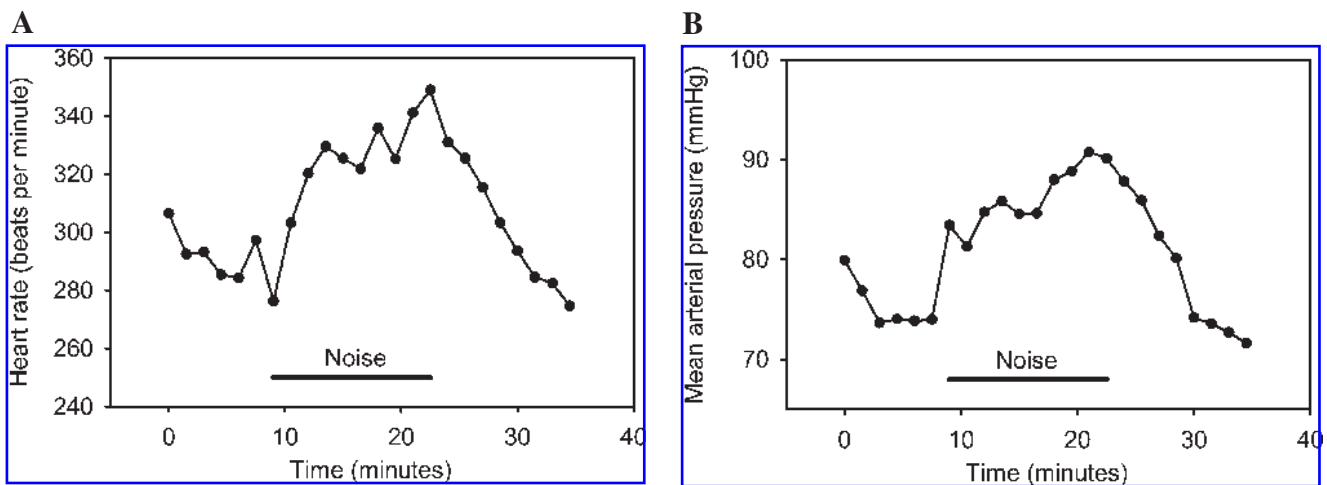


FIG. 4. Timeline of changes in heart rate (A) and mean arterial pressure (B) when 1 rat is exposed to 90-dB white noise for 15 minutes. These responses are typical for all rats involved in the experiment.

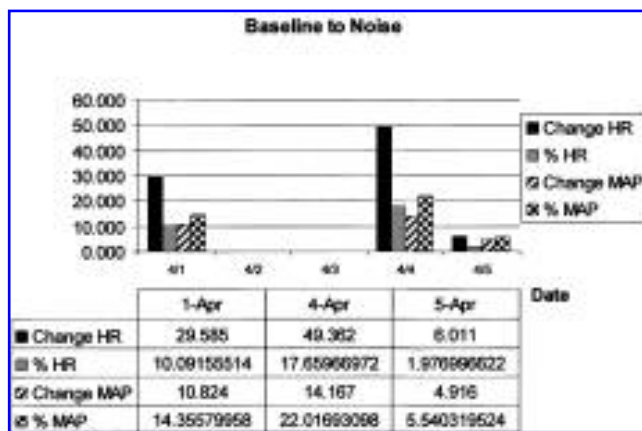


FIG. 5. Mean changes in heart rate and mean arterial pressure for 1 rat when exposed to 90-dB white noise on 3 separate days. These responses are typical for all rats involved in the experiment.

by exposure of the rats to loud noise. Neither Reiki nor sham Reiki significantly affected MAP.

Strengths and weaknesses of the study

This study is among the most rigorous tests of the efficacy of Reiki that has been performed, first because the Reiki groups were compared with sham Reiki controls and second because an animal model was used, thus removing problems with variations in diet and lifestyle and complications with attitude that are encountered when using human subjects. The same noise-stressed rat model was used in another study clearly demonstrating that interaction with a Reiki practitioner significantly reduces noise-induced microvascular damage.¹⁰

One possible weakness of the present study was that only 3 rats were used. The number of rats had to be small so as to minimize the time required for all the pairs of rats to receive Reiki from the 2 Reiki practitioners in each session. If more than 2 Reiki practitioners had been working in the animal room, the animals might have been disturbed, producing an uncontrolled variable.^{11,12}

Strengths and weaknesses in relation to other studies

There is only one published study² that can be directly compared with the present research. In that study, preliminary data were presented showing that both Reiki and sham Reiki significantly reduced HR in 2 small groups of healthy humans and that Reiki, but not sham Reiki, significantly reduced diastolic and mean arterial BP. However, the BP data, as reported by the authors, were questionable due to instability problems with the measurement technique. In the present study, the use of rats as experimental subjects allowed us to take advantage of the highly reliable and precise technique of radiotelemetry for cardiovascular measurements.

Thus, our results for both BP and HR are more robust than those obtained in the previous study.

A second strength of the present study is that the cardiovascular effects of Reiki were measured in the same animals when they were resting and when under stress, rather than just in calm subjects. Our finding that Reiki prevented the increase in HR caused by exposure to loud noise supports the use of Reiki as a stress reducer. Experiencing emotional stress causes increases in HR and BP and elevated release of stress hormones. All these responses result in a greater workload for the heart, which can be dangerous.¹³ The use of Reiki in stressful situations could therefore be an effective tool for minimizing cardiac work and so protecting the heart.

One weakness of both studies is the lack of measurements to determine whether the cardiovascular effects of Reiki are mediated by decreased sympathetic activity or increased parasympathetic activity. A previous study in which rats implanted with radiotelemetric transducers were subjected to 90-dB noise⁹ demonstrated no change in sympathetic activity in response to noise; instead, there was a significant reduction in parasympathetic activity. Consistent with this finding, in healthy humans, anxiety is associated with loss of vagal control of the heart.¹⁴ Thus, it is possible that Reiki may have prevented the noise-induced increase in HR observed in the rats by successfully impeding a reduction in parasympathetic activity.

Meaning of the study

This study showed that Reiki reduces HR in stressed and unstressed animals and promotes HR homeostasis, both of which optimize cardiac function. Resting HR is an important indicator of how hard the heart is working to maintain adequate blood flow; a high resting HR is strongly correlated with an increased rate of death as assessed in middle-aged men monitored over a 20-year period.¹⁵ Homeostatic capacity of the cardiovascular system is related to the sensitivity of the baroreceptors and adrenoreceptors; a high sensitivity enables the system to quickly adjust to external stimuli so that cardiac work is minimized. Another method of stress reduction, mindfulness-based stress reduction (MBSR), also shows a homeostatic effect, this time on BP in women with cancer.¹⁶ For participants with relatively high levels of baseline systolic BP at entry to the study, MBSR was associated with a significant decrease in resting systolic BP.

One difference between this study and the article by Mackay et al.² is that in the latter study there was a significant effect of Reiki on MAP. One reason that Reiki affected HR but not MAP in the present study could be that unlike HR, MAP depends on multiple factors including HR, cardiac contractility, and total peripheral resistance, and so Reiki would have to affect all these factors similarly in order for MAP to be altered. It is possible that performance

of Reiki for a longer period of time might have produced a change in MAP. In fact, in the previous study,² Reiki was performed for 30 minutes compared to the 15 minutes used in this protocol. Another question is whether Reiki can have a more lasting effect on cardiovascular function than monitored in both studies. In another experiment in which humans were trained in yoga for 30 days, these subjects showed a lower resting HR after the yoga training compared to before the training, whereas control subjects showed no difference after 30 days.¹⁷ If Reiki can be demonstrated to have prolonged beneficial effects on the cardiovascular system, this may result in therapeutic options to reduce BP that are cheaper than medications and that have no undesirable side effects.

CONCLUSIONS

Short periods of Reiki are effective in reducing HR in stressed and unstressed rats, as measured using the highly accurate technique of radiotelemetry. This finding provides support for further study of Reiki as a potential therapy for cardiovascular disorders.

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