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Optimal Timing for Chiropractic Spinal Adjustment According to Heart Rate Measures: A Case Study

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Abstract Timing of an intervention is an important part of quality clinical care, including chiropractic care. In this case study the heart rate tests of resting heart rate (RHR) and heart rate variability (HRV) were used as outcome measure and for determining when to administer a chiropractic spinal adjustment. Optimal post-adjustment results were observed when the tests showed worse pre-adjustment values. Further application in other patients is planned.

Keywords: *resting heart rate, heart rate variability, chiropractic*

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1. Introduction

Timing of an intervention is an important consideration in practice. Yes, it matters *what* is done, but it also matters *when* it is done. Timing of an intervention matters because if it is not the right time, the intervention may do more harm than good:

> While competent in specifying how to treat, medicine generally fails to decide correctly *when* [emphasis added] to intervene in the evolving process. This is the main source of medical iatrogenesis [1].

This writer, a chiropractor, bases the timing for his intervention (spinal adjustment of vertebral subluxation) on heart rate measurements. Conceptually, a chiropractic vertebral subluxation is a slight vertebral misalignment that disturbs spinal cord and / or spinal nerve function [2]. The author uses resting heart rate (RHR) and heart rate variability (HRV) because these evidence-based measures can be used to assess neurological (autonomic) function [3,4]. And autonomic health is the main focus of the author's chiropractic practice. RHR and HRV are supported by outcomes research that shows a lower RHR is healthier than a higher one [5] and a higher HRV value is healthier than a lower one [4].

Different clinicians use heart rate measures for different purposes. The medical doctor might use heart rate to diagnose a cardiovascular problem. The writer uses RHR and HRV not only as an outcome assessment, but also for determining *when* to adjust the patient. If the measures indicate poor autonomic health on a given visit, then the patient's spine is assessed for slight misalignment. So autonomic dysfunction + slight misalignment = vertebral subluxation, the remedy for which is a chiropractic spinal adjustment. This is important because the autonomic nervous system: a) controls so many vital functions and b) is a key factor in healthy longevity [4]. The author has reported good results using this approach, where the heart rate measures tended to improve following adjustment [6,7]. The author has also reported that timing of a spinal adjustment, according to heart rate variability was related to better HRV outcome when the pre-adjustment HRV value was less than 28 milliseconds [8]. That study was done at the group level for a single office visit and had exceptions as groups studies sometimes do. In other words, some patients in that study who were adjusted when indicated (by the low HRV) still had post-adjustment HRV values that were worse than the pre-adjustment values. The worsening is assumed to be only temporary though follow-up study has yet to substantiate this. Fortunately, the majority of patients in that study who were adjusted when their HRV was < 28 ms experienced improved (higher) HRV following spinal adjustment.

The present study is a continuation of the aforementioned group study, at the level of the individual patient. The purpose of the study is to show how RHR and HRV can be used to determine possible optimal timing for spinal adjustment for an individual patient.

2. Case Study

2.1. The Patient

The patient is an adult female who gave her permission to write up her case for publication. Her chief complaint was headaches and neck pain, which substantially improved over time after the author's care began.

2.2. The Subluxation

The purpose of a chiropractic adjustment is to correct a chiropractic subluxation [2]. The operational definition of subluxation in the study was based on the exam procedures at Hart Chiropractic that included: a) neurological assessment using RHR and HRV and b) spinal alignment assessment using palpation. These neurological assessments were used for determining *when* to adjust. Adjustment was given when RHR increased and / or HRV decreased.

2.3. Heart Rate Measurements

For HRV, the time domain measure of root mean square of successive differences between heart beats (rMSSD), measured in milliseconds (ms) was used. The terms *rMSSD* and *HRV* are used interchangeably in this paper. HR was measured in beats per minute (BPM).

Both measures (HR and HRV) were recorded using the Heart Rate Variability Logger app [9] in connection with the Kyto ear clip sensor [10] (Figure 1).

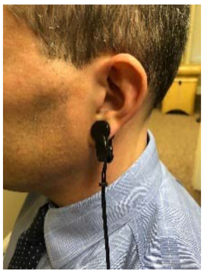

Figure 1. HRV - ear clip set-up

The sensor sends a Bluetooth signal to the smartphone app and the set-up has good agreement with standard ECG technology [10,11]. Both measures (RHR and HRV) were recorded simultaneously for 1 minute each during a recording session with the patient in the seated position after a seated rest period of at least 5 minutes.

Average normative data for this patient's age and gender is 76 BPM for RHR [12] and at least 21 ms for the HRV [13].

The *location* for adjustment was based on the author's upper cervical spine focus on atlas subluxation, using a low-force percussion instrument (Figure 2).

Figure 2. Set-up for atlas adjustment (author setting-up on colleague who gave his permission for photo use)

3. Results

Results for RHR and HRV are shown by visit in Figure 3 (RHR) and Figure 4 (HRV). Four adjustment were given in the study, indicated with an "A" in the figures. Post-adjustment measurement was taken approximately 1-minte after the adjustment.

Two of the four visits where adjustments were given showed the worst pre-adjustment measurements, on 10-29-19 and 12-10-19 (Figure 3 - Figure 4). Adjustments on these visits were followed by slight post-adjustment improvements (except for HRV on the 12-10-19 adjustment - Figure 4) but continued to show substantial improvement on subsequent visits. Additionally, the 74.4 ms HRV value observed (on 11-12-19, two weeks after an adjustment) is a statistical outlier, suggesting this improvement did not happen by chance alone. The 78.2 ms on the first visit, before any adjustments were given, is also an outlier. Outlier calculation was performed in Excel using the inter-quartile method with a factor of 1.5 for moderate outlier detection [14].

Adjustments on visits where the pre-adjustment measurements were *not* the worst, on 6-6-19 and 10-15-19 resulted in little-to-no improvement or notable worsening of the post-adjustment measurements (Figure 3 - Figure 4).

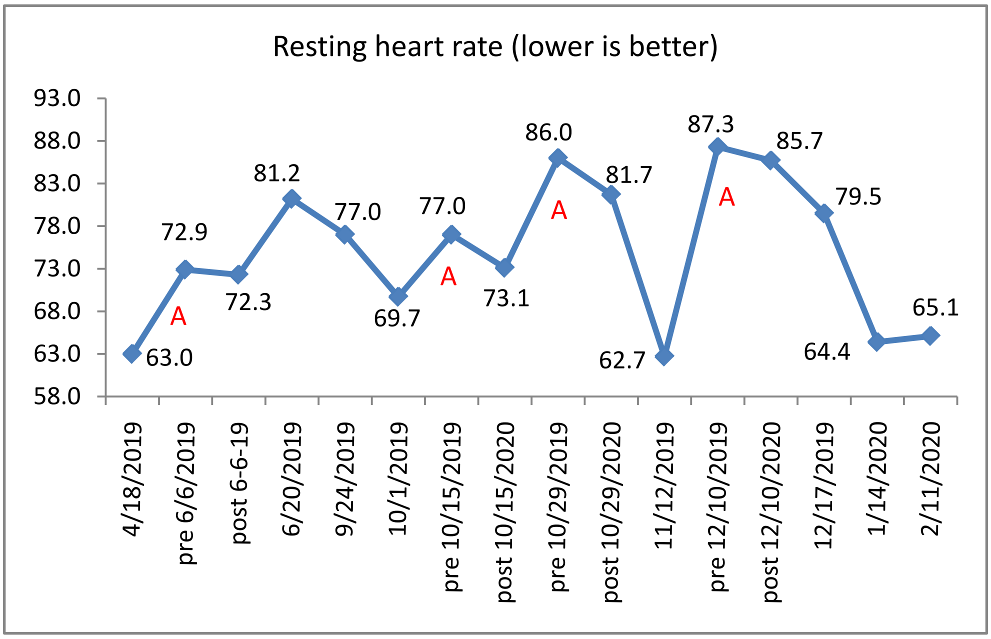

Figure 3. Resting heart rate (in beats per minute). A lower value is better than a higher one

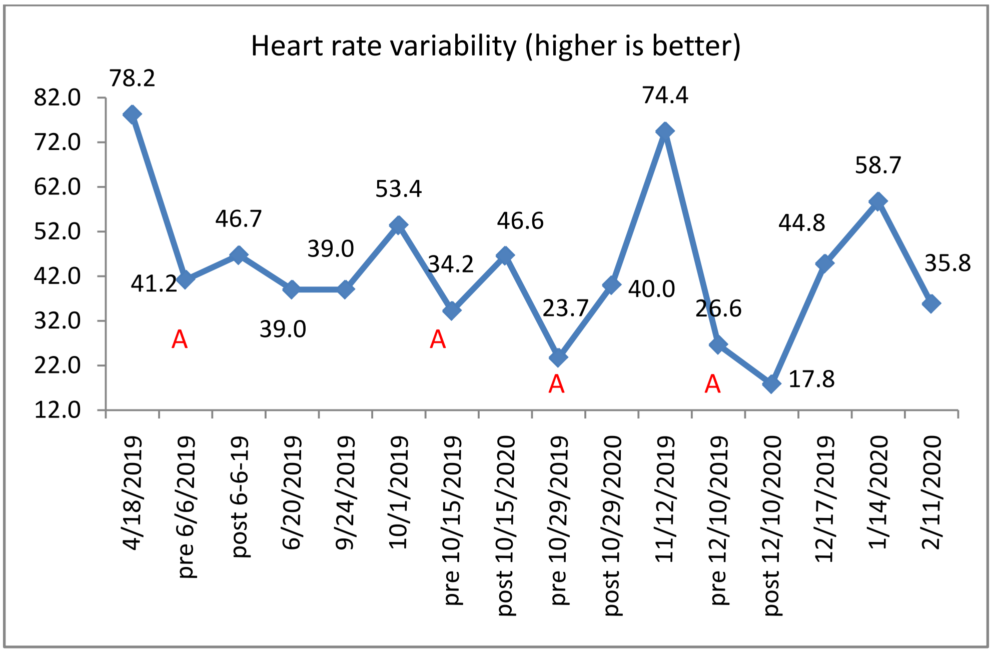

Figure 4. Heart rate variability. A higher value is better than a lower one.

4. Discussion

This study provides an example of how heart rate tests can be used not only as outcome measures but also to determine *when* to adjust the chiropractic patient for optimal autonomic results. This is important because the autonomic nervous system controls so many vital functions in the body.

A limitation to the study is its observational design, which prevents a claim of cause-and-effect. Another limitation is based on the cliché: *What goes up must come down* which could apply to RHR (where down is better than up). The cliché could be adapted for HRV to read as: *What goes down must come up*. These clichés are reminders that clinical improvements such as these in the present study can happen on their own, without any intervention, thanks to the body's ability to heal and maintain itself. Nonetheless it *appears* that in this patient's case, spinal adjustment produced the best results when the pre-adjustment measurements showed: a) 86 BPM or higher for RHR and b) 26 ms or lower for HRV (rMSSD). Further application of this novel method in other patients is a reasonable next step.

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