Reduction in Resting Heart Rate Following Chiropractic Adjustment and Exercise: A Case Study

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Abstract Introduction: Resting heart rate (RHR) is a simple but powerful predictor of autonomic health which can be used on a visit-by-visit basis for an individual patient to conveniently assess his or her neurological progress. This case report provides an example of this approach. The method incorporates outlier analysis for a total of five measurements over a 6 week period that included chiropractic care and exercise. Methods: An adult female patient with elevated RHR received chiropractic care from the author. She also began an exercise program during this time. Approximately six weeks later she experienced a substantial reduction (improvement) in RHR on a follow-up visit. Inter-quartile outlier analysis was applied to determine if the improvement was statistically unusual. The advantage of doing this analysis is that it would give an indication of whether the change occurred by chance alone. This in turn provides a level of clinical certainty regarding progress of the patient. Results: The first two RHR measurements, four days apart were 81.6 beats per minute (BPM) and 81.9 BPM respectively. Follow-up RHR measurements (in BPM) were 79.5, 77.8, and 66.3. This last reading, 66.3 BPM was detected as an extreme outlier. Conclusion: This case study shows how RHR and outlier analysis can be used to determine neurological progress on a given visit for an individual patient. In this case there was such progress following chiropractic care and exercise. Further study with other patients and longer follow-up periods will be a good next step.

Keywords: heart rate, chiropractic spinal adjustment, exercise, biostatistics


1. Introduction

Resting heart rate (RHR) is a simple but evidenced based measure that can be used to assess the health of the autonomic nervous system [1,2,3]. Additionally, RHR is a strong predictor of health in general, where low RHR is associated with for example, a healthier and longer life span compared to those with high RHR [3,4,5,6].

It is well known that endurance exercise tends to lower heart rate while the person is in the rested state [7]. In addition there is emerging evidence that chiropractic care can also lower RHR [8]. The present case study pertains to a patient from the author’s neurologically focused chiropractic practice. The patient obtained neurological (autonomic) benefit following chiropractic care and exercise, evidenced by a reduced RHR on a follow-up visit.

The purpose of the study is to show how:

a) Chiropractic and exercise can work together in lowering (improving) elevated RHR, and

b) Statistical analysis can be applied to the level of the individual patient to determine if RHR change is a statistical outlier.

While statistical analysis is typically applied to groups of patients, the author applies it in this study to the level of the individual patient. Application of statistical analysis to the individual patient is appropriate as long as statistical assumptions are not violated. The obvious advantage with individual application is that the statistical results are 100% relevant to the individual patient whose data was analyzed. This in turn gives added confidence to the clinician as to how well the patient is progressing and whether intervention is indicated on a given visit.

2. Case Report

The adult female patient in this study gave her permission for her case to be published. She consulted the author in October 2019 with jaw pain. Indicators for chiropractic spinal adjustment that the author uses in his practice include: a) RHR as a neurological (autonomic) indicator for when to adjust, and b) manual palpation to determine if a slight misalignment is present, and if so, which direction it is misaligned to.

RHR was measured with the smart phone app technology, Heart Rate Variability Logger [9].
detects blood flow change (color) using the technology of photoplethysmography (PPG). The sensor sends a Bluetooth signal to the app which calculates the RHR value. The set-up has good agreement with standard ECG technology [10,11].

Figure 1. Ear Sensor on a colleague (who gave his permission for his ear to be in the photo)

Figure 2. Author setting up for atlas adjustment on a colleague (who gave his permission for his face to be in this photo)

On the first of five visits in this report, the patient’s RHR was 80.6 BPM which is higher than the average 74 BPM for healthy adult females [12]. The elevated RHR substantiated the presence of a neurological disturbance. A misalignment was then palpated at the level of the atlas (C1) vertebra. A diagnosis of atlas subluxation was made. A chiropractic subluxation consists of a slight spinal (vertebral) misalignment that disturbs spinal nerve function. The patient had both criteria – a) neurological disturbance, evidenced by a high RHR and b) slight vertebral misalignment. Adjustment of the atlas subluxation was made with a percussion instrument in the seated position on 10-12-19 (example in Figure 2).

On the second visit (10-16-19) the patient reported that the jaw symptom resolved. However, the RHR continued be relatively high, at 81.9 beats per minute (BPM) (Figure 3). It was suggested that care continue to see if the RHR would improve (decrease), for a health benefit beyond symptomatic relief. On this visit a second adjustment was given based on the continued high RHR and presence of the atlas misalignment. During this visit there was a conversation about another natural approach to lowering RHR, namely, exercise. The next day the patient began a program of in-home exercise on a trampoline, 1-2 times per day along with some toning exercises. The sessions lasted about 20 minutes each.

The patient was seen weekly by the author during this time (Figure 3). On the 3rd visit (10-22-19) there was a slight reduction in RHR, so no adjustment was given. There was further reduction on the next (4th) visit to 77.8 BPM and therefore again, no adjustment was given. At this point, the author suggested, based on the moderate amount of improvement in RHR that the next check-up could go longer: a month. On the 5th visit (one month later) and last visit at the time of this writing (11-26-19), there was substantial improvement in RHR, a decrease to 66.3 BPM (Figure 3).

Visits where an adjustment was given are the first two (10-12-19 and 10-16-19) and are pre-adjustment measurements.

During this time frame for the five RHR measurements (10-12-19 to 11-26-19), no other lifestyle changes were made by the patient and she had not been on any medication. Measurements were obtained during the same hour of the day on the five different days over the 45-day time frame for the study.

Figure 3. Resting heart rate by visit
3. Statistical Analysis

Outlier analyses, performed by the author, was done for all pre-adjustment readings. The method of outlier detection used was the interquartile range (IQR) method, where the limits are calculated as follows:

- Lower limit: Quartile 1 – (outlier factor x IQR)
- Upper limit: Quartile 3 + (outlier factor x IQR).

The commonly used outlier factor of 1.5 was used, for detection of moderate outliers. Observed values outside the limits would be considered outliers. The 4th visit’s measurement, the 77.8 BPM was not detected as an outlier.

The last visit’s 66.3 BPM reading was found to be an outlier. Curious as to whether this value, 66.3, might also be an extreme outlier, a second analysis was performed. Here, the commonly used factor of 3 (for detection of extreme outliers) was used. For this latter analysis, the lower and upper limits were 72.7 BPM and 84.6 BPM respectively. The 66.3 BPM value is obviously still lower than this lower limit and therefore is considered an extreme outlier (Table 1).

Table 1. Analysis for extreme outliers

<table>
<thead>
<tr>
<th>Quartile 1</th>
<th>Quartile 3</th>
<th>IQR</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Outlier</th>
</tr>
</thead>
<tbody>
<tr>
<td>77.8</td>
<td>79.5</td>
<td>1.7</td>
<td>72.7</td>
<td>84.6</td>
<td>66.3</td>
</tr>
</tbody>
</table>

IQR is inter-quartile range (Quartile 3 – Quartile 1).

4. Discussion

This study shows how chiropractic and exercise can work together to improve autonomic function. It also shows how statistics can be applied to the level of the individual patient. In particular, the noticeably low (improved) RHR on the last visit was an extreme statistical outlier. This indicates that the patient obtained a neurological benefit that probably did not happen by chance following the second spinal adjustment and the patient’s newly implemented exercise program. The observational design of the study does not permit a claim of cause-and-effect. However, it is not unreasonable to suggest that one (or both) of the natural interventions (chiropractic and exercise) appear to be a factor.

The 4th visit was not an outlier but the lowest RHR measurement as of that date. Because of the improvement, though not an outlier, no chiropractic adjustment was given. This approach is consistent with the author’s practice philosophy, that it is good not to provide an intervention if none is needed. There was greater confidence on the 5th visit that an intervention was not needed thanks to the RHR improvement being detected as an outlier.

Future research could include further follow-up analysis to see how long RHR improvement lasted. The value of the present study is that it shows how to analyze an individual patient’s numerical data for statistical unusualness. This has practical importance to the clinician who examines an individual patient one-visit-at-a-time to determine what, if any intervention is indicated on that visit.

5. Conclusion

In this case study the patient experienced improved neurological health following chiropractic care and exercise. Evidence for the improvement was a reduction in resting heart rate on a follow-up visit that was calculated as an extreme outlier. Follow-up analysis to determine duration of the RHR improvement would be a reasonable next step in this line of research.

References


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