

The Synergetic Relationship Between Manual Osteopathic Treatment and Sleep Quality

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Abstract

The topics in this paper will explore the complex interplay of manual osteopathic treatment and sleep. The founder of Osteopathy, Andrew T. Still described many principles and philosophies of the human body and its natural healing properties, which continue to be the backbone of the practice today. There is little discussion however, of the effects of sleep on the body's restorative capacity, and how it may affect these properties previously mentioned by Still. The research conducted for this paper aims to answer questions pertaining to the potential causes of insomnia, the negative side effects of a lack of sleep, benefits of restful sleep, and outcomes of manual osteopathic treatment. The relationship is two fold in the sense that insomnia may be caused by chronic pain, but without proper sleep, recovery may be incomplete thus leading to a pain cycle detrimental to health. The introduction of manual treatment can be correlated with a greatly improved sleep quality resulting in positive consequences that extend beyond the physical body.

Keywords: sleep health, chronic pain, insomnia, sleep debt, manual osteopathic therapy

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Preface

The practice of Osteopathy dates all the way back to 1874, when Dr. Andrew T. Still grew tired of seeing classic medications and treatments doing more harm than good, and other forms of alternative medicine failing to live up to expectations. Osteopathy was his attempt at creating a practice that did not fail in the face of medical issues, a group of principles guided by the God of Nature that would reward you if you stayed the course (Still, 1910). Throughout Still's works, he described and gave his personal treatment techniques for every disease and condition imaginable at the time, the main issue of course being that many of these conditions could lead to serious disability or death. Evidently, the 19th century leading up to the 20th was not medically advanced when compared to the present, and as such, looked for answers to rather simple problems such as asthma and diarrhea. With the progression of surgeries and medications in recent history, we have been left with lots of time to consider other factors that influence health such as sleep.

Osteopathy, Pain, and Healing

Osteopathic Manual Therapy is a branch of osteopathy focused on assessment, diagnosis, and treatment of disorders of the body's structure through manipulations of joints or organs and gentle oscillatory movements. These techniques are intended to restore the flow of fluids and improve functionality of structures, which reduces pain and allows patients to return to normal activity (What is Osteopathic Manual Therapy?, 2018). One of the guiding principles of manual therapy is that abnormalities in one section of the body can lead to dysfunction in any other part. As such, balance of bodily structures is paramount to patient recovery. The word Osteopath can be directly translated to bone dysfunction, which has various origins including ligamentous, musculoskeletal, tendinous, fascial, nervous, fibrous, synovial, or vascular issues (What is Osteopathic Manual Therapy?, 2018).

Various health professions have been able to look after acute pain for a long time, but more often than not, chronic pain is just managed and never cured. Some of the most common forms of chronic pain come from headaches, lower back pain, arthritis pain, neurogenic pain, or psychogenic pain, and Cirino (n.d.) points to some causes including: chronic fatigue syndrome, fibromyalgia, inflammatory bowel disease, interstitial cystitis, and temporomandibular joint dysfunction. Manual Osteopathic Treatment has been proved time and time again to be an excellent option for chronic pain patients, but the bodies of these individuals must be in a relatively functional state for optimal healing to occur.

Throughout the book *Osteopathy Research and Practice*, Still reveals that the human body is akin to a city, with the organs as functionaries and the blood as seed. If the city is in bad condition, it will grow worse and worse until a plague takes over and destroys the city. Of course, this is just an analogy, but the truth in this statement lies with the idea that each disease has a cause, and removal of this cause leads to disappearance of the effect. Still (1910) went so far as saying that each atom of blood is a seed to any plant in nature, so long as it is delivered to the right soil. Therefore, the body's natural healing capacity relies on blood flow and quality, organ function, and structural integrity. Manual Osteopathic Therapy can be effective in correcting structural integrity and organ function, but factors such as sleep may play a much larger role in blood and metabolic biology.

Sleep Health

A cloak of mystery has always surrounded sleep, and even with the descriptive state of medicine today, it has not been given a whole lot of attention. Sleep disorders have been described in depth, but the term sleep health is relatively unknown. Over time, paradigms for the definition of health have shifted to focus on functioning, well being, and interaction with the environment as opposed to those that emphasize disease. Buysse (2014) define four models of health as follows:

- Medical/Clinical Model, defining health as an absence of disease or disability.
- World Health Organization Model, which emphasizes health as well being.
- Wellness or Role Performance Model, which emphasizes function and integration of the body, mind, and spirit.
- Environmental or Adaptive Model, which emphasizes health as resilience.

The medical model has been dominant since the practice of medicine began, but the other three are gaining heavy traction in research, as psychological issues are becoming more and more visible with each passing day. While few studies have actually provided a concrete definition for sleep health, people have attempted to construct one using the principles presented in the models mentioned above.

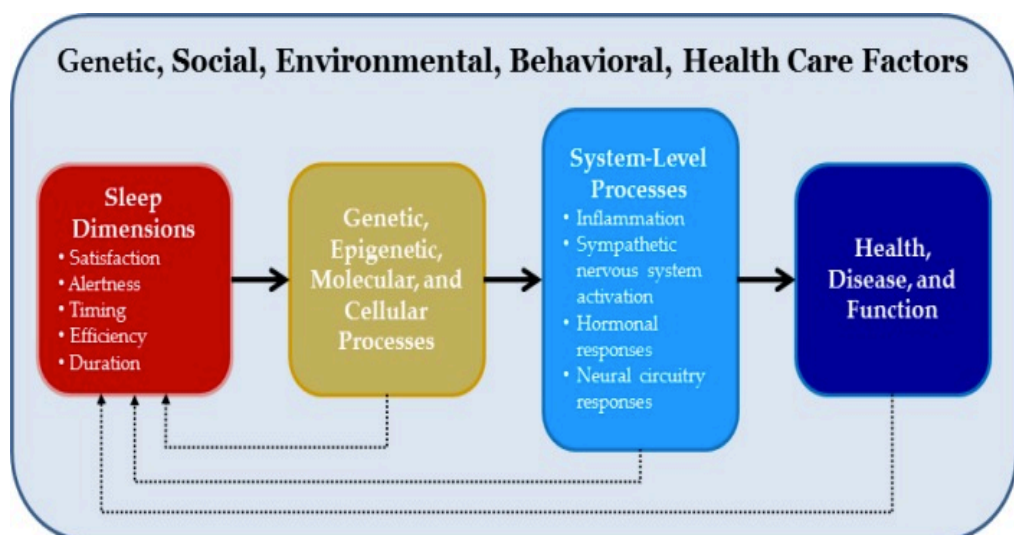


Figure 1: Conceptual model of sleep health (Buysse, 2014)

Authors have developed a conceptual model of sleep health (Figure 1) that postulates various dimensions of sleep-wake function affecting outcomes of health and function. Depending on how these dimensions are carried out, changes to genetic, epigenetic, molecular and cellular processes may occur which eventually lead to changes in system level process and degradation in health. The five dimensions are given the following criteria:

- Quality/Satisfaction: a subjective assessment of good or bad sleep.
- Alertness/Sleepiness: the ability to be attentive when awake.
- Timing: when in the 24-hour day you choose to sleep.
- Sleep Efficiency: how easily you can fall asleep and return to sleep.
- Sleep duration: the amount of sleep obtained per 24 hours.

The relevance of these factors lies with the fact that they may be assigned a direction, creating a reference point for discussing sleep health. For example, to be considered in good health, one must have subjective satisfaction, appropriate timing, adequate duration, high efficiency and sustained alertness during waking hours (Buysse, 2014).

Insomnia

Humans have a natural clock that intends for us to fall asleep with the sunset, and wake up with sunrise. The amount of sleep received during this time frame would reflect an optimal combination of the five dimensions of sleep health, leading to a productive lifestyle. For many, this cycle is still a golden standard, but for many others, differing factors have lead to irregular bouts of insufficient sleep. Crosta (2017) defines insomnia as a sleep disorder characterized by difficulty falling asleep or staying asleep, leading to feelings of daytime sleepiness, lethargy and general feelings of being unwell.

People that present with insomnia may do so for many reasons including but not limited to: disruptions in circadian rhythm, psychological issues, medical conditions, hormones, and external factors. While disruptions in circadian rhythm and external factors are important causations of insomnia, they are not as common as psychological issues or medical issues such as chronic pain, anxiety, and chronic obstructive pulmonary disease (Crosta, 2017).

To treat the underlying causes of insomnia, it is important to isolate where in the body these sleep disturbances occur. Rheault (2018) places emphasis on the nervous system being a primary cause for concern. The central nervous system consists of the brain and spinal cord, but receives information from the peripheral nervous system with regards to sensory input, somatic input, and autonomic input. All three of these inputs are imperative to our survival, and even small disturbances in each can lead to mixed signals that are misinterpreted by the nervous system making it harder to relax and fall asleep (Rheault, 2018). Sensory, somatic, and autonomic inputs are also consistent with the original principles of Still since they relate to the muscles, organs, and blood respectively.

Sleep and the Autonomic Nervous System

Previous studies in the field of sleep health have uncovered that poor quality is correlated with cardiovascular diseases like myocardial infarction among women and coronary heart disease among men. In a study by Castro-Diehl et al. (2016), autonomic modulation was measured by looking at heart rate, high-frequency heart rate variability, and salivary amylase levels during the Multi-Ethnic Study of Atherosclerosis Sleep Protocol. This protocol involves monitoring the subjects' sleep quality using an actigraphy, diary, and questionnaire followed by measuring the markers of autonomic modulation mentioned above.

Results of the study indicated that participants who slept fewer than 6 hours per night had higher baseline heart rate and greater heart rate orthostatic reactivity, and participants who slept between 6 and 7 hours per night had lower baseline high-frequency heart rate variability than those who slept more than 7 hours per night. Both of these groups were considered to have low efficiency sleep and had higher levels of salivary amylase. The significance of all these findings is that those who do not get enough sleep each night have lower levels of cardiac parasympathetic tone (vagal), and/or higher levels of sympathetic tone (Castro-Diehl et al., 2016). Increased sympathetic tone is associated with higher baseline heart rate, vasoconstriction, which leads to

increased blood pressure, and a shift of blood flow from visceral organs to muscles. Impaired autonomic nervous system regulation therefore leads to a non-optimal environment for proper blood flow and quality as there is an overall decrease in blood flow due to higher blood pressure and the blood does not have as much time at each location to perform its role.

Chronic Pain Effects on Sleep

The experience of chronic pain is associated with poor quality of life and functional impairment, and Tang, Wright, & Salkovskis (2007) found that cases of clinical insomnia were 18 times more likely in patients with chronic pain than healthy controls. Although it is logical to assume that the presence of pain correlates with insomnia, the effects of pain intensity on reported insomnia are not so obvious. One study carried out by Bahouq, Allali, Rkain, Hmamouchi, & Hajjaj-Hassouni (2012) examined severity of chronic back pain, sleep characteristics, and types and consequences of insomnia. The index of severity of insomnia was used with a score ranging from 0 (best) to 28 (worst). They found that severity of insomnia appeared to be related to pain and fatigue, and that assessment of insomnia should be incorporated into chronic back pain management (Bahouq et al., 2012).

While it is commonly reported that the back is the most common site of chronic pain, many other parts of the body are susceptible to damage leading to chronic pain. Murase et al. (2015) looked at the independent and combined effects that pain in multiple areas could have on sleep in the general population. Subjects were given a structured questionnaire that considered short sleep as being less than 6 hours/day. The tests were then graded by tertiles of a Numerical Response Scale and a Roland-Morris Disability Questionnaire. Figure 2 shows the adjusted odds ratios of the algorithmic scores. The plots indicate that both knee pain and back pain were individually and additively associated with short sleep duration and poor sleep quality as reported by subjects, which is significant considering that many patients present with multiple issues. Consistent with the previous study is the finding that severity of pain also contributed to sleep disturbance.

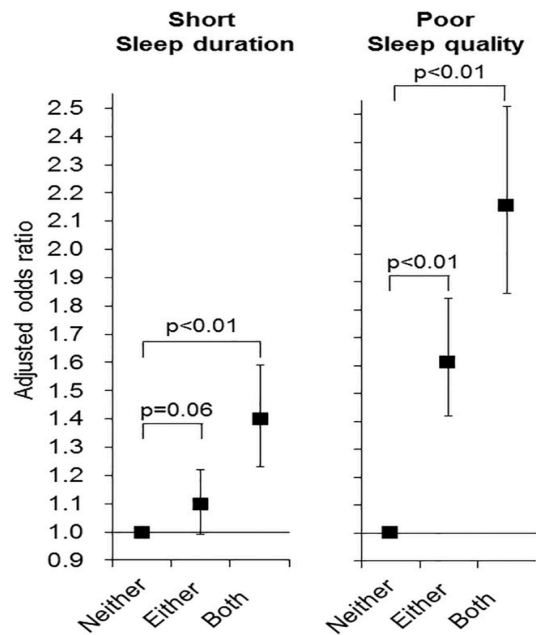


Figure 2: Odds ratios of coincident knee pain and back pain for short-term sleep duration and poor sleep quality (Murase et al., 2015)

Sleep Effects on Chronic Pain

With the knowledge that chronic pain has a notable connection with insomnia and overall sleep quality, we can shift attention to the effects that a lack of sleep has on pain. There is a complex organization accompanying sleep that occurs each night. The process of sleep can be broken up into two states: non-rapid eye movement (NREM) and rapid eye movement (REM), each responsible for a kind of homeostasis. During NREM sleep, there are three stages, characterized by a progressive and more synchronous cortical neuron activity, autonomic function, and increased arousal thresholds (Luyster, Strollo, Zee, & Walsh, 2012). REM sleep on the other hand has electroencephalogram readings indicative of relaxed wakefulness and therefore variable autonomic activity with atonia of skeletal muscles. The third phase of NREM

sleep is the only phase that is considered deep or restorative sleep. When people do not experience this phase of sleep, whole-body desynchronization may occur.

Another large part of the homeostatic drive to sleep has to do with the time elapsed since the last sleep interval. The longer a person stays awake, the greater the homeostatic pressure to sleep increases. Insomnia or other sleep disorders lead to a sleep debt, furthering the pressure, eventually reaching levels that completely overwhelm attempts to stay awake even when your life is at risk (Luyster et al., 2012). The sleep debt effects and lack of restorative sleep are both associated with metabolic and cardiovascular disease, cancer progression, and potentially death. Some of these diseases include: ischemic heart attack, atherosclerosis, obesity, type 2 diabetes, breast cancer, and fatigue, which subsequently increases risk of life threatening accidents (Luyster et al., 2012). While not directly related to chronic pain, some of these side effects of inadequate sleep may increase the risk of developing chronic pain.

A study performed by Giancarlo Vanini aimed to confirm whether sleep loss could predict the development of chronic pain. To do so he introduced sleep deprivation to Male Sprague-Dawley rats before injecting their hind paws with formalin. The rats were grouped in a 12-hour light:dark cycle for 7 days prior to testing with free access to food and water. Two days prior to testing, the rats were individually housed and examined for signs of distress or discomfort to obtain baselines for mechanical sensitivity and thermal nociception (Vanini, 2016). Once testing began, the rats were split into 4 groups: two groups were deprived of REM and NREM sleep through the use of mild auditory and tactile stimulation, with one being injected with formalin and the other being injected with saline, and the other two groups were kept awake through tapping on the sides of their cages plus stimulation of whiskers, with one being injected with formalin and the other being injected with saline. The injections of formalin were given following sleep deprivation with the goal of causing long-lasting mechanical hypersensitivity in and distal to the injected limb. Results indicated that total sleep deprivation preceding a noxious inflammatory insult significantly increased this mechanical hypersensitivity (Vanini, 2016).

Benefits of Manual Osteopathic Treatment

One of the major goals of this paper was to discuss whether manual osteopathic treatment (OMT) could simultaneously improve sleep or be improved by good quality sleep. To do so, it is necessary to confirm the healing benefits that come from manual treatment, specifically with regards to the most common form of chronic pain; low back pain. A study carried out by Licciardone, Kearns, & Minotti (2013) assessed the response to osteopathic manual treatment and ultrasound therapy according to baseline severity of chronic low back pain. The trial used a randomized double blind, sham-controlled, 2 x 2 factorial design. The recruitment process excluded individuals that had previously received manual therapy, leading to a group between 21-69 years of age. Lastly, subjects were split up into low pain subgroups and high pain subgroups (Licciardone et al., 2013).

The treatment protocols were similar and occurred along the same intervals; 15 minute sessions at weeks 0-2, 4, 6, and 8 provided by the same examiner using classic manual osteopathic treatments. These techniques included: high-velocity low-amplitude thrusts, moderate-velocity moderate-amplitude thrusts, soft tissue stretching, kneading, myofascial release, and muscle energy techniques. The difference between the actual manual treatment and sham treatment was that sham methods used light touch, improper patient positioning, purposely-

misdirected movements, and less force, all aimed at simulating OMT without the proper technique.

Following the treatment protocol, statistical analysis was applied to the patients' visual analog scores. Licciardone et al. (2013) reported that while there was no statistical interaction between OMT and ultrasound, patients in both low and high pain groups experienced a substantial improvement in chronic back pain compared to those that received the sham OMT treatments. It is important to note that all patients were still allowed to receive treatment for pain during the study, just not manual therapy. In addition to overall diminishment of pain, positive secondary effects were observed such as improved back-specific functioning and clinical satisfaction. Although not statistically significant, subjects did report improvements in general health, and decreases in work disability, use of prescription medication, and use of CAM therapies (Licciardone et al., 2013).

Results

The studies examined for the purpose of this research paper focused on the effects of chronic pain on sleep, the effects of sleep on chronic pain, and how manual osteopathic treatment could benefit and be benefited by good sleep. While all studies have their limitations such that replication is necessary to validate the findings, it is important to note that relevant conclusions can still be drawn. Andrew Still believed that blood flow and quality were necessary for the body's healing capacity; research showed that inadequate sleep decreased this function through increased sympathetic nervous system activity. It was also discovered that sleep acts as a homeostatic function in the body and is necessary to our survival. Build up of sleep debt was attributed to cardiovascular and metabolic disease, cancer progression and risk of death, all of which could positively predict development of chronic pain. Lastly, multiple studies showed that chronic pain can individually and additively reduce sleep quality.

Overall, sleep health with regards to the five dimensions of satisfaction, alertness, timing, efficiency, and duration has been proven to positively impact medical health through preventative and homeostatic mechanisms. Once thought to be unimportant in the general medical model of health, sleep is now recognized as a crucial piece for recovery, survival, and productivity. With the proven science of Manual Osteopathic Therapy putting all the pieces of the body together, good sleep quality is the glue that can hold them together. Though this interaction may still not garner the attention it deserves, I believe that more research should be conducted with regards to sleep health and manual treatment together in order to optimize and accelerate the body's healing process.

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