Preliminary Experiments on Contact Healing, Breathing Exercises, Sounds and Their Responses

Sixth Degree Research Team, Rosicrucian Order, AMORC
(Hugh McCague, Ph.D. and Bryan Young, M.D. with contributions from Donna Bella, Shelley Higgins, Wendy Keslick, Nosa Orobaton, and Dave Stein)

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Abstract

A series of preliminary experiments employed the following exercises as treatment interventions and causes: i) breathing (regular, negative, positive), ii) chanting specified vowel sounds (intoned three times in sequence, on each occasion), iii) exposure to a 432 Hz tone, and iv) contact healing treatments with operator and recipient. The response outcomes or effects were pain level, systolic/diastolic blood pressure, pulse rate, and potential (voltage) difference between the left and right hands of subjects. Additional computed outcomes were mean arterial pressure and pulse pressure. Pulse rates tended to be 3.5 beats/minute higher ($p=0.018$, one-tailed) with positive breathing than with negative breathing, a finding consistent with other published literature. Mean pulse rates decreased by 3.9 beats/minute ($p=0.001$, one-tailed), and self-reported levels of pain, on the average, decreased by 2.8 (on a 0 to 10 scale; $p=0.010$, one-tailed) following contact healing treatments. Both of these decreases may not be entirely explainable as a physiological response; the plausibility of the mind/psyche effect of on the observed changes cannot be excluded. The other results were not statistically significant at the $\alpha = 0.05$ level. We recommend follow-up studies with larger samples sizes to confirm these associations and the strength of the possible effects of metaphysical exercises on health and healing.

Expériences préliminaires et résultats, portant sur les soins par contact, les exercices respiratoires et les sons vocaux.

par l'Equipe de recherches sur le Sixième Degré du Temple, de l'Ordre de la Rose-Croix A.M.O.R.C. (juridiction américiane):
(Hugh Mc Cague, Ph.D. et Brian Young, M.D. avec la participation de Donna Bella, Shelley Higgins, Wendy Keslick, Nosa Orobaton et Dave Stein)

Résumé

Une série d'expériences préliminaires s’est servie des exercices suivants aux effets d’interventions et causes de traitement : 1) respiration (normale, négative, positive), 2) intonation de sons de voyelles spécifiques (entonnés trois fois chacun), 3) exposition à un son, ayant 432 Hz de fréquence, et 4) traitement de contact avec opérateur et patient. Les résultats de la réponse, ou les effets, sont basés sur : niveau de la douleur, pression artérielle systolique/diastolique, pouls et différence de potentiel (tension) entre la main droite et gauche des patients observés.

Nous avons également enregistré des résultats additionnels, comme la tension artérielle moyenne et différentielle. Le pouls avait tendance à battre 3,5 battements/minute plus élevé ($p = 0{,}018$ unilatérale) avec la respiration positive par rapport à la négative, une conclusion conforme à d'autres documentations déjà publiées. La moyenne du pouls a diminué de 3,9 battements/minute (p = 0,001 unilatérale), et des niveaux déclarés de douleur par le patient-même, ont diminué, en moyenne, de 2,8 (sur une échelle de 0 à 10; p = 0,010 unilatérale) à la suite de traitements de guérison. Ces deux baisses ne sont peut-être pas tout à fait explicables comme une réponse physiologique, la plausibilité de l'effet du mental/psychique sur les changements observés ne pouvant être exclue.

Les autres résultats n'étaient pas statistiquement significatifs à α = 0,05. Nous conseillons des études ultérieures de suivi à plus grande échelle, afin de confirmer ces associations et l'intensité des effets possibles des exercices métaphysiques sur la santé et la guérison.

Experimentos Preliminares sobre Curación con el Contacto, Ejercicios de Respiración, Sonidos y Sus Respuesta.

Por el Equipo de Investigaciones del Sexto Grado, Orden Rosacruz, AMORC
(Hugh McCague, Ph.D. and Bryan Young, M.D. con contribuciones de Donna Bella, Shelley Higgins, Wendy Keslick, Nosa Orobaton, y Dave Stein)

Resumen

Una serie de experimentos preliminares que emplearon los siguientes ejercicios para la intervención de tratamientos y sus causas: I) respiración (regular, negativa, positiva), II) Entonación de específicos sonidos vocales (entonados tres veces cada uno), III) exposición al tono de frecuencia Hertz 432, y IV) Tratamientos de curación de operador a recipiente. La respuesta, resultados o efectos en done el nivel de dolor, presión arterial sistólica/diastólica, frecuencia del pulso, diferencia de potencial de (voltaje) entre la mano derecha y la izquierda de los sujetos. Resultados adicional que muestran presión arterial y presión del pulso. La frecuencia del pulso estribo más arriba entre los 3.5 latidos/minuto, (p=0.001,en el margen), y niveles de auto-reportes de dolor, en promedio, disminuido por 2.8 (en la escala de 0 a 10; p=0.10. al margen) después de la aplicación de tratamientos de contacto. Ambas disminuciones es posible que no se logren ser explicadas completamente como una respuesta filológica; no puede ser excluida la plausibilidad del efecto mente/Psiquis del observador. Los otros resultados no fueron estadísticamente significantes bajo el nivel a=0.05. Por lo tanto recomendamos el continuar las investigaciones utilizando cantidades más altas como ejemplos para confirmar la relación entre la potencia de los posibles efectos de los ejercicios metafísicos en curaciones y la salud.

Experimentos Preliminares no Contato de Cura, Exercícios de Respiração, Sons e suas Respostas

Time de Pesquisa do sexto grau, Rosicrucian Order, AMORC
(Hugh McCague, Ph.D. e Bryan Young, M.D. com contribuições de Donna Bella, Shelley Higgins, Wendy Keslick, Nosa Orobaton, e de Dave Stein)

Resumo

Uma série de experimentos preliminaries empregaram os seguintes exercícios como tratamentos de intervenção e causas: i) respiraração (regular, negativa e positiva), ii) entonação de sons vocálicos específicos (entonado três vezes em sequência, em cada ocasião), iii) exposição a um tom 432 Hertz, e iv) tratamentos de contato de cura entre o administrador e o receptor. Os resultados ou os efeitos foram no nivel de dor, pressão sanguínea sistólica/diastólica, medida do pulso, e diferença potencial (da tensão) entre a mão esquerda e direita dos indivíduos. Adicionalmente foram computados a pressão arterial média e a pressão de pulso. As taxas de pulso aumentaram em 3.5 batidas/minuto (p=0.018, one-tailed) com a respiração positiva comparada com a respiração negativa, um achado consistente com outra literatura publicada. As taxas de pulso diminuiram em 3.9 batidas/minuto (p=0.001, one-tailed), e níveis auto-relatados de dor, na média, diminuiram em 2.8 (em uma escala de 0 a 10; p=0.010, one-tailed) após o contato com os tratamentos de cura. Essas duas baixas no resultado não podem ser inteiramente explicadas como uma resposta fisiológica; o provável efeito mente/psique das mudanças não podem ser excluídas. Os outros resultados não foram estatisticamente significativos no nível α = 0.05. Nós recomendamos estudos complementares com um maior número de exemplos para confirmar essas associações e a força dos efeitos possíveis de exercícios metafísicos na saúde e na cura.

Erste Experimente mit Heiltherapie anhand direkter Berührungstechniken, Atemübungen, Klängeund ihre Resonanz.

Forschungsabteilung 6. Studiengrad, die Rosenkreuzer, A.M.O.R.C.
(Hugh McCague, Ph.D. und Bryan Young, M.D. mit Beiträgen von Donna Bella, Shelley Higgins, Wendy Keslick, Nosa Orobaton und Dave Stein)

Zusammenfassung

Im Rahmen einer Serie vorabgehender Experimente wurden folgende Übungen sowohl im Rahmen einer Behandlung als auch unabhängig davon durchgeführt: i) (normale, negative, und auch positive) Atmung, ii) Intonieren von bestimmten Vokalintonationen (jeweils drei Mal hinter einander), iii) einen Ton mit einer Bandbreite von 432 Hz anhören, und iv) Heiltherapie anhand direkter Berührungstechniken anzuwenden. Die Reaktion bzw. die Wirkung äußerte sich im Bereich der Schmerzgrenze, des systolischen und diastolischen arteriellen Druckes, des Pulsschlages und der unterschiedlichen Spannungen zwischen der linken und der rechten Hand der Probanden. Zusätzliche Computerergebnisse beziehen sich auf den mittleren arteriellen Blutdruck und auf die Pulsamplitude. Der Pulsschlag wies eine Steigerung von 3,5 Schläge pro Minute (pp=0,018, einseitig) nach einer positiven Atmung auf, dies im Vergleich zur negativen Atmung, was nahezu übereinstimmt mit den Ergebnissen aus anderen Publikationsquellen.
Der durchschnittliche Pulsschlag senkte sich um 3,9 Schläge pro Minute (pp=0,001, einseitig), und die selbst angegebene mittlere Schmerzgrenze ergab eine Reduzierung um 2,8 (auf der 0 bis 10 Scala; pp=0,010, einseitig) als Folge der Heiltherapien auf Basis von direkter Berührungstechniken. Die Senkung beider genannten Werte sollte nicht ausschließlich als eine physiologische Reaktion bewertet werden; denn man kann den Einfluss von Geist und Psyche nicht ausschließen. Die andere Resultaten waren in Bezug auf α = 0.05 statistisch jedoch nicht relevant. Um diese Ergebnisse zu bestätigen, empfehlen wir follow-up Untersuchungen mit größeren Testgruppen durchzuführen um festzustellen in wie weit metaphysische Übungen die Gesundheit und die Heilung beeinflussen können.

Introduction

This series of preliminary experiments built on research reported in the "Mindquest" series of articles that appeared in the during the 1970s and 1980s in the *Rosicrucian Digest*, published by the Rosicrucian Order, Ancient Mystical Order Rosae Crucis (hereafter referred to as AMORC).[1] The experiments were carried out to test and contribute to what is known in AMORC studies about the roles and effects of the contact healing and vowel sound intonations on physiological functions. The results from these initial explorations can guide the design and conduct of larger follow-up experiments, further aided by refined protocols and increased precision and accuracy[2] in measurements.

Related Work

The work of Shields[3] and of Mori et al.[4] on heart rate variability with deep breathing is a useful parallel to our investigation of breathing effects on pulse rate. Similarly, Mori et al. have noted a reduction in blood pressure with deep breathing.[5] Also, the suggestive efficacy of pulsed radiofrequency administered to the second cervical ganglion (C2) for the treatment of cervicogenic headache has some parallels to the contact healing treatments performed in our study.[6]

Experiment Design

The study was conducted on July 20-22, 2012 in the offices of the Rosicrucian Park, San Jose, California. A series of exercises was devised and performed by volunteer research subjects: i) Breathing, regular, negative (exhalations held) and, positive (inhalations held), ii) Chanting two vowel sounds (performed sequentially in sets of three intonations), iii) exposure to the 432 Hz tone, and iv) contact healing treatments administered by a designated operator to a given subject. One vowel sound was chanted aloud in one set only, whereas the other vowel sound was chanted aloud in a first and second set, and then silently within for a third set five minutes later. Four primary outcome measurements were recorded and these included pulse rate, blood pressure (diastolic, systolic), the voltage difference between the left and right hands, and self-reported levels of pain. Two additional quantities were computed from measured outcomes; namely, mean arterial pressure[7] and pulse pressure.[8] Blood pressure measurements were taken using a home electronic blood pressure monitor (Omron Blood Pressure Monitor, HEM-712C). Voltage measurements were taken using a voltmeter (RadioShack 29-Range Digital Multimeter, 2200813). The 432 Hz tone was produced employing the WavTones Online Audio Frequency Signal Generator[9] on a laptop computer. Investigators measured pulse rates using either i) digital watches with seconds indicated, counting tactile pulsations obtained from holding the wrist of the subject over the radial artery, or ii) the blood pressure monitor which also indicated heart rate (pulse rate).

The study utilized a pre-post measurement design. The self-conducted exercises (e.g., chanting Sound 1) or the contact healing was the intermediary intervention and treatment. Operators, who administered contact healing treatments, were randomly assigned from the pool of investigators to recipient subjects.

The healing treatment part of the study employed a Numerical Rating Scale (NRS) for pain for the recipient's self-reported pain or discomfort level before and after the contact healing treatment. This 11-point scale consists of the whole numbers from 0 to 10 where 0 designates no pain and 10 designates "worst imaginable pain".[10] The 11-point NRS is one of the most reasonable and useful assessment tools for pain.[11] The AMORC protocols used included mainly contact treatment in conjunction with breathing.

All the operators and treatment recipients in the study were active students of AMORC. The operators were all from the Sixth Degree Research Team, which is associated with the International Research Council (IRC) of AMORC. The recipient subjects were actively practicing and available AMORC students at the time of the study. The samples of operators and recipient subjects were convenient samples. As such, the recipient subjects were not necessarily representative of AMORC students or of the general adult population.

The sample size of recipient subjects was small as expected for a preliminary and low cost study. The sample sizes were n=12, 13, 14 and 19 depending on which measurements were involved. Missing values sometimes further reduced the sample size n. However, the repeated measures obtained for pulse for the breathing exercises experiment increased the effective sample size[12] for this particular experiment.

The common guideline for a statistical significance level $\alpha=0.05$ was employed.[13] One can also lower this level as a (parsimony) penalty for conducting multiple statistical tests. One-tailed tests were performed because the direction of change between paired pre- and post- measurements were hypothesized in advance,[14] based on the AMORC teachings and prior studies. For example, the direction of change was a decrease for some hypotheses (e.g., pain level lowers with the healing treatment).

All participants stayed in the individual pre/post experiments as is common for studies of brief duration.

Results

Post-hoc statistical power analyses were conducted with results reported later below. A commonly used guideline for statistical power[15] is $1 - \beta = 0.80$. A challenge for some of this study's tests was achieving a power of at least $1 - \beta = 0.80$ due, in part, to the small sample size. Post-hoc calculations of achieved power were done using a common estimated effect size index d_z.[16] Such an approach is a rough guideline at best. It is preferable to use already determined clinically significant[17] effect sizes in power calculations when available and prior to the study.

Breathing Experiment Results

A type of regression model was fitted with pulse rate as the response (dependent) variable and breathing state as the explanatory (independent) variable. The state variable was coded i) -1 for negative breathing, ii) 0 for regular breathing, and iii) 1 for positive breathing. The model was fitted using the breathing state variable as continuous/scale and then fitted again taking the state variable as categorical. The use of state as continuous/scale seems reasonable because negative breathing, regular breathing, and positive breathing can be deemed to be successively equally spaced apart (as is definitely the case for other measurements that are in a recognized unit such as pulses/minute). However, as a validation check, the results with the state variable as categorical are, as reported below, very similar.

A multilevel or Mixed Model[18] was used because there are repeated measurements for each participant and an unbalanced data structure due to missing values. A repeated measures ANOVA (analysis of variance) requires that no values be missing.

Due to the small sample size (i.e. number of participants or subjects), bootstrap methods[19] were also applied to the Mixed Models. The Mixed Model p-values[20] for the state variable are very similar with the original Normality (parametric) assumptions versus the use of the non-parametric bootstrap:

Estimation Method	State (Breathing)	Fixed effect coefficient[21] b	t	df (degrees of freedom)	p-value (1-tailed)
Normal (parametric)	Scale/ Continuous	1.75	2.12	81	0.0184
Bootstrap (2000 resamples): Positive breathing compared to Negative breathing, the base condition	Scale/ Continuous	1.75	-	-	0.0250
Normal (parametric):	Categorical	3.48 (2x1.74)	2.095	80	0.0197
Bootstrap (2000 resamples): Positive breathing compared to Negative breathing, the base condition	Categorical	3.48 (2x1.74)	-	-	0.0307

Table 1. Mixed Model Results for Breathing Effects on Pulse

The model showed that positive breathing tends to result in a pulse rate 2x1.75=3.50 beats/minute higher than for negative breathing with $p=0.0184$ (one-tailed) below the statistical significance level $\alpha=0.05$. As anticipated, regular breathing, as an intermediary state between negative and positive breathing, appears to have a pulse rate approximately midway between these latter two breathing modalities. When state was taken as categorical, there was no statistically significant difference between regular breathing and these two other ways of breathing. A larger sample size may well show a statistically significant difference. However, even with the small sample size the larger difference between positive and negative breathing was, as previously noted, statistically significant. These results in which the pulse rate was higher with positive breathing than negative breathing are consistent with other research findings.[22]

Healing Results

Paired samples t-tests were conducted for the pre-post measurements with respect to contact healing treatments.[23] Pulse pressure and mean arterial pressure measures were also calculated for the pre-post tests.

Pairs: Post-healing treatment value minus Pre-healing treatment value		Paired Differences					t	df	p-value (1-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pain Level	-2.833	2.041	.833	-4.975	-.691	-3.400	5	.010
Pair 2	Systolic Pressure	-1.500	18.554	4.959	-12.213	9.213	-.302	13	.384
Pair 3	Diastolic Pressure	1.857	10.538	2.816	-4.227	7.942	.659	13	.261
Pair 4	Pulse Rate	-3.929	3.912	1.045	-6.187	-1.670	-3.758	13	.001
Pair 5	L & R Hand Voltage Difference	-51.840	55.335	24.747	-120.548	16.868	-2.095	4	.052
Pair 6	Pulse Pressure	-3.357	12.882	3.443	-10.795	4.081	-.975	13	.174
Pair 7	Mean Arterial Pressure	.738	12.325	3.294	-6.378	7.855	.224	13	.413

Table 2. Healing Paired Samples T-Tests: Effects on Pain, Pulse, Hand Voltage, and Blood Pressure

Due to missing values, Pairs 1 and 5 above reduced n (equal to df plus 1) to 6 and 5 respectively, which calls for particular caution in the interpretation of these specific results with such small sample sizes. Pre- and post-pain level was recorded only for those recipients (n=6) who were experiencing pain at the pre stage. Five of these six persons experienced reductions in pain ranging from 2 to 6 units on the 0 to 10 NRS pain scale, and the remaining person's pain level remained unchanged at 3.

The results of particular note are the reported decrease in pain and the observed drop in pulse rates after the contact healing treatment with p-values well below the statistical significance level $\alpha = 0.05$:

Pain pre-post: M (mean)= -2.833
t (t-value)= -3.400,
df (degrees of freedom)=5,
p (probability)=0.00963 (one-tailed)
Bootstrap: p=0.0155 (one-tailed; 2000 resamples)
Power $1-\beta=0.90$

M = -2.833 above indicates that the mean change in pain (NRS scale 0 to 10) from before (pre) the healing treatment to after (post) the healing treatment was a decrease of approximately 2.8 units. The other results below for M (mean) can be similarly interpreted.

Pulse rate pre-post: M= -3.929

t= -3.758
df=13
p=0.00120 (one-tailed)
Bootstrap: p=0.00175 (one-tailed; 2000 resamples)
Power 1- β =0.97

A suggestive result is the decrease in hand voltage balance at a borderline statistical significance level with $0.05 < p < 0.1$:

Hand voltage balance: M= -51.8400
t= -2.095
df=4
p=0.0521 (one-tailed)
Bootstrap: p=0.0641 (one-tailed; 1996 resamples)
Power 1- β= 0.53

The readings from the voltmeter were unstable. Recipients were instructed to "lightly grasp" the voltmeter probes between their index finger and thumb of each hand, which is less than ideal. Consequently, two factors that could have independently affected voltage readings between participants, and for the same participant each time the measurement was taken, include: a) the grasp weight and strength, and b) skin moisture. Both of these variable factors would influence the conductivity of the probe and resultant reading. In a subsequent study, using the more proper taped-on electrodes and leaving them in place on the participants would allow for more consistent voltage readings.

In addition, an increase in sample size would be helpful in retesting all these results.

Other Chanting and 432 Hz Tone Results

Pairs: Post-treatment value minus Pre-treatment value		Paired Differences					t	df	p-value (1-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pulse with Sound 2 Chanted Aloud 3 times	-4.667	10.228	2.952	-11.165	1.832	-1.581	11	.071
Pair 2	Pulse with Sound 2 Chanted Aloud 2 times	.154	13.334	3.698	-7.904	8.212	.042	12	.484
Pair 3	Pulse with Sound 2 Chanted Silently for 5 min	-.385	12.427	3.447	-7.894	7.125	-.112	12	.457

Pair 4	Pulse with Subjects Listening to 432 Hz Tone	-1.538	12.567	3.486	-9.133	6.056	-.441	12	.334
Pair 5	Systolic Pressure with Sound 1 Chanted Aloud	-2.667	19.604	11.319	-51.367	46.033	-.236	2	.418
Pair 6	Diastolic Pressure with Sound 1 Chanted Aloud	5.000	6.928	4.000	-12.211	22.211	1.250	2	.169
Pair 7	Pulse with Sound 1 Chanted Aloud	-.333	7.506	4.333	-18.978	18.311	-.077	2	.473

Table 3. Chanting (Sounds 1 and 2) and Tone Paired Samples T-Tests: Effects on Pulse Rate and Blood Pressure

Due to missing values, Pairs 5, 6 and 7 above have reduced n (equal to df plus 1) to 3, which indicates that particular caution is needed in the interpretation of these specific results, given such small sample sizes.

A suggestive result at a borderline statistical significance level with $0.05 < p < 0.1$ (for the standard paired t-test) is the decrease in pulse with the first set of intonations of Sound 2:

Pulse, with Sound 2 chanted aloud pre-post: M= -4.667
t= -1.581
df=11
p=0.0711 (one-tailed)
Bootstrap: p=0.157 (one-tailed; 2000 resamples)
Power $1- \beta = 0.44$

An increase in sample size would be helpful in retesting all these results.

Responders Results

For each pre-post measurement pair, binary indicator variables were created and valued 1 if the subject responded in the anticipated/hypothesized manner, and 0 if they did not. In taking the mean of binary responder variables, each subject then had a proportion (between 0.00 and 1.00 inclusive) of the times that they responded in the hypothesized manner. These proportions yield percentage values when multiplied by 100.

The measurements used were those from the healing (systolic, diastolic, pulse, pain, and voltage between hands) and the Sound 1 vowel sound (systolic, diastolic, pulse, and voltage between hands) measurements. Response variables could also be worked out for some of the other measurements taken in order to pursue this matter further even with this current preliminary study. However, the current calculated response rates are already useful as they are based on a substantial range of different types of measurements.

Participants' response rates were clustered predominantly around a mean of 0.61 (equivalent to 61%) and trailed off in the tails to the lowest and highest response rates of 0.00 and 1.00, respectively (Figure 1). The group did not form into a U-shaped distribution in which participants were primarily either non-responders (response rate 0.00 or close to 0.00) or consistent responders (response rate 1.00 or close to 1.00). Participants were not polarized as definite non-responders and responders. The closer a participant's response rate is to the average, the more common it tends to become with respect to others' response rates in the study.

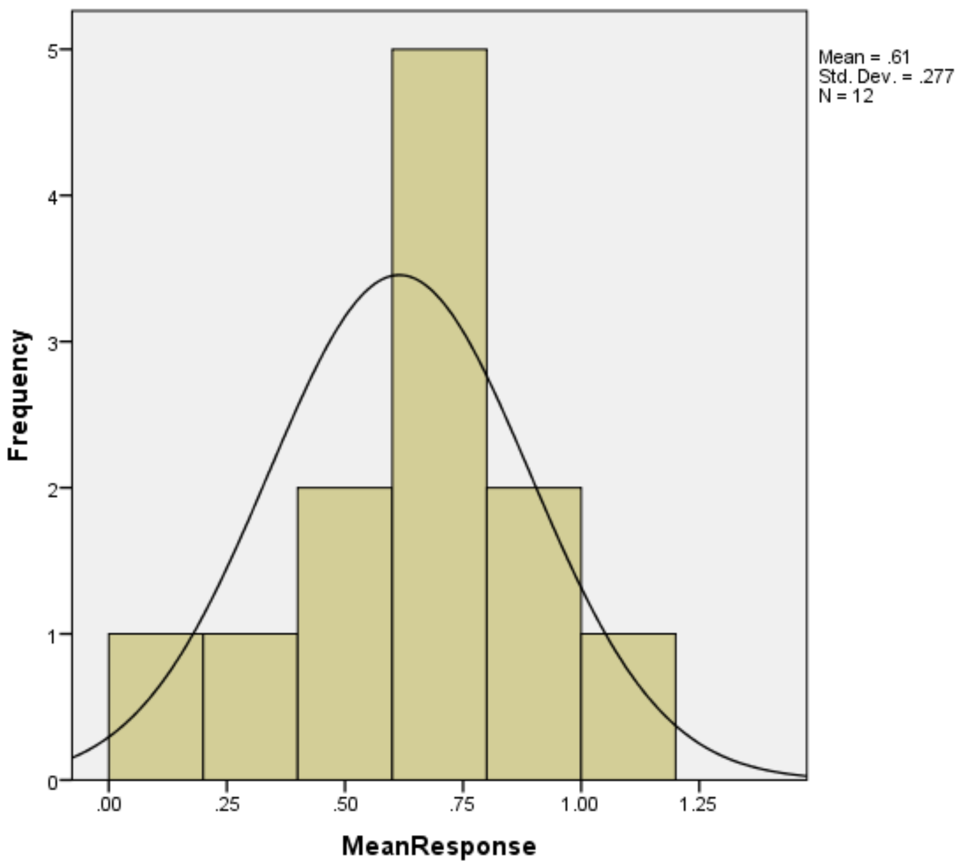

Fig. 1. Histogram of the Mean Response Rate for Each Subject with a fitted Normal Curve

The observed mean response rate of 0.61 can be tested against an unacceptable low rate. One could take that latter rate as 0.5 with the view that response and non-response could each occur by apparent chance half (0.5) of the time. In this application, a much lower response rate than 0.5 may be more indicative of what could be deemed to occur by chance. However, taking the threshold response rate at 0.5 and testing the hypothesis that the response rate is greater than 0.5 yields:

M= 0.115
t=1.437

df=11
p=0.0893 (one-tailed)
Bootstrap: p=0.0608 (approximated one-tailed; 2000 resamples)
Power: $1- \beta = 0.383$

Notably, these results indicate a borderline significance level (with $0.05< p <0.1$). With a larger sample size than the current n=12, this result may well be both statistically and clinically significant, especially when one considers the current low achieved power.

Discussion

The decreases in self-reported levels of pain after treatments versus levels reported before treatment and the corollary declines in pulse rates after treatments may not be entirely explainable as a purely physiological response; rather these observed changes may well be a manifestation of the real effect of the mind/psyche on healing outcomes. The reduction in pulse rate with the healing procedure has not been previously reported. It is not merely a reflexive physiological response; it is quite likely centrally mediated in the brain. Heart rate is determined by the balance of sympathetic and parasympathetic nervous system tone. Increased sympathetic activity accelerates the heart rate, while parasympathetic nervous stimulation slows the heart rate via the vagus nerve.[24]

Central control of the autonomic nervous system is mediated by the hypothalamus and other centers in the brainstem, which in turn, are influenced by higher centers and networks in the brain.[25] Key structures for both the central pain network and its connection to the hypothalamus are the amygdala, an almond-shaped nucleus in the temporal lobe, and the insula, a cortical region deep to the Sylvian fissure.[26] These regions, as part of the pain network, can affect the balance of sympathetic and parasympathetic "tone" on heart rate. Emotions can thus influence the heart rate through this higher control system. It is of interest that sympathetic stimulation can ameliorate the inflammatory response.[27] Thus, autonomic influences might affect the induction of pain pathways by lessening inflammation. Although not the focus of this study, we note the documented sex difference in autonomic response[28] that could be a subject of further exploration in a larger sample.

Study Limitations

This study has a number of limitations. First, there is a possibility that recipient subjects anticipated a reduction in pain ahead of the contact healing that, via interaction, could have produced larger than expected reduction in reported levels of pain. Second, while waiting times were maintained between each set of exercises, the results of the previous exercises may have influenced the exercises that followed. Third, the small sample size, while applicable for a preliminary study, meant the study does not have sufficient power for small effect sizes. Fourth, the convenient sample of recipient subjects meant they are not necessarily representative. Fifth, we did not confine the contact healing to a specific duration, and this could have confounded the measured outcomes. Subsequent study design will take account of these factors and control for them accordingly.

Recommendations

We recommend a larger study with an improved design. Funding permitting, we propose an experimental design with placebo-like interventions. Where possible, the design will consider blinding. We propose a larger sample size of subjects that is representative of the Rosicrucian student population. We recommend that the subjects include a spectrum of students that ranges from those with none or limited experience with the exercises to those with high proficiency. We also propose that additional controls (e.g., increased wait times between exercises and repeat baseline measurements through the study period) be introduced to apply to recipient subjects as well as improved quality of measurements including instrumentation.

Conclusion

Pulse rates tended to be 3.5 beats/minute higher ($p=0.018$, one-tailed) with positive breathing than with negative breathing. The mean decreases in pulse rates by 3.9 beats/minute ($p=0.001$, one-tailed) and in self-reported levels of pain by 2.8 (on a 0 to 10 scale; $p=0.010$, one-tailed) following contact healing treatments may not be entirely explainable as a physiological response; the plausibility of the mind/psyche effect on the observed changes cannot be excluded. The other results were not statistically significant at the $\alpha = 0.05$ level.

This preliminary study was fruitful in assessing methods and providing some noteworthy preliminary results, particularly in regard to the breathing effects on pulse rate and contact healing's effects on pulse rate and self-reported pain level. These results were consistent with some previously reported research findings and the studies of the Rosicrucian Order, AMORC. This study provided more detailed information on the size of effects. Larger follow-up experiments would definitely be of value.

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[1] Some of these articles were later synthesized in the book by George F. Buletza, former Director of the Research Department, Rose-Croix University. George F. Buletza*, Marriage of the Mind: Processes of Insight and Integration,* (San Jose, CA: Grand Lodge of the English Language Jurisdiction, AMORC, 1997).
[2] Accuracy and precision are different concepts in science. Measurements that are close to the correct value are accurate. Precise measurements of the same quantity are all within a narrow range. If the correct value is in that narrow range, or precise interval, then those measurements are both precise and accurate. Phillip I. Good et al., *Common Errors in Statistics (and How to Avoid Them)*, 2nd ed., (Hoboken, NJ: John Wiley and Sons, 2006), 219.
[3] Robert W. Shields, Jr., "Heart Rate Variability with Deep Breathing as a Clinical Test of Cardiovagal Function," *Cleveland Clinic Journal of Medicine* 76 (2009): Supplement 2, S37-S40.
[4] H. Mori et al., "How Does Deep Breathing Affect Office Blood Pressure and Pulse Rate?" *Hypertension Research* 28, no. 6 (2005): 499-504.
[5] *Ibid*.
[6] Juan Zhang et al., "Pulsed Radiofrequency of the Second Cervical Ganglion (C2) for the Treatment of Cervicogenic Headache," *Journal of Headache and Pain* 12, no. 5 (2011): 569-571; M.J. Mehnert et al., "Update on the Role of z-joint Injection and Radiofrequency Neurotomy for Cervicogenic Headache," *PM&R (The Journal of Injury, Function and Rehabilitation)* 5, no. 3 (2013): 221-7. Also, closely related is W. Halim W et al., "Long-term Pain Relief in Patients with Cervicogenic Headaches after Pulsed Radiofrequency Application into the Lateral Atlantoaxial (C1-2) Joint Using an Anterolateral Approach," *PAIN Practice* 10, no. 4 (2010): 267-71.
[7] Mean arterial pressure is (approximately) equal to Diastolic Pressure + (1/3)(Systolic Pressure - Diastolic Pressure) = (2/3) (Diastolic Pressure) + (1/3)(Systolic Pressure). The latter expression is a weighted mean.
[8] Pulse pressure is equal to Systolic Pressure minus Diastolic Pressure.
[9] Stéphane Pigeon, "WavTones Online Audio Frequency Signal Generator."
[10] Amelia Williamson et al., "Pain: A Review of Three Commonly Used Pain Rating Scales," *Journal of Clinical Nursing* 14 (2005): 799.
[11] *Ibid*., 803.

[12] Richard H. Jones, "Bayesian Information Criterion for Longitudinal and Clustered Data," *Statistics in Medicine* 30 (2011): 3051-3052. For the Mixed Models, the data was placed in the required long format with rows for each repeated measurement for each subject.
[13] α is the standard set for the probability of a Type I error (i.e. the probability that the null hypothesis is rejected when it is true for the test being carried out). A common null hypothesis for this study is that the difference (change) in post measurement was not as hypothesized (e.g., a decrease was hypothesized, but did not occur).
[14] Statistical software commonly provides default p-values for two-tailed tests (often used to test for either an increase or decrease, not just a decrease). Such p-values can be divided by 2 in order to provide the p-value of a corresponding one-tailed test.
[15] The power of a statistical test is closely related to Type II error. Type II error occurs when the null hypothesis is accepted when the alternative hypothesis is true. For example, a common alternative hypothesis for this study is that the difference (change) in the post measurement would be a decrease. Power is 1 minus the probability (β) of a Type II error.
[16] Faul et al., "Means: Difference between Two Dependent Means (Matched Pairs)," "G*Power 3.1.3"; J. Cohen, *Statistical power analysis for the behavioral sciences*, (2nd ed., Hillsdale, NJ: L. Erlbaum Associate, 1988), 36.
[17] Clinically significant refers to an effect that clinicians would generally agree is of value and note in practice and in regard to health consequences. It is possible that an effect may be statistically significant (at, say, $\alpha=0.05$), but too small to be considered clinically significant.
[18] Andrew Gelman et. al., *Data Analysis Using Regression and Multilevel/Hierarchical Models*, (New York: Cambridge University Press, 2007). Mixed Models are also referred to as multilevel models, mixed effects models, and in, some cases, hierarchical models. They are a type of regression that accounts for the potential dependence of observations at successive levels in a model (e.g., repeated outcome measurements, at level 1 in the model, of the same person/subject, at level 2 in the model). Such dependence violates an assumption of standard multiple regression models. Mixed Models are different from, but in some cases equivalent to, Structural Equations Models (SEM) commonly employed in quantitative methods in the social sciences. Mixed Models are a powerful analytic method that have been particularly developed over the past quarter century. All reality can be viewed as having a structure applicable to multilevel models.
[19] The simplest form of bootstrapping is successively resampling with replacement from a sample in order to obtain confidence intervals for a given statistic, such as the mean. 2000 is generally a reasonable number of resamples or bootstrap samples. Bootstrap methods can be helpful (though not a remedy) for improving the accuracy of inferences based on small samples (e.g., $n<25$ for basic statistical tests). The central analogy of bootstrapping is "The population is to the sample as the sample is to the bootstrap samples" (John Fox. *Applied Regression Analysis and Generalized Linear Models*, (2nd ed. Los Angeles: Sage, 2008), 590). This analogy is akin to the correspondence of the microcosm (resample) with the macrocosm (sample).
[20] These p-values are the probability that the coefficient of (i.e. multiplying) the state variable is less than or equal to 0 (i.e. pulse stays the same or decreases as state increases) in the context of the model.
[21] The fixed effect coefficient is a regression coefficient. Mixed models have both fixed effects and random effects. The latter helps deal with the dependence of observations (e.g., repeated measurements of pulse taken from the same individual subject).
[22] Shields.
[23] Paired samples t-tests tests are the most common sound method for comparing measurements before and after a treatment when there are no additional explanatory variables (covariates and factors). More specifically, they test if there is a statistically significant difference between the mean of the differences of the paired post and pre measurements. Correlations (Pearson correlations) could also be taken between the post and pre measurements. However, these correlations would answer a different question; namely, what is the direction and strength of the linear relationship between the post and pre measurements? This latter question is not particularly needed for this report. If, in a follow-up study with a larger sample size, explanatory variables (e.g., subject's sex and age) in addition to the treatment are introduced into the research questions and hypotheses, an ANOVA or ANCOVA (analysis of covariance), or even more informative, a multiple linear regression can be performed. Rather than have the change score (the post measurement minus the pre measurement) as the outcome (response) variable, more information can be maintained by using the post measurement as the outcome variable and use as explanatory variables the pre measurement variable and other relevant variables (e.g., subject's sex and age, if applicable). For multiple linear regression, correlation (r) is of note particularly because r^2 is the proportion of the variation in the post measurement (outcome variable) explained by the linear relationship with the explanatory variables.
[24] P. Brodal, *The Central Nervous System: Structure and Function*, (Oxford: Oxford University Press 2004), 369-396.

[25] Lee J. Napadow et al., "Brain Correlates of Phasic Autonomic Response to Acupuncture Stimulation: An Event-related fMRI Study," *Human Brain Mapping* 34 (2013): 2592-3606.
[26] A.I.Vinik, "The Conductor of the Autonomic Orchestra," *Frontiers in Endocrinology* 3 (2012): 71.
[27] L.V. Borovikova et al., "Vagus Nerve Stimulation Attenuates the Systemic Response to Endotoxin," *Nature* 405, no. 6785 (2000): 458-462.
[28] Allison C. Nugent et al., "Sex Difference in Neural Correlates of Autonomic Arousal," *International Journal of Psychophysiology* 80, no. 3 (2011):182-191.