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Effect of Spontaneous Non-Therapeutic Light Massage on Heart Rate Variability in Young Adults: A Pilot Study

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Abstract

Objective: To verify the effect of spontaneous, non-therapeutic, light massage on heart rate variability.

Method: Interval RR was collected on seven young adults, in baseline (1 min) and intervention (3 min) conditions, through a validated cardiofrequencimeter (Polar V800). The temporal series were treated on heart rate variability software (gHRV).

Results: During massage, heart rate slowed down, RR mean interval has augmented, SD2 has augmented, SD1/SD2 ratio significantly diminished, and Poincare plots became a more defined comet tail pattern.

Conclusion: Preliminary data suggest that even a spontaneous, non-therapeutic, light massage may afford parasympathetic activation, with potential benefits to heart functioning.

Keywords

Massage; Heart rate variability; Cardiofrequencimeter

Introduction

Massage therapy is assumed to be the most frequent alternative treatment to back pain [1], and traditional techniques, like Swedish massage and Tai massage, proved to have similar sensorial, muscular and articular effects [2]. However, massage seems to have a broader effect on biological [3], hormonal [4] and psychological [5] systems. In fact, even gentle touch seems to have some psychological effects [6,7]. Vagal activity seems to be triggered by massage, reducing heart rate frequency [8], but more importantly, it results in enhanced heart rate variability (HRV) [9,10]. Simpler ways of physical contact, like hand-holding, also enhance HRV [10].

HRV results from the variations of the RR intervals, the elapsing time between two consecutive R waves, and is considered an expression of physiological modulation of the heart rhythm [11]; with the sympathetic nervous system (SNS) increasing heart rate and the parasympathetic nervous system (PNS) lowering it [12].

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Non-linear analysis has powerful instruments to visualize and quantify PNS, as the Poincaré plot which is a graphic that represents the association between successive RR intervals [13,14]. Poincare plots allows mathematical determination of two standard deviations of the lengths of RR intervals [15]: i) SD1- the standard deviation of successive differences, obtained from points perpendicular to the line-of-identity, for estimation of the short term variability; and, ii) SD2- the standard deviation of R-R intervals, obtained from points along the line-of-identity, for estimation of the long term variability [16-18]. From the lengths of the semi-axis of SD1 and SD2 an ellipse is fitted.

So, the objective of the present exploratory study was to verify the effect of non-therapeutic light massage on the heart rate variability of healthy young adults, based on short-term HRV analysis.

Materials and Methods

Seven young adults (20.0 ± 1.41 years of age, 5 females) were instructed to not smoke, drink alcohol or coffee 4h before data collection; they didn't know the purpose of the study, and informed written consent was obtained. No medication for anxiety or depression, and no heart or brain damage were reported [19]. Data were collected at the participants' homes, in a quiet environment, with room temperature between 19 and 22°C.

With subjects in the supine position, collecting's sequence was the following: 1) baseline condition (B)-resting normal breathing (2 minutes), from which the second minute was taken; and, 2) massage condition (M)-light circular massages simultaneously at both ear lobes, with thumb and index finger (4 minutes), from which the last 3 min were taken.

For physiological data acquisition and recording Polar V800 was used [20]. Analyzes of HRV was made through gHRV software [21]. In order to reject incorrect beats, like values exceeding the cumulative mean threshold or not acceptable physiological values, automatic filtering with adaptive thresholds was used [22]. To obtain a filtered non-equispaced heart rate signal in the frequency domain analysis, a linear interpolation method was used [23]. For non-linear indexes, SD1, SD2, and Poincare plots were obtained.

For statistical treatment was used the IBM-SPSS program, version 24. To verify data normal distribution Shapiro-Wilk test was used. For within group comparison Wilcoxon test (Z) was used, with Monte Carlo estimation. Effect size r and Wilcoxon rank-biserial correlation coefficient rrb was calculated [24]. Spearman's correlation coefficient (rho) was used for association between variables.

Results

The mean heart rate diminished (ns) in M condition (68.29 ± 10.01 beats per minute, Md=70) compared to B condition (70.43 ± 10.61 beats per minute, Md=70), and mean RR interval has augmented (ns) (901.14 ± 133.80 ms, Md=863; 872.86 ± 128.13 ms, Md=856, respectively).

Poincare plots reveal that in the M condition the (healthier) comet tail becomes more defined (Figure 1). This general tendency of Poincare plots is confirmed by SD1 and SD2, with maintenance of

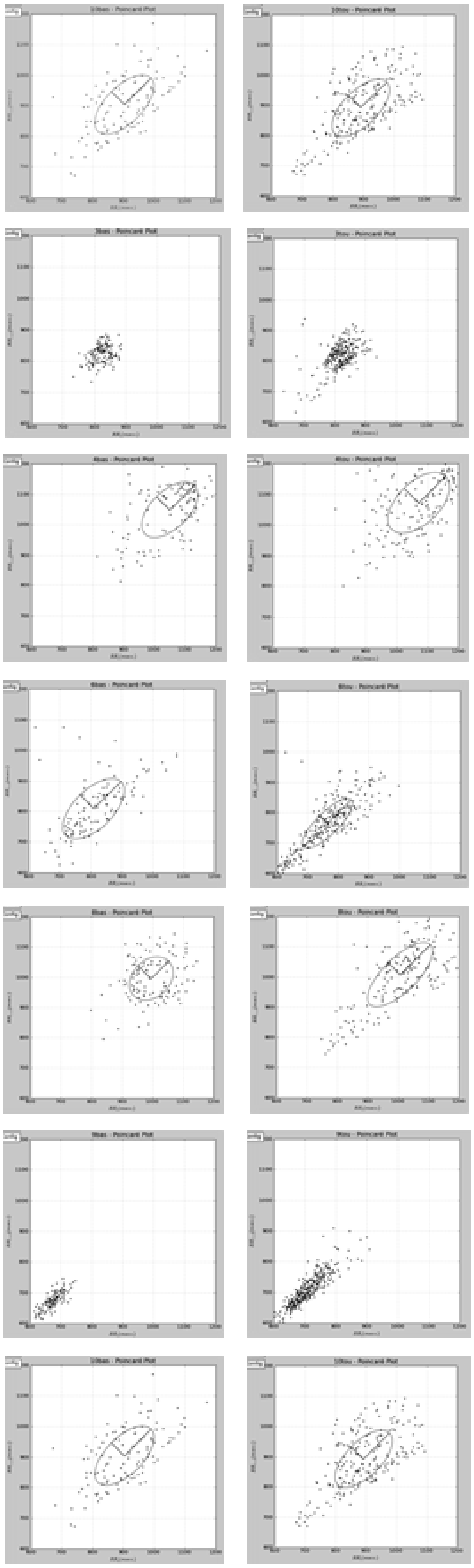

Figure 1: Poincare plots in the B (left) and in the M (right) conditions, ordered from participant 1 (top) to participant 7 (bottom).

Table 1: Estimation of SD1 and SD2 Poinare plots axis (mean ± standard deviation, median), comparison within group (Z), effect size (r), and Wilcoxon rank-biserial correlation coefficient (rrb), per condition (B- Baseline; Massage).

	Baseline	Massage	Z	r	rrb
SD1	45.83 ± 20.44, 60.32	43.21 ± 17.49, 36.40	0.000, ns	0.00	0.14
SD2	83.88 ± 37.43, 80.79	107.71 ± 31.59, 120.75	-1.690, ns	0.64	-0.43
SD1/SD2	0.55 ± 0.15, 0.54	0.41 ± 0.13, 0.40	-2.197, p<0.05	0.83	0.71

short term beat-beat variability (SD1), and a tendency for long-term beat-beat variability (SD2) to be higher during M than during B. This tendency is confirmed by a significant smaller SD1/SD2 ratio in the M condition (Table 1).

The expected significant inverse association between mean heart rate and RR mean interval occurred; however, it was perfect in M condition (rho= -1.000) but not for B condition (rho= -0.991, p<0.001). Additionally, in M condition, a tendency for an inverse association occurred between SD2 and mean heart rate (rho=-0.750, p=0.052), and a tendency to a direct association between SD2 and mean RR interval (rho=0.750, p=0.052); but not in B condition (rho=-0.270, p=0.558; rho=0.286, p=0.535, respectively). Finally, while in the B condition a strong direct significant association occurred between SD1 and SD2 (rho=0.857, p<0.05), it vanished in the M condition (rho=0.571, p=0.180).

Discussion

A simple, reduced in time and non-therapeutic massage resulted in potentially beneficial (transient) effects in HRV of healthy young adults. In the M condition participants augmented HRV, sustained by a significantly lower SD1/SD2 ratio, and lowered heart rate frequency. Additionally, associations revealed that in the M condition SD2 was enhanced by heart rate slowing down and mean RR interval augmentation. However, not all participants responded with the same intensity to M condition, as can be individually observed in Poincaré plots (Figure 1).

This study will be continued by longer time series collecting, to allow more complete heart rate variability analysis, and with special population groups, that can benefit with this non-clinic and non-expensive intervention, like ADHD children.

Conclusion

The results of this exploratory study revealed that a simple and brief massage can be used to stimulate better cardiovascular functions, even in healthy young adults; supporting the hypothesis that for heart rate variability enhancing the light massage can be a complementary non-pharmacological and non-clinical procedure.

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