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THE PSYCHOLOGICAL AND PHYSIOLOGICAL EFFECT OF PERFORMING THE PRIMAL REFLEX RELEASE TECHNIQUE ON FEMALE, DIVISION I COLLEGIATE ATHLETES

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The psychological and physiological effect of performing the primal reflex release technique on female, division I collegiate athletes experiencing anxiety symptoms.

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Anxiety is a cognitive, behavioral, and physiological reaction to stress, and athletes have an increased risk being in a high-stress environment. One of the effects of increased stress on the body is a condition known as central sensitization (CS) where the central nervous system amplifies sensory input across many organ systems causing a pain response in normally non-painful areas or hypersensitivity to stimuli. The Primal Reflex Release Technique (PRRT) is a manual-therapy approach for evaluating and relieving musculoskeletal pain in patients, and is meant to facilitate a "neural reboot" of a hyper-aroused nervous system. The purpose of this study is to examine the effect PRRT has on the psychological and physical symptoms of anxiety. In this study 11 participants consented to being involved and completed a baseline State Trait Anxiety Inventory (STAI), and 4 of those were chosen to receive the treatment. Those who received the treatment completed the STAI-Y1 form to measure state anxiety, had their heart rate and blood pressure measured, and had a Nocioceptive Exam completed before receiving PRRT. Immediately after the clinician performed PRRT the STAI-Y1 was repeated as well as their physical vital signs. The athlete then completed the STAI-Y1 a third time 48-72 hours' post-treatment, which concluded their participation in the study. A significant difference in state anxiety ($p=0.045$) and heart rate ($p=0.043$) was found immediately between pre-and post-treatment. Systolic blood pressure approached significance ($p=0.077$) and diastolic blood pressure had no significant change. In comparison to other holistic treatments of massage and meditation, it is suggested the reduction in state anxiety and heart rate could be due to a relaxation mechanism that inhibits the stress response. In conclusion, PRRT is a unique form of treatment that needs to have further research done to understands its effects on psychology and physiology. The evidence from this study indicates that PRRT can provide immediate relief from symptoms of state anxiety and provides a relaxing effect decreasing the heart rate.

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Chapter 1

Introduction

Anxiety is a response to stress that takes place both physically and emotionally, which can be unsettling to those who experience it.[1] Anxiety symptoms may result in significant distress and can impair all aspects of daily living.[2,3] Due to being in a high-stress environment, athletes have shown to be at higher risk of experiencing state anxiety, which is caused by their perception of a stressful situation. This can take a toll psychologically and physiologically causing symptoms to manifest both emotionally and physically.[3] A reason there are physical symptoms during a stressful event may be due to the associated hyperarousal of the autonomic nervous system when one is experiencing anxiety.[4] This hyperarousal can cause fatigue, racing heart, muscle tension, difficulty concentrating, a racing heart, or sleep disturbances.[1,4,5]

Anxiety can also be the cause of increased stress on the body. One of the effects of increased stress on the body is a condition known as central sensitization (CS).[6] CS is considered a state when the central nervous system amplifies sensory input across many organ systems. This amplification can cause hypersensitivity to stimuli and/or a pain response in normally non-painful areas.[6] There are several treatments for this pain and hypersensitivity, including treatment known as the Down Regulation (dR) aspect Primal Reflex Release Technique (PRRT).[7] Th dR portion of PRRT is believed to reduce the hyperaroused portions of the nervous system called "primal reflexes." PRRT has been found to be highly effective by practitioners for treating musculoskeletal conditions and pain, but no studies have been performed to examine whether PRRT impacts more psychological factors, like state anxiety.[7] Therefore, the purpose of this paper is to examine the effect PRRT dR has on the psychological and physical symptoms of anxiety.

Stress and Anxiety

While often used interchangeably, stress and anxiety are two separate entities. Stress is defined as, "a state of mental or emotional strain or tension resulting from adverse or demanding circumstances."[8] There is "good stress" (eustress) which results from the perception of excitement or a challenge, and "bad stress" (distress) which results from an undesirable state of chronic fatigue, worry, frustration, and the inability to cope.[9] The response to stressors can have either protective or damaging consequences on the body. This response is a result of the brain and the body communicating through the autonomic nervous system, the endocrine system, and the immune system.[9] These systems all help the body to adapt to acute stress, but also can be the cause of the negative effects of chronic stress.[9] Stress can be the cause of fatigue and irritability when someone feels depleted, or unable to respond to a stressor.[9] Further, when there are many stress systems in the body being activated, such as the hypothalamic-pituitary-adrenal (HPA) axis, the autonomic nervous system, and the immunological reactivity of the individual, it can greatly challenge homeostasis.[10] The dysregulation of these systems can be an integral factor of disease activation and progression. Stress itself is not an illness, but it does describe external events that can contribute to pain and illness.[10]

Anxiety is a cognitive, behavioral, and physiological reaction to stress, which is disruptive to the individual experiencing it.[1] Anxiety causes significant disability and impairment in occupational, relationship, and physical health.[2] Anxiety is believed to be the anticipation of what can happen in the future and is coupled with muscle tension and avoidance behaviors.[1] Stress is also common in competitive athletes, and female athletes report higher anxiety rates than males.[3,11] For athletes, symptoms of anxiety may stem from a variety of sources, including family, health, competition, financial concerns, interpersonal relationships, school, or jobs. These

symptoms result in significant distress and can impair daily living in school, work, play, and interpersonal relations.[3] Due to the daily perceived stress, anxiety has become a frequently measured variable in sports psychology.[12]

Psychiatric disorders have become more frequent in today's society. Studies have found that 46.6% of the United States' population will have a psychiatric disorder at some point in their life, and anxiety was found in 28.85% of the population.[10] The frequency of anxiety is one reason why it is being studied in sports psychology.[10] Also, the dynamic nature that encompasses the many symptoms of anxiety is a topic of study in psychology. Anxiety is considered a negative emotional state that is characterized by apprehension, nervousness, and worry which is associated with physiological arousal.[12] It is considered multi-dimensional because it has both cognitive and somatic components. In addition, anxiety can be divided into two broad forms: trait and state anxiety.[13] Trait anxiety is a stable personality characteristic, defined as an individual's natural response to daily experiences. This means they have a predisposition to react to situations in a consistent way.[13] Trait anxiety has at least four dimensions: social evaluation, physical danger, ambiguous, and daily routines. State anxiety is a transitionary emotion characterized by physiological arousal and consciously perceived feelings of apprehension, dread, and tension. State anxiety has two dimensions: cognitive worry and autonomic emotional.[13]

Anxiety isn't a "one-type-fits-all" disorder, but works on a continuous scale. People can experience anxiety at varying amounts, ranging from low to severe.[13] Some people may experience low levels of anxiety while others will be affected to a greater degree which can affect their social, emotional, or occupational functioning. Those who are diagnosed with an anxiety disorder are at the severe end of the anxiety continuum, and are viewed as qualitatively

different from a person with a normal anxiety level. This is aligned with the psychometric approach to anxiety assessment.[13]

When an individual is experiencing anxiety, there can be a range of symptoms. Physical symptoms commonly appear when one is stressed or feeling anxious.[10] Some common physical symptoms are muscle tension, tremors, tachycardia, sweating, gastrointestinal symptoms, genitourinary, musculoskeletal, or somatosensory complaints. McFarlane found an association between psychiatric symptoms and perceived stress and pain.[10] This could be due to psychiatric disorders having a common neurobiology with the pathophysiology of chronic pain and a similar mechanism of symptom manifestation. Life stressors are associated with various adverse health outcomes, which also include somatic symptoms such as pain.[10] Experiential avoidance, which is common in those with anxiety, has been linked to risky behaviors and could be a global risk factor for physical health problems as well. These behaviors can include substance abuse or risky sexual behaviors that themselves have a negative impact on health.[2]

Anxiety not only has multiple physical repercussions, but there are emotional symptoms as well. Some of these include an excess feeling of fear, nervousness, or worry, in addition to avoidance behaviors.[1] These symptoms occur because anxiety and fear are often associated with a "fight or flight" reaction in the autonomic nervous system and anxiety may cause avoidance of situations that trigger or worsen these symptoms. It has also been found that females commonly have a "tend-and-befriend" response rather than the typical "fight or flight" response.[9] Females do tend to flee from extreme danger, but there are differences between the male and female response via perception and behavioral stressors.[9] There are also physiologic differences in the regulation of mediators involved in the stress response. When under stress, the body goes into what is called an "allostatic state." This means that there is altered and sustained activity level of

the primary mediators that affect energetic and associated behaviors in responses to stressors.[9] Allostatic states can cause wear and tear on the regulatory systems in the body since it isn't in a homeostatic state. When the body is in an allostatic state with a heightened alarm response due to elevated levels of glucocorticoids and catecholamines, it may lead to an allostatic overload.[9] The overload may predispose the individual to disease and cause a state of exhaustion.[9]

Anxiety is often associated with hyperarousal of the autonomic nervous system.[4] Anxiety involves both physical and emotional symptoms, including restlessness, feeling on edge, fatigue, difficulty concentrating, muscle tension, trembling, shortness of breath, a racing heart or problems sleeping.[1,4,5] The brain-body connection has been shown to manifest in physical symptoms.[9] When someone is experiencing stress, it puts physiological stressors on the bodily systems.[14] The brain changes structurally and chemically when one undergoes chronic or acute stressors, and hormones called stress mediators are released.[14] Glucocorticoids and catecholamines are the two hormones of the "fight or flight" stress response, but there are other stress mediators that are involved in the body's adaption to stress. Homeostasis is a term used for the systems that are essential for life, allostasis is what maintains these systems in a balanced state. When a system goes beyond the limit of homeostasis, the mechanisms that create the imbalance are known as an allostatic state. This is the result of an imbalance in the primary mediators. For example, glucocorticoids and catecholamines are two important hormones that's influence allostasis. Once function of catecholamines is to increase pro-inflammatory cytokine production, while glucocorticoids inhibit this release. However, when these hormonal mediators are out of balance, inflammation may increase which is linked to several disease states.[14] The parasympathetic nervous symptoms also play a regulatory role because it opposes the sympathetic nervous system and slows the heart.[14]

Stress mediators can have both protective and damaging effects on the body, resulting in physical symptoms. These hormone mediators can be helpful or harmful, depending on the time course of their secretion. The stress mediators themselves can cause problems with anxiety.[9,14] This phenomenon has caused researchers to develop a new framework and terminology for the link between the protective and damaging effects of biological stressors, called "allostasis" and "allostatic overload."[9] The new terminology allows researchers to be more precise and better explain how the essential protective and adaptive effects of physiologic mediators maintain homeostasis. The physiologic mediators are also responsible for the cumulative effects on daily life when they are overused or mismanaged.[9] For example if the body's alarm response is triggered and the adrenal output of glucocorticoids and catecholamines are elevated for an extended period, the body may go into an allostatic state which could lead to allostatic overload.[9,14] Allostasis distinguishes between the systems essential for life (homeostasis) and what maintains the balance in these systems (allostasis).[9] When the homeostatic mechanisms go beyond the limits of homeostasis, it is considered an allostatic state. Changes in the body that result from being in an allostatic state are known as allostatic overload, which are the cumulative results on the physiological systems of an allostatic state.[9,14]

An allostatic state is when the primary mediators are in an altered or sustained activity level in response to a changing environment or a challenge.[9] An imbalance of the primary mediators is caused by the over-production of some mediators and under-production of others, which lead to altered physiologic function and disease. For example, an elevation of inflammatory cytokines and decrease of cortisol is often associated with chronic fatigue syndrome.[9] When a body is in an allostatic state it can cause wear-and-tear on the regulatory systems in the brain and body. It has been found that when stress is repeated over several weeks

some neurons will atrophy causing memory to be impaired while other neurons grow and fear is enhanced.[9] Chronic stress uses the same hormonal mediators as those used to suppress immune function, which may explain some of the physical complaints of people experiencing chronic stress.[9] During allostatic states physical symptoms include memory impairment from neuron atrophy, enhanced fear from new neuron growth, poor sleep, or ongoing stress.[9] Further, some examples of allostatic overload can include acceleration of atherosclerosis, increased risk for cardiovascular disease and stroke, abdominal obesity, loss of minerals from bone, immunosuppression, along with abnormal circuitry in the hippocampus, amygdala, and prefrontal cortex.[9]

Those who are at risk for experiencing anxiety are not easy to identify. There are a few risk factors that are commonly associated with anxiety such as exposure to a stressful life event, anxiety disorders in close biological relatives, parental history of mental disorders, elevated afternoon cortisol level in the saliva, shyness, and being female.[15] Athletes may be at a greater risk due to being in an ongoing stressful environment. Many athletes identify with increased state anxiety during their athletic seasons for a variety of reasons, ranging from injury to looming difficult competitions. Further, if an athlete becomes injured, anxiety may increase as well. Players who are injured have been found to have a higher anxiety score than uninjured players.[16] Further, women are found to be 56% more likely to suffer from an anxiety disorder than men over their lifetime and are more susceptible to difficulties in their environment.[17] These risk factors make female athletes in a high stress environment at a much greater risk to experience anxiety symptoms.[16,17]

Central Sensitization, Anxiety, and Pain

One of the consequences of prolonged stress and allostatic overload may be a condition known as central sensitization (CS). Central sensitization is defined as a state when the central nervous system amplifies sensory input across many organ systems.[6] The increased response to sensation includes increased plasticity of the neurons which makes the neurons more sensitive to stimulation.[6] The principal indicators of CS include hyperalgesia (hyper sensitivity to noxious stimuli) and allodynia (pain in response to normally non-noxious stimuli). Pain results from multiple processes which alter the function of nociceptive neurons, including increases in membrane excitability, facilitation of synaptic strength, and decreases in inhibitory transmission.[6] The affected neurons demonstrate spontaneous activity, reduced activation threshold and enlarged receptive fields. Hypersensitivity amplifies the sensory response elicited by normal inputs such as innocuous stimuli and normal body sensations.[6]

Changes in central sensitization may be involved in multiple, poorly-understood medical conditions. These central sensitivity syndromes (CSS) involve hyper activation of central neurons, which leads to various synaptic and neurotransmitter/neuromodulator changes.[18] Disorders that are under the category of CSS include chronic fatigue syndrome, multiple chemical sensitivity syndrome, posttraumatic stress disorder, and tension-type headaches. Also, psychiatric somatoform states are included with conditions such as somatization disorder, medically unexplained symptoms, and functional pain disorders.[18] These disorders share several common symptoms such as pain, fatigue, poor sleep, sensory hyperarousal, and a high rate of comorbid mood disorders.[18] These symptoms are very similar to the symptoms of anxiety, which suggest that both anxiety and central sensitization share important central nervous system changes, which then affect other parts of the body. The presence of sensory hypersensitivity over

a wide region indicates an augmented central pain processing mechanism. Peripheral and central sensitization have been suggested to be an underlying mechanism of chronic musculoskeletal pain. When regarding muscle pain, it is thought that neurobiological sensitization that operates at somatic, cognitive, and behavioral levels may increase anxiety symptoms.[19] Inducing pain in an anatomical region away from the clinical pain region is a strategy used to investigate signs of central sensitization and/or alterations of nociception in the spinal cord.[19]

Central sensitization is a condition that can create a great deal of stress physiologically and psychologically. The hypersensitivity of the nervous system creating physical pain for individuals will also take a toll mentally. When an individual is in pain, their mental state needs to be observed in addition to their physical state. Treatments that can help the symptoms of central sensitization, such as referred pain, are needed and one will be discussed later in this paper.

Methods of Treating Anxiety

Treatment for anxiety symptoms range from medication, to counseling, to alternative therapies. Standard care approaches for health care professions treating anxiety are psychotherapy, cognitive-behavior therapy, medication, residential treatment, complementary and alternative treatments, and transcranial magnetic stimulation.[20] Two of the most common treatments are psychotherapy and medication.[21,22] Psychotherapy, also known as "talk therapy" has been found to be an effective treatment for those with anxiety disorders. To be effective, it must target the individual's specific anxieties. Though it is a common treatment, temporary discomfort is often found due to thinking about, or confronting feared situations.[22] Cognitive Behavioral Therapy (CBT) is a type of psychotherapy used to help those with anxiety disorders. It teaches different ways of thinking, behaving, and reacting to situations that induce anxiety or

fear.[22] This is done via two approaches, cognitive therapy and exposure therapy. Cognitive therapy identifies, challenges and neutralizes unhelpful thoughts, and exposure therapy confronts the underlying fears. Exposure therapy is meant to help people engage in situations they have been avoiding and is often used with relaxation exercises and/or imagery.[15] Self-help and support groups are also used and can be beneficial. Another form of treatment is teaching stress-management techniques. Stress-management techniques, such as meditation, can help an individual calm themselves and could make therapy more effective.[15]

The second most common treatment for anxiety is medication, which does not cure an anxiety disorder but can help relieve symptoms.[22] Patients are commonly treated using a combination of medication and psychotherapy to produce better outcomes. The most common medications used for anxiety disorders are antidepressants, anti-anxiety drugs, and beta-blockers.[22] Antidepressants are used to treat conditions such as anxiety, pain, and insomnia along with depression. The most common form of antidepressant is a selective serotonin reuptake inhibitor (SSRI) because it does not cause as many side effects as other classes of antidepressants. Though they are helpful in treating mental health disorders there are common side effects such as nausea and vomiting, weight gain, sleepiness, sexual problems, and diarrhea.[22] Anti-anxiety medications are used to help reduce symptoms such as panic attacks, or extreme fear and worry. The most frequently used treatment for some forms of anxiety and anxiety disorders are benzodiazepines.[22] Though benzodiazepines are effective and fast-acting, patients can build up a tolerance if taken for a long period of time or become dependent on them. If it has been decided to remove this medication from their treatment plan then it needs to be tapered off slowly because people can experience withdrawal symptoms or their anxiety can return.[22] Some possible side effects from the medication are nausea, blurred vision, headache,

confusion, tiredness, and nightmares. Beta-blockers are also used to help treat and manage the physical side effects such as trembling, racing heartbeat, and sweating. These can be used for a short period of time or "as needed" to reduce acute anxiety. Side effects from beta-blockers include fatigue, cold hands, dizziness or light-headedness, and weakness.[22]

Though these treatments are found to be effective they are not suitable for everyone. First it is expensive to treat anxiety and anxiety symptoms. The physical health symptoms of those with a diagnosed anxiety disorder produce a substantial strain on the medical health system and are considered a significant public health burden.[2] One study found that the estimated total medical costs for an individual diagnosed with an anxiety disorder to be $6,475. This estimation includes all inpatient, outpatient, and prescription drug charges.[23] In 2013 the Journal of Health Affairs estimated that $201 billion dollars was spent in the United States on mental disorders such as anxiety and depression.[24] This is a significant amount of money being spent on traditional treatments, and those are just the people who have a diagnosed disorder. It is common for individuals without a diagnosed disorder to receive medication from a doctor or to see a psychologist for treatment. This means the cost of treatment for anxiety is going to be even higher than what has been recorded. Further, the side effects of the medications may be disabling to a competitive athlete, and many medications are banned substances at the collegiate or professional level (such as beta-blockers). Though psychotherapy and medication are the most common treatments for anxiety symptoms, they may not be the best treatment for some athletes. Between the cost and side effects of medication, and the perceived stigma of seeing a psychologist, the likelihood of an athlete going this route for treatment of anxiety may be unlikely. With the increase in health care costs there is a growing interest in alternative

treatments such as using meditation or yoga. Though alternative treatments can be considered beneficial, it is crucial to study the effects these treatments have on anxiety.

Down-regulation/Primal Reflex Release Technique

A relatively new method of treating pain and dysfunction that may have anxiety or central sensitization components is the down Regulation (dR) aspect of Primal Reflex Release Technique (PRRT).[7] The dR technique is a manual-therapy approach for evaluating and relieving musculoskeletal pain in patients. It is touted as a quick treatment which provides instant relief, and is advertised as being effective in more than 80% of patients with painful conditions.[7] PRRT practitioners state it is not uncommon for patients to feel up to 50 % improvement after the first visit, and most patients don't need this treatment more than several sessions to resolve their condition.[25]

The dR technique is based on the belief that over-stimulation of the primal reflexes in the body creates pain and keeps re-occurring painful patterns. These primal reflexes—withdrawal, startle, and protective joint reflexes—are integrated into the body for survival purposes. Events that are startling or painful can trigger these reflexes as a naturally occurring defense mechanism.[7] After the event has passed, though, these reflexes can remain in a hyper-ready state. Having activated reflex responses over a sustained period can lead to pain patterns being reproduced, repeated, and maintained, interfering with healing and resisting therapeutic efforts to restore natural function. The application of dR is meant to facilitate a rapid "neural reboot" to reset the neural control of joints, muscles, and fascia to release joint restrictions, trigger points, and fascial restrictions. It is used to treat restricted motion, pain with or without motion, reduced spontaneity of motion, muscle tightness, muscle tension, or muscle stiffness.[7]

John Iams, the developer of PRRT and dR, discovered how to find these reflexes and defined them as TriggeRegions, to differentiate from the more well-known trigger points. TriggeRegions are an area of hyperesthesia that can be found by palpating over predictable areas while applying little to no inward pressure.[25] These TriggeRegion areas have been found to have specific patterns. It is suspected that the presence of the TriggeRegions may be a maladaptation to stress. The TriggeRegions are located where the dura mater is attached either directly or indirectly. The connection between dura mater and its reciprocal tension mechanism could be the reason for the body's quick response to this treatment.[25]

To start a dR, the practitioner examines these areas by palpating bilaterally in a "One Minute Nocioceptive Exam". This exam scans for any "up-regulated" reflexes. The exam is done by alternately palpating on particular sites starting from the right side then assessing the left at the TriggeRegions that Iam's has identified.[25] During the Nociceptive Exam, the practitioner is observing to see whether the Nociceptive Startle Reflexes can be elicited. A response is identified if the patient gasps, groans, or grimaces. The grimace has been found to be the most frequent response.[25] These signals will not all present themselves on every patient or at each point, but the more irritable the pain pattern the greater response they will have to the exam. If no response is noted then the practitioner can assess and note if the area is tight, tender and/or thickened. This examination is performed pre-and post-treatment to assess how the primal reflexes, specifically the startle and withdrawal reflex, have been affected. The dR technique is designed to down-regulate three of the primal reflexes and uses light stimulation for about 12 seconds to reflexively and reciprocally inhibit facilitated areas.[25] The technique should not cause any discomfort to the patient, and often practitioners find minimal tight, tender, or thickened regions after the treatment demonstrating a reduction in reflex-based excitatory nocioception. It

is important to note that PRRT dR does not treat everyone's pain, and if it doesn't work in the first two sessions when tried should no longer be continued because it can be ruled out as a successful treatment for that patient.[25]

The phenomenon of "up-regulated" primal reflexes shares similarities to central sensitization.[6,7] CS induces pain at an anatomical region different from their clinical pain site. During the One-Minute Nocioceptive Exam the practitioner is palpating for painful sites where there may be hypersensitivity, which is similar to what happens with CS. The similarities are why it is thought that PRRT dR can be used to "down-regulate" the nervous system in order to relieve physical symptoms.

Summary

The PRRT dR technique is generally used to treat pain, muscular tightness, spasm, and hyper-active nerves that are believed to be related to the "up-regulation" of primal reflexes. These "up-regulated" neural reflexes may occur as a result of, or concurrently with, central sensitization. These indications also seem to mirror many of the physical symptoms of anxiety, and prior research has shown a relationship between anxiety and the physical symptoms of central sensitization.[19] While PRRT dR is generally used to treat physical symptoms, it is currently unknown if using a treatment like PRRT dR would alter cognitive and emotional states, specifically those of anxiety. Thus, we want to investigate if the utilization of a treatment designed for physical symptoms could also reduce the cognitive and emotional symptoms of state anxiety, which may be present in patients receiving this treatment. Therefore, the purpose of this professional paper is to determine if PRRT dR is an effective treatment for reducing the physical and cognitive/emotional symptoms of anxiety in NCAA female athletes. Anxiety may stem from many different sources and is difficult to overcome. Having a treatment option for

clinicians to use to help treat athletes with anxiety in a cost-effective way would be beneficial for both the athlete and their sports medicine staff.

Chapter 2

Methods

This was a small observational study of the changes in state anxiety after a PRRT dR treatment.

Participants: The participants were 11 members of the University of Montana women's intercollegiate teams, from the ages of 18-22. Participation was voluntary and participants signed an informed consent form, approved by the Institutional Review Board. Any interested participant completed the initial, baseline STAI form. In order to be included in the subsequent data collections, a participant must have been selected to receive PRRT dR treatment from single clinician (KJ) if they exhibited hypersensitivity to pain or other symptoms.

Instruments: The primary instrument used in this project was the State Trait Anxiety Inventory (STAI). This a popular instrument used to measure signs and symptoms of anxiety which correspond to state and trait anxiety. The STAI is a self-rating inventory that is composed of two forms: a state form (STAI Y-1) and the trait form (STAI Y-2). To complete the STAI, the participants answer a total of 40 verbal statements (20 in the STAI-YI and 20 in the STAI- Y2) that use a 4-point Likert scale. The Likert scale is a subjective measurement of the experienced intensity of a given symptom, from 1 being "not at all" to 4 being "very much so." Some of the items on each form are inversely scored, meaning that if the participant selected "1= not at all", the actual score would be a 4. These inverse items are designed to ensure the participant pays attention to each item in the scale and responds accurately.[26] The total score for each form is determined by summing the numeric ratings of each symptom, and ranges from 20-80 points. The higher the score the larger the anxiety level of the participant.

The STAI has been found to have excellent psychometric data. The internal consistency ranges from good to excellent (Cronbach's alpha of 0.77-0.96), a test-retest reliability of r= 0.44-0.49, and the construct and concurrent validity are rated very good.[27]

Protocol: Recruitment: Recruitment took place prior to, or immediately following, a team practice or lifting session. Permission was obtained from each coach to inform the team about the study, and to hand out consent forms and the STAI (both the Y1 and Y2 forms). Athletes interested in participating completed the consent form and STAI forms, then put them in an enclosed box in the Rhinehart Athletic Training Center (RATC) graduate assistant office. This initial STAI was used to establish a baseline for all athletes willing to participate.

Protocol: PRRT dR Intervention: The clinician, an athletic trainer with over 30 years of experience and 4 years experience using PRRT, performed the PRRT treatment on all participants. She routinely uses PRRT to treat pain and muscular symptoms on athletes. There are various criteria that this clinician uses to determine if an athlete needs PRRT. These criteria include:

- Results of the mental health screening all athletes completed during their annual physical exam. If they had a high score, indicating concern, the athlete was considered for PRRT treatment.
- The athlete's primary athletic trainer believes they are a good candidate for the treatment
- The athlete has pain in multiple TriggeRegion areas that are not associated with an existing injury.
- The athlete is showing signs of excessive anxiety.

If the participant was selected to receive the PRRT dR, an appointment in the RATC was scheduled with the clinician and primary investigator. Treatments did not occur within 1 hour of the conclusion of a practice, team conditioning, or strength and conditioning/lifting session, in order to prevent exertion from influencing the results.

All participants arrived to the RATC and completed the state portion of the STAI (form Y-1) The participant then sat quietly for 15 minutes to relax and allow heart rate and blood pressure to return to resting values. After 15 minutes, the principal investigator took the participant's resting heart rate using a pulse oximeter (Nonin, Onyx II 9580) and measured blood pressure manually with a stethoscope and a sphygmomanometer. The blood pressure reading was done on the participant's left arm using recommended technique.[28]

After obtaining pre-treatment heart rate and blood pressure, the clinician performed a One-Minute Nocioceptive Exam by palpating bilaterally at the designated TriggeRegions. Starting at the proximal calf and moving superiorly to the head and neck, each athlete was asked to use the Numeric Pain Rating Scale (NPRS) to vocalize the pain they experience as each point was palpated. The NPRS is a 0-10 pain scale with 0 representing no pain and 10 representing the worst pain imaginable. Also noted during the evaluation was the presence of a gasp or grimace as a reaction to pain, along with the tissue texture at each TriggeRegion. After the One-Minute Nocioceptive Exam was completed the clinician performed the PRRT dR treatment. The treatment is completed by inciting certain reflexes in a specific order. This process began with the palmar reflex followed by the epicranial release, frontalis release, obicularis oculi, tricranial + TMJ Zygomatic arch, rectus capitus posterior minor dR, hyoid flip technique, and the digastric/mylohyoid tap (see appendix 1). After completion of the dR, palpation of each

TriggeRegion was repeated to evaluate change in tenderness. The evaluation and treatment took 15-20 minutes.

Once the clinician completed the PRRT dR treatment on the participant, the participant immediately had their heart rate and blood pressure taken again by the primary investigator, in the same room and in the same position as the pre-treatment measurement. The participant then completed the state portion of the STAI (form Y-1). This concluded the data collection on the day of the treatment. Finally, 48-72 hours post-treatment the participant completed the state portion of the STAI (form Y-1) for a final time. Each participant met with the primary investigator in the RATC, to complete the form. This concluded their participation in the study.

Data Analysis: The immediate effects of PRRT dR on state anxiety and physical vital signs (heart rate and blood pressure), were statistically analyzed, in addition to changes in state anxiety 2-3 days after the treatment. A repeated-measures ANOVA's was performed to assess the changes in the state form of the STAI (form Y-1) at 3 points: pre-treatment, immediately post-treatment, and 48-72 hours post treatment. Repeated measured t-tests were used to compare heart rate, systolic blood pressure, and diastolic blood pressure measurements between pre-treatment and immediately post-treatment. Alpha was set as $p \leq 0.05$.

Pre-season state and trait scores of the STAI (forms Y-1 and Y-2) were compared between the participants who were selected to undergo dR, to those who were not, to see if participants with higher reported trait anxiety were more likely to be selected for this form of treatment. A one-way ANOVA was performed with alpha set as $p \leq 0.05$.

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Chapter 3: Manuscript

Introduction

Anxiety is a cognitive, behavioral, and physiological reaction to stress causing significant disability and impairment in occupational, relationship and physical health.[1,2] Anxiety is the anticipation of what can happen in the future and is coupled with muscle tension and avoidance behaviors. Competitive athletes and female athletes, report higher anxiety rates than males.[3,4] For athletes, symptoms of anxiety may stem from a variety of sources, including family, health, competition, financial concerns, interpersonal relationships, school or jobs. These symptoms result in significant distress and may impair daily living in school, work, play, and interpersonal relations.[3] Due to the impact psychological factors have on mood and performance, anxiety has become a frequently measured variable in sports psychology.[5] The impact these factors have on enjoyment of sport, continued participation, and self-efficacy drives the research to explore the components of anxiety.[5]

Diagnoses of psychiatric disorders have increased in recent years. 46.6% of the United States' population will be a diagnosed with a psychiatric disorder at some point in their life. Anxiety disorders are found in 28.85% of the population.[6] Further, women are found to be 56% more likely to suffer from an anxiety disorder than men over their lifetime and are more susceptible to difficulties in their environment.[7] These data points only reflect diagnosed disorders, and do not represent the millions of others who experience symptoms of anxiety that do not meet diagnostic criteria. At lease 30% of collegiate athletes report symptoms of anxiety at the beginning of the season.[8] Therefore, female athletes in a high stress environment at a much greater risk of experiencing anxiety symptoms.[7,9]

Chronic anxiety and stress may cause hypersensitivity to stimuli or a pain response in normally non-painful areas, a condition called "central sensitization" (CS).[10,11] Patients with CS often report chronic pain, as well as emotional and psychological symptoms including anxiety, fatigue, and depression.[10] Various treatments are available for the symptoms of CS, but these treatments are often time-intensive, expensive, or come with undesirable side effects. Often, they do not adequately treat the symptoms experienced by individuals with CS.[10]

The down regulation (dR) aspect of primal reflex release technique (PRRT) is a manual therapy approach to evaluate and relieve musculoskeletal pain in patients, including those who display characteristics of CS. The "primal reflexes"- withdrawal, startle, and protective joint reflexes—are activated when a startling or painful event occurs.[12] These reflexes are a defense mechanism against threats and help prevent injury. However, these reflexes may remain in a hyper-ready state after the threat has passed, which creates pain, muscle tension, and hypersensitivity to stimuli. There is limited research on this technique, although case studies demonstrate decreased pain and muscle tension in patients treated with PRRT dR.[11]

While PRRT is generally used to treat pain, muscular tightness, and hypersensitivity no research has explored if using PRRT dR will change other symptoms that often occur with pain, including the physical and psychological symptoms common with anxiety.[11] Therefore, the purpose of this research study was to determine if PRRT dR is an effective treatment for reducing psychological and physical symptoms of anxiety in NCAA Division I female athletes. The immediate effects of PRRT dR on state anxiety and physical vital signs (heart rate and blood pressure) were assessed, in addition to changes in state anxiety that remained 2-3 days after the treatment.

Methods

This was a small observational study of the changes in state anxiety after a PRRT dR treatment.

Participants: The participants were 11 members of the University of Montana women's intercollegiate teams, from the ages of 18-22. Participation was voluntary and participants signed an informed consent form, approved by the Institutional Review Board. Any interested participant completed the initial, baseline STAI form. In order to be included in the subsequent data collections, a participant must have been selected to receive PRRT dR treatment from single clinician (KJ) if they exhibited hypersensitivity to pain or other symptoms.

Instruments: The primary instrument used in this project was the State Trait Anxiety Inventory (STAI). This a popular instrument used to measure signs and symptoms of anxiety which correspond to state and trait anxiety. The STAI is a self-rating inventory that is composed of two forms: a state form (STAI Y-1) and the trait form (STAI Y-2). To complete the STAI, the participants answer a total of 40 verbal statements (20 in the STAI-YI and 20 in the STAI- Y2) that use a 4-point Likert scale. The Likert scale is a subjective measurement of the experienced intensity of a given symptom, from 1 being "not at all" to 4 being "very much so." Some of the items on each form are inversely scored, meaning that if the participant selected "1= not at all", the actual score would be a 4. These inverse items are designed to ensure the participant pays attention to each item in the scale and responds accurately.[26] The total score for each form is determined by summing the numeric ratings of each symptom, and ranges from 20-80 points. The higher the score the larger the anxiety level of the participant.

The STAI has been found to have excellent psychometric data. The internal consistency ranges from good to excellent (Cronbach's alpha of 0.77-0.96), a test-retest reliability of r= 0.44-0.49, and the construct and concurrent validity are rated very good.[27]

Protocol: Recruitment: Recruitment took place prior to, or immediately following, a team practice or lifting session. Permission was obtained from each coach to inform the team about the study, and to hand out consent forms and the STAI (both the Y1 and Y2 forms). Athletes interested in participating completed the consent form and STAI forms, then put them in an enclosed box in the Rhinehart Athletic Training Center (RATC) graduate assistant office. This initial STAI was used to establish a baseline for all athletes willing to participate.

Protocol: PRRT dR Intervention: The clinician, an athletic trainer with over 30 years of experience and 4 years experience using PRRT, performed the PRRT treatment on all participants. She routinely uses PRRT to treat pain and muscular symptoms on athletes. There are various criteria that this clinician uses to determine if an athlete needs PRRT. These criteria include:

- Results of the mental health screening all athletes completed during their annual physical exam. If they had a high score, indicating concern, the athlete was considered for PRRT treatment.
- The athlete's primary athletic trainer believes they are a good candidate for the treatment
- The athlete has pain in multiple TriggeRegion areas that are not associated with an existing injury.
- The athlete is showing signs of excessive anxiety.

If the participant was selected to receive the PRRT dR, an appointment in the RATC was scheduled with the clinician and primary investigator. Treatments did not occur within 1 hour of the conclusion of a practice, team conditioning, or strength and conditioning/lifting session, in order to prevent exertion from influencing the results.

All participants arrived to the RATC and completed the state portion of the STAI (form Y-1) The participant then sat quietly for 15 minutes to relax and allow heart rate and blood pressure to return to resting values. After 15 minutes, the principal investigator took the participant's resting heart rate using a pulse oximeter (Nonin, Onyx II 9580) and measured blood pressure manually with a stethoscope and a sphygmomanometer. The blood pressure reading was done on the participant's left arm using recommended technique.[28]

After obtaining pre-treatment heart rate and blood pressure, the clinician performed a One-Minute Nocioceptive Exam by palpating bilaterally at the designated TriggeRegions. Starting at the proximal calf and moving superiorly to the head and neck, each athlete was asked to use the Numeric Pain Rating Scale (NPRS) to vocalize the pain they experience as each point was palpated. The NPRS is a 0-10 pain scale with 0 representing no pain and 10 representing the worst pain imaginable. Also noted during the evaluation was the presence of a gasp or grimace as a reaction to pain, along with the tissue texture at each TriggeRegion. After the One-Minute Nocioceptive Exam was completed the clinician performed the PRRT dR treatment. The treatment is completed by inciting certain reflexes in a specific order. This process began with the palmar reflex followed by the epicranial release, frontalis release, obicularis oculi, tricranial + TMJ Zygomatic arch, rectus capitus posterior minor dR, hyoid flip technique, and the digastric/mylohyoid tap (see appendix 1). After completion of the dR, palpation of each

TriggeRegion was repeated to evaluate change in tenderness. The evaluation and treatment took 15-20 minutes.

Once the clinician completed the PRRT dR treatment on the participant, the participant immediately had their heart rate and blood pressure taken again by the primary investigator, in the same room and in the same position as the pre-treatment measurement. The participant then completed the state portion of the STAI (form Y-1). This concluded the data collection on the day of the treatment. Finally, 48-72 hours post-treatment the participant completed the state portion of the STAI (form Y-1) for a final time. Each participant met with the primary investigator in the RATC, to complete the form. This concluded their participation in the study.

Data Analysis: The immediate effects of PRRT dR on state anxiety and physical vital signs (heart rate and blood pressure), were statistically analyzed, in addition to changes in state anxiety 2-3 days after the treatment. A repeated-measures ANOVA's was performed to assess the changes in the state form of the STAI (form Y-1) at 3 points: pre-treatment, immediately post-treatment, and 48-72 hours post treatment. Repeated measured t-tests were used to compare heart rate, systolic blood pressure, and diastolic blood pressure measurements between pre-treatment and immediately post-treatment. Alpha was set as $p \leq 0.05$.

Pre-season state and trait scores of the STAI (forms Y-1 and Y-2) were compared between the participants who were selected to undergo dR, to those who were not, to see if participants with higher reported trait anxiety were more likely to be selected for this form of treatment. A one-way ANOVA was performed with alpha set as $p \leq 0.05$.

Results

Of the athletes who were eligible to be a part of the study, 11 consented to participation, 4 of which received the treatment. The participants' age ranged from 18-22 years old with a

mean of 21.00 ± 0.816 years, and from the women's volleyball (n=2), soccer (n=3), basketball (n= 4), tennis (n=1), and softball (n=1) teams. Of these 11 participants, 4 received PRRT dR treatment. These athletes were female, ranging from 18-20 years old with a mean age of was 19.50 ± 1.0 years, and from the women's volleyball (n=2) and soccer (n=2) teams.

No significant difference was found comparing the STAI-Y1 ($F_{(1,9)} = 0.238$, p= 0.637) and for STAI-Y2 ($F_{(1,9)} = 0.184$, p= 0.678) scores between the participants who did receive treatment and who did not (see Table 1.)

Table 1: STAI-Y1 and STAI-Y2 comparison for athletes who received PRRT vs. the control group

Variable	PRRT mean ± s.d.	Control mean ± s.d.	$F_{(dF)}$	p-value
STAI-YI	32.50 ± 13.229	35.68 ± 9.668	$F_{(1,9)} = 0.238$	p= 0.637
STAI-Y2	35.75 ± 9.946	38.14 ± 8.335	$F_{(1,9)} = 0.184$	p= 0.678

The changes in STAI-Y1 values pre-treatment, post-treatment, and 42-72 hours post-treatment approach significance ($F_{(2,6)}$= 4.751, p = 0.058) (see Table 2). Due to the exploratory nature of the study, a paired t-test was performed to assess the pre-treatment to post-treatment changes in STAI-Y1 a posteriori.

Table 2: Comparing STAI-Y1 pre-treatment, post-treatment, and 48-72 hours post-treatment.

Variable	Pre-Tx mean ± s.d.	Post-Tx mean ± s.d.	48-72 hours mean ± s.d.	$F_{(df)}$	p-value
STAI-Y1	31.25 ± 5.909	23.75 ± 2.363	29.00 ± 7.703	$F_{(2,6)}$= 4.751	p = 0.058

The STAI-Y1 (t_3=3.326, p = 0.045) and heart rate measurements (t_3= 3.368, p = 0.043) showed a significant change post-treatment. The systolic blood pressure approached significance

(t_3= 2.646, p = 0.077). The diastolic blood pressure did not change (t_3= 1.169, p = 0.327). Table 3 presents the heart rate, systolic and diastolic blood pressure, and STAI-Y1 scores pre and post-treatment.

Table 3: Analysis of STAI-Y1, heart rate, systolic blood pressure, and diastolic pressure before and after treatment.

Variable	Pre-Tx mean ± s.d.	Post-Tx mean ± s.d.	$t_{(df)}$	p-value
STAI-Y1	31.25 ± 5.909	23.75 ± 2.363	t_3=3.326	p = 0.045
HR	76.00 ± 17.701	63.75 ± 13.574	t_3= 3.368	p = 0.043
Systolic BP	114.75 ± 3.948	111.25 ± 2.986	t_3= 2.646	p = 0.077
Diastolic BP	69.00 ± 6.831	65.75 ± 1.50	t_3= 1.169	p = 0.327

Discussion

The purpose of this study was to examine the psychological and physiological effects of PRRT. The investigators determined that PRRT dR does produce changes in decreased heart rate and state anxiety. The decrease in heart rate and state anxiety symptoms from pre-treatment to immediately post-treatment, indicate changes in both psychological state and physiology.

State and trait anxiety scores were compared to normative values for female college students, to compare if female athletes who volunteered for this study had similar reported levels of trait anxiety.[16] In Endler's study of undergraduate college students, the state anxiety for female students was measured at 36.23 ± 11.23 and trait anxiety was measured 42.31 ± 10.60.[16] The participants who participated in this study had slightly lower trait and state anxiety levels, regardless of group. The difference in scores could be due to several reasons. First, there were only eleven participants in this study, thus small sample size may influence the results. Also, it is

possible that those who filled out the consent forms were less anxious than those who did not. This consent forms were handed out to 69 athletes, so only 6.27% of the athletes decided to participate. It is a possibility that those who turned in the surveys to participate did not believe they had any symptoms of anxiety, and thus were more comfortable agreeing to be a part of the study.

Second, STAI baseline scores were not used as a determining factor for if the participant would receive treatment. Due to the STAI scores not being used as inclusion criteria for receiving treatment, it indicates that other factors helped decide if an athlete was to receive treatment such as hypersensitivity or muscle tension.

There have been no experimental studies using PRRT dR, thus direct comparisons to published research is no possible. However, comparing the results of PRRT dR to other, similar manual therapy techniques provides an opportunity to explore similarities and differences to more established techniques. Studies of facial massage, which also involves working with facial structures, found a significant reduction in anxiety which they attributed to "sleep induction" associated with a deep sense of relaxation and changes in brain wave activity, similar to what occurs just prior to sleep.[17,18,19] Massage, including facial massage, is concluded to have this calming effect on the physiology.[17]

The study done by Hayamata used an ECG to monitor heart rate variability as well as the STAI to monitor anxiety symptoms in conjunction with a facial massage.[19] Hatayama looked at anxiety levels and the activity of the autonomic nervous system in 32 healthy Japanese women with a mean age of 28.5 years old. This study found that the low and high frequency heart ratio (LF/HF ratio) significantly increased after the massage, though the heart rate remained the same.[19] This is significant because the LF/HF ratio represents sympathetic nervous activity. The

investigators speculated that the increased sympathetic nervous activity after the facial massage could be a positive stress reaction to the treatment, often referred to as *eustress*, and that eustress may increase sympathetic nervous system output despite no perceived distress. The study also found that the STAI anxiety score significantly declined after a facial massage.[19] The STAI scores went from 36.25 ± 1.33 to 28.25 ±1.04 after the massage ($P<0.001$). The investigators discussed that the decrease in anxiety scores and the increase in sympathetic nervous activity could be considered refreshment instead of relaxation.[19] Facial massage may cause similar changes as PRRT dR, as several of the reflexes that are stimulated during the treatment are on the face and neck. This could be why facial massage causes similar changes to the observed changes after PRRT dR, because it affects the same area.

A study done by Buttagat looked at the therapeutic effects of traditional Thai massage (TTM) on various factors including anxiety.[21] In this study, the participants received 9 massage treatments over the course of 3 weeks. Anxiety was measured using the STAI state form pre-treatment, immediately post-treatment on the first day, one day after the last treatment, and 2 weeks after the last treatment.[21] This study found a significant decrease in anxiety at every measurement point. The STAI mean baseline was 47.4, the post-test 1 mean was 36.0, the post-test 2 was 31.5, and the post-test 3 was 34.3. The significant decrease from baseline to post-treatment in this study is comparable to the 7.5 point drop observed after PRRT dR. Anxiety continued to decrease after completion of the 9 massage treatments, which may indicate that if PRRT dR was completed over a series of sessions rather than just one, single treatment it may demonstrate similar results. Buttagat and colleagues also found a decrease in pain intensity and muscle tension and an increase in pressure pain threshold, and these improvements remained up to 2-weeks post-treatment.[21] One reason the researchers thought TTM decreased anxiety was due

to the relaxation response that occurs during treatment.[22] When this occurs the stress response is inhibited and anxiety levels are decreased.[22] The decrease in stress also produces an increased vagal outflow and diminished activity of the sympathetic nervous system.[23] These mechanisms can all be attributed to an immediate decrease in anxiety. There is a possibility that the reduction in state anxiety after PRRT dR treatment may be due to a similar relaxation mechanism experienced during TTM. This may provide one reason why practitioners of PRRT dR believe that it is an effective treatment for pain.

Meditation is gaining attention by the medical community today as a method of reducing anxiety. Lee and colleagues studied 46 patients with anxiety disorder and assigned them to an 8-week clinical trial either being a part of a meditation-based stress management program or an anxiety disorder education program.[24] The STAI along with other anxiety measures were used as a measure outcome at 0, 2, 4, and 8 weeks into the program. The meditation-based stress management group showed significant improvement in both state and trait scores.[24] Researchers concluded that the meditation-based stress management program can be an effective treatment in relieving anxiety symptoms in those who have anxiety disorders.[24] The STAI-Y1 showed that the meditation group decreased their anxiety score during every measurement taken in the study. Between baseline and 2 weeks into the program, mean state anxiety decreased 5.6 points, from week 2 to week 4 there was a 1.3 point decrease, from week 4 to 8 there was a 0.7 point decrease, and from baseline to 8 weeks there was a 7.6 point decrease.[24] This is important because the 7.6 point decrease in state anxiety from the meditation-based stress management program occurred after 8 weeks, where PRRT dR had a 7.5 point decrease in state anxiety in about a 20 minute treatment session.[24] This suggests that PRRT dR may be as effective as meditation is for state anxiety for those suffering from anxiety symptoms, but it provides relief

much faster than meditation does. However, the decrease in STAI did not persist after PRRT dR, unlike that seen in the meditation studies. This treatment comparison indicates that more research should be completed to indicate if PRRT dR may be comparable, or perhaps used with, meditation or other forms of stress reduction.[24]

Another study, done by Edwards, compared single bouts of aerobic exercise or meditation on state anxiety in young adults.[25] State anxiety was measured using the STAI before and after the selected intervention. This study found that state anxiety significantly decreased from baseline to post-intervention in meditation (P=0.002), meditation then walk (P=0.03), and walk then meditation groups (P=0.002), but not in the walk (P=0.75) or control (P=0.45) groups.[25] The mean STAI score differences between baseline and after meditation (n=4.6), after a walk then meditation (n=5.6), and after meditation then a walk was (n=3.1).[25] The difference between STAI scores pre and post treatment is actually greater post PRRT dR than post various methods of meditation. Edwards found that meditation may be a preferred method of relieving anxiety symptoms in comparison to aerobic exercise.[25] The state anxiety scores post PRRT dR were actually lower than after meditation but the difference between pre and post treatment is greater after PRRT dR, which indicates that PRRT dR has similar affects neurologically.

A systematic review done by the American Heart Association, examined the neurophysiological and neuroanatomical changes after meditation.[26] A 2-month mindfulness meditation program resulted in increased left-sided anterior brain electrical activation.[27] This electrical activation is a pattern associated with positive affect and emotion, and these changes were only seen in the group that practiced meditation.[27] This study did not find consistent data on how heart rate is affected by meditation, but it did show that blood pressure often decreased after meditation. PRRT dR appeared to acutely change both anxiety and heartrate, which may indicate

that the neurophysiologic changes associated with meditation are slightly different than those caused by PRRT dR. The fact that PRRT dR also lead to a significant decrease to heart rate indicates that PRRT dR affects the cardiovascular system more so than meditation, while meditation appears to create longer-lasting decreases in anxiety. Future studies should examine if repeated treatments of PRRT dR can cause a similar long-lasting change in state anxiety, and perhaps be an alternative method for changing both the physical and psychological symptoms of anxiety.

Limitations

There are many limitations that came with this study such as investigator error, participant bias, and limited study size. The investigator measured blood pressure manually and used a pulse oximeter to measure heart rate. There can be some error in these methods, particularly manual blood pressure, which could skew the results. There could be participant bias due to the subjective nature of the STAI, especially if the participant is under the impression they should "feel better" after the treatment. Another limitation is some of the participants in the study had received the treatment from this clinician before and were potentially more comfortable which could skew the STAI scores. The number of participants in the study is also a major limitation. Only 6.7% of those who received consent forms filled them out, and not everyone who consented received the treatment. Coordinating treatment time with athletes was difficult due to the variability of their schedules and the many commitments as a student athlete. Often, the clinician delivering the treatment was out-of-town when a participant had time to receive a treatment, or vice versa. Class and practice schedules also made scheduling treatment times difficult. This difficulty in coordinating schedules did prevent some athletes who could have received the treatment from actually receiving it. Also, the pain data from the Nocioceptive

Exam pre- and post-treatment was not included in this study, and in future studies it should be analyzed. A larger sample size would be very beneficial in understanding the effectiveness of PRRT dR psychologically and physiologically.

Conclusion

In conclusion, PRRT dR is a unique form of treatment that needs to have further research done to understand its effects on psychology and physiology. The evidence from this exploratory study indicates that PRRT dR can provide immediate relief from state anxiety symptoms, and can help decrease the patient's heart rate providing a relaxing effect. This study should be done on a larger number of athletes, specifically those who had diagnosed anxiety disorders or often report anxiety symptoms. PRRT dR may be a comparable form of treatment for state anxiety in comparison to other holistic treatments such as meditation and massage. Clinicians may consider using PRRT dR to help patients who experience anxiety symptoms, or to assist patients during a stressful, short term situation.

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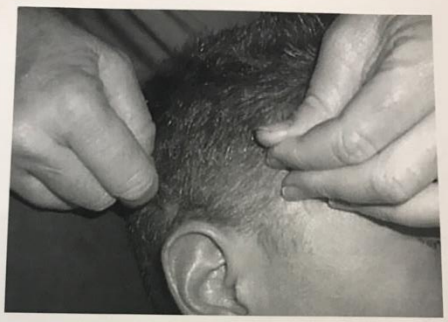
Appendix 1: PRRT Techniques



Epicranial Release

Uses:

- especially valuable for NSR™ in the epicanial muscles(occipitofrontalis and the temperoparietalis).
- usually found on the right side of cranium but be certain to examine left also

Assess:

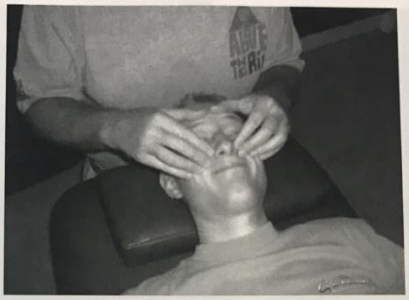
Palpate the occipitalis, frontalis over the eyebrows and the temperoparietalis for NSR™. Note: the occipitalis is easily found by asking the patient to lift eyebrows while palpating the muscle belly behind the ear.

Rx:

- grasp hair near the front of hairline with one hand and at the posterior margin of the temporalis muscle.
- tell the patient you're going to ***gently*** pull perpendicular to the skull; ask that they simply resist any movement of the head.
- hold for about 12 seconds or longer if needed.

Note: track by palpation the various sutures for NSR™ activity; do this bilaterally for comparison and if upregulate, perform the above release.

Notes: pps. 205 & 218



Frontalis Release

Uses: frequently corrects many NSR™ areas.
Often used with Obicularis Oculi Release.

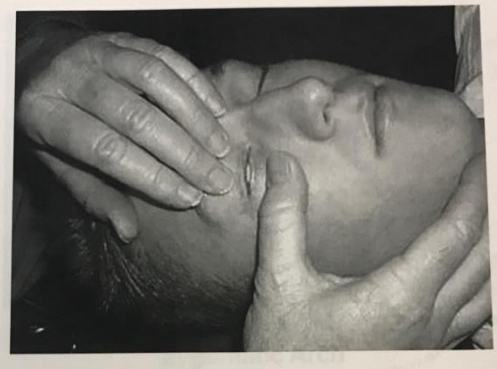
Assess: palpate for NSR™ in medial eyebrow; usually found on right.

Rx:

- patient to close eyes and keep them closed.
- raise eyebrows and keep them raised.
- use your thumbs to flick downward on the medial portion of the eyebrows.
- simultaneously, use your middle fingers to flick upward from the maxilla.

Note: be sure to lift your thumb upward as you "flick" to avoid any eye contact. Do this ***gently*** as possible and ask patient if it's OK with them

Notes: pps. 205 & 218



Obicularis Oculi

Uses: to assist in dR of muscles especially head & neck

Assess: treat if Dural Drivers™ manifest NSR™.

Rx:

- ask the patient to keep eyes closed
- gently and lightly attempt to quickly open the eyelids

Note: be careful not to poke or push inward on the eye .

Caution: ***inquire about the presence of contacts & remove.***

Notes: p. 218

The Palmar Reflex

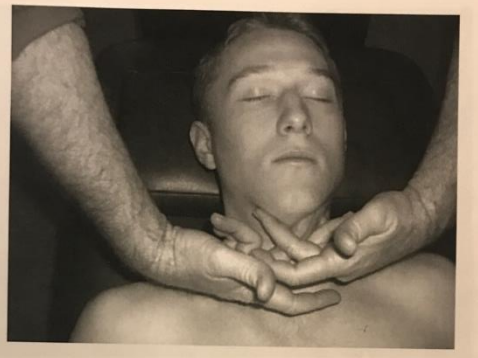
Uses: to dR all NSR™ findings; may resolve all or most of them with this 1 maneuver; use as the 1st technique

Assess: Palpate for the NSR™ in the finger flexor belly just distal to their origin on the medial epicondyle; also palpate for both FPB deep head & adductor pollicis.

Rx:

- supine with eyes closed
- shown; arm overhead to comfort in max external rotation; fingers apart to max; thumb max aBduction with IP max ext; 4th finger into max hyperextension to comfort
- You may use a pen or pencil to maintain the 4th finger in hyperextension
- usually only 12 seconds is necessary but longer may be needed 30–1 min
- can do both or right or left only. Usually only found on right

Notes: ab not sure – do both sides together ~30 sec



Hyoid Flip Technique

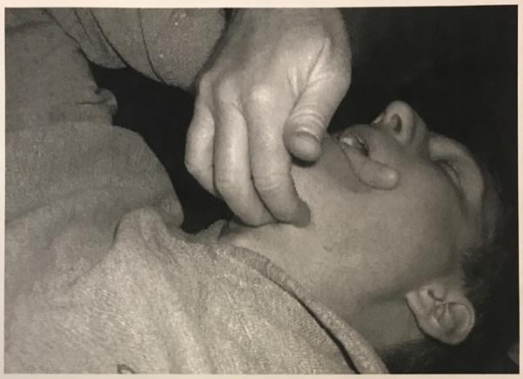
Uses: primal technique to downregulate numerous areas of NSR™ esp those in the upper quarter(usually right)

Assess: palpate the supra and infra-hyoid muscles for tightness and tenderness(usually right)

Rx:

- hook the lateral edge of the hyoid using opposite middle finger.(right middle on left and left middle on right)
- flip the hyoid simultaneously gently
- next flip one side at a time.
- repeat several times for 12 seconds

Notes: pps. 214-216



Digastric/Mylohyoid Tap

Uses: helpful as both a clinical technique for dR the TMJ muscles of closure (masseter, temporalis, medial and lateral pterygoids)

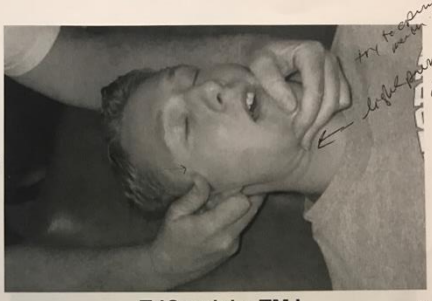
Assess: if the TMJ muscles manifest NSR™ this is likely to be helpful.

Rx:

- ask the patient to gently open their mouth
- place something between their teeth, i.e. their finger, tongue depressor, etc
- attempt to elicit the DTR of the digastric and mylohyoid muscles as you gently tap with 2 fingers in the soft spot behind the mandible
- tap up to a dozen times or ask the patient to perform it themselves.

Caution: The patient should be instructed to have something between their teeth so as not to chip a tooth

Notes: pps. 214-215



TriCranial + TMJ
Zygomatic Arch

Uses: for NSR™ anywhere in the body including head, neck and facial pain

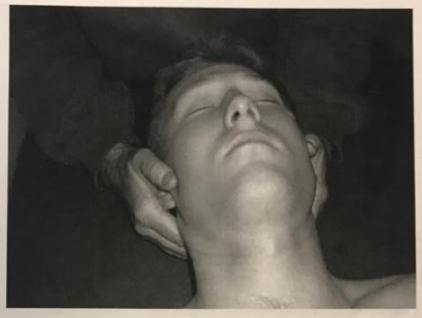
Assess: palpate for the zygomatic arch to be more superior; usually right side involved

Rx: make a 3-point contact on the involved side
- Hook the middle finger behind the mastoid process
- Hook the index finger behind the middle of the ear
- Hook the thumb along the upper ledge of the zygomatic arch
- Hold the mandible gently as shown
- Ask the patient to attempt to glide it toward the involved side and gently try to open
- Use your forearm to gently attempt to move their head toward involved side
- Attempt to gently rotate their head to the left
- Ask the patient to resist the rotation and side bending
- Wait for up to 1 minute for release sensation

Reassess: palpate for NSR™ in the head, neck and face

NOTES:
There are 2 possible positions for the TriCranial Technique:
Zygomatic
Frontal Bone
The techniques are all the same except for the position of the thumb on the involved side .
If you have difficultly combining the actions of both hands, begin by just performing the side of involvement first. Then as you gain psychomotor skills, add in the opposite hand/arm.

5a



Rectus Capitus Posterior Minor dR

Uses: to dR all NSR™ findings in the body esp in the head neck and shoulder girdle

Assess: palpate for the NSR™ in the RCP Minor

Rx: supine with patient"s head in neutral
- explain you're going to use only ounces of pressure to move the head
- move the head a few millimeters by attempting:
- extend the occiput on C1
- palpate the RCPM while holding this position and wait for about a minute for a release

Notes: look down with eyes only - bare suboccipital flexors - weak
- force on forehead - ↑ extension
- passive return