01. Introduction

Medical students report high levels of stress and burnout. The combination of physical stressors such as poor posture while studying, impaired quality of sleep, and mental stress from the rigorous curriculum stimulates the sympathetic nervous system to secrete cortisol, the stress hormone. Prior studies have shown that persistent elevated cortisol levels are associated with adverse physical and mental health outcomes.

Osteopathic Manipulative Medicine (OMM) employs various manual techniques to modulate the autonomic nervous system, aiming to restore a balance between the sympathetic and parasympathetic branches. Through targeted manipulations such as myofascial release, cranial techniques, and others, OMM can potentially alleviate stress, reduce muscle tension, and enhance blood circulation.

02. Objective

Our goal was to determine if regular weekly sessions of targeted OMM could help medical students mitigate their stress levels during preclinical years and reduce the rate at which systemic cortisol levels increase throughout a medical school semester, possibly improving both short and long term health outcomes. We additionally tried to determine if weekly cortisol levels changes were linked to changes in cognitive function.

03. Methodology

Participant salivary samples were collected on a weekly basis for 6 weeks and stored in a -4°C refrigerator. These samples were analyzed using an Immunoassay kit. 100 uL of each sample was diluted in 200 uL of Assay Buffer. Standard cortisol concentration showed an inversely proportional exponential relationship to optical density at 450 nm as seen in Table 1.

Participant stress levels were also measured using the College Student Stress Scale (CSSS) survey. CSSS is a subjective 11-item survey that uses a scale of 1 to 5 to measure undergraduate student stress over an academic year due to various factors. The survey was modified to ask how often the participant perceived an aspect of stress within the last week. A designation of 1 indicated no stress while 5 indicated persistent stress; the scores were added together for subsequent analysis. 1

04. Osteopathic Manipulative Treatment

Paraspinal inhibition is a gentle, passive technique targeting the fascia surrounding the spine. It targets the sympathetic chain ganglia that reside in the paraspinal region to reduce sympathetic output, thereby softening the visceral structures. The student researcher contacted the area while applying lateral traction with the participant in supine position until a change in muscle tone was felt.

Rib raising is a passive, direct technique used to address restricted excursion of the rib cage and modulate sympathetic nervous system activity. The technique consists of a gentle pull of the ribs away from their articulation with the spine.

Condylar Decompression

OA treatment, specifically through condylar decompression, is a passive, direct cranial technique used to free local restrictions around the occipitotemporal joint. This technique is used to normalize parasympathetic tone to decrease cortisol levels.

05. Analysis

The study assessed the weekly change in optical density (ΔOD) measured at 450 nm for both the treatment and control groups. The sample size for each group was n = 5. The treatment group exhibited a mean ΔOD of 0.0215 with a standard deviation (SD) of 0.0243, while the control group exhibited a mean ΔOD of -0.0044 with an SD of 0.0061. The average ΔOD of the treatment and control groups, along with the average ΔOD of each participant is shown in Table 2.

Under the assumption of a normal distribution of data, we conducted an unpaired, two-tailed t-test to compare the average ΔOD between the treatment and control groups. The t-test yielded a t-value of 2.309 with 8 degrees of freedom (df), resulting in a p-value of p = 0.0497, which is statistically significant at the p < 0.05 level. This change in ΔOD between the two groups was visualized in Figure 2. An additional effect size analysis supported our finding of a significant decrease in weekly cortisol levels in the treatment group. Cohen’s d = 1.460

Based on the College Student Stress Scale (CSSS) responses, there was no significant difference in perceived stress between the control and treatment groups (p = 0.8655, two-tailed). The mean weekly change in stress scores was 1.084 for the treatment group and -1.212 for the control group, with a negligible effect size (r squared = 0.003809). The CSSS score change for both groups is visualized in Figure 1.

Table 2 – Average weekly ΔOD of each participant

<table>
<thead>
<tr>
<th></th>
<th>Treatment (n=5)</th>
<th>Control (n=5)</th>
<th>Average ΔOD (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average ΔOD</td>
<td>-0.0096</td>
<td>-0.0052</td>
<td>0.0044</td>
</tr>
<tr>
<td>0.05465</td>
<td>0.052167</td>
<td>0.0497</td>
<td>0.03177</td>
</tr>
<tr>
<td>0.0133</td>
<td>0.00394</td>
<td>0.008</td>
<td>0.00384</td>
</tr>
<tr>
<td>0.0381</td>
<td>0.009485</td>
<td>0.0044</td>
<td>0.00384</td>
</tr>
<tr>
<td>0.0475</td>
<td>0.009485</td>
<td>0.0044</td>
<td>0.00384</td>
</tr>
<tr>
<td>0.0517</td>
<td>0.009485</td>
<td>0.0044</td>
<td>0.00384</td>
</tr>
</tbody>
</table>

06. Conclusion and Future Considerations

1. Regular osteopathic manipulative treatment (OMT) is shown to significantly reduce increases in cortisol levels. Figure 2 shows a statistically significant increase in ΔOD in the treatment group while there was a decrease in ΔOD in the control group. The inverse relationship between cortisol concentration and ΔOD indicates a significant decrease in cortisol amongst the treatment group.

2. Despite the physiological evidence from cortisol levels suggesting reduced stress through OMT, there wasn’t a statistically significant pattern observed in the self-reported stress perception scores measured using the CSSS survey between the two groups.

3. High levels of cortisol have been linked to chronic diseases, and future studies can look at the use of OMT on patients with diseases such as Diabetes Mellitus or Hypertension and determine if treatment can lower their cortisol levels and, by extension, improve their health outcomes.

References


Figure 1 - Average weekly change in CSSS score

Figure 2 - Avg Weekly ΔOD Changes