UTILIZING MULLIGAN CONCEPT SUSTAINED NATURAL APOPHYSEAL GLIDES FOR UNRESOLVED CHRONIC LOW BACK PAIN IN THE ATHLETIC POPULATION: A DISSERTATION OF CLINICAL PRACTICE IMPROVEMENT

A Dissertation
Presented in Partial Fulfillment of the Requirements for the
Degree of Doctor of Athletic Training
with a
Major in Athletic Training
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College of Graduate Studies
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by
Kari Odland

Major Professor: James M. May, D.A.T.
Committee Members: Russell Baker, D.A.T.; Alan Nasypany, Ed.D.; Eric Dinkins P.T.
Department Administrator: Phillip W. Scruggs, Ph.D.

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AUTHORIZATION TO SUBMIT DISSERTATION

This dissertation of Kari Odland, submitted for the degree of Doctor of Athletic Training with a Major in Athletic Training and titled "Utilizing Mulligan Concept Sustained Natural Apophyseal Glides for Unresolved Chronic Low Back Pain in the Athletic Population: A Dissertation of Clinical Practice Improvement," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor: ______________________________________ Date: ______________

James M. May, D.A.T.

Committee
Members: ______________________________________ Date: ______________

Russell T. Baker, D.A.T.

______________________________________ Date: ______________

Alan M. Nasypany, Ed.D.

______________________________________ Date: ______________

Eric Dinkins, P.T.

Department
Administrator: ______________________________________ Date: ______________

Phillip W. Scruggs, Ph.D.

ABSTRACT

The capstone of the Doctor of Athletic Training program is a Dissertation of Clinical Practice Improvement (DoCPI). The DoCPI is designed to examine and articulate an athletic trainer's evolution as a scholarly practitioner. Included in this extensive document is a Plan of Advanced Practice, which encompasses an understanding of current clinical practices, professional goals, strengths and weaknesses, and a blueprint for my clinical practice future. Reflecting on patient-reported outcomes and clinical strengths and weaknesses combined to contribute to the chapters that are contained within this DoCPI. The final research multi-site study reflects the philosophy of the DAT in its mission to engage in action research and utilize practice-based evidence to address local clinical practice challenges and enhance clinical decision making. The exploration of the effects of Mulligan Concept® positional sustained natural apophyseal glides on mechanical neck pain within the athletic population has provided a means to directly treat non-traumatic musculoskeletal injury of the cervicothoracic region without reluctance. The point of engaging in action research is not to discover new knowledge or argue theories but rather to obtain insight that has practical applications to the solution of a specific problem. The following DoCPI offers evidence of how action research can be integrated and applied in a clinically meaningful way as well as depict my adventure from a novice athletic trainer to advanced practitioner.

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CHAPTER 1

NARRATIVE SUMMARY

First recognized as a healthcare profession in 1990 by the American Medical Association (AMA), athletic training (AT) continues to evolve, working to match the growing educational and clinical demands of healthcare. The ongoing transition from the professional Baccalaureate degree to the required professional Masters of Science degree demonstrates this trend. The AT profession has undergone an amazing amount of growth during a relatively short amount of time. In less than 50 years, professional ATs have progressed from the equipment room to the athletic training room, and we are now entering clinics, hospitals, and industrial settings (Starkey, 1997). In the ever-changing field of healthcare, athletic trainers have chosen to compete with other allied healthcare professionals for a legitimate place as a provider of healthcare services (Peer & Rakich, 2001).

As athletic training continues to emerge as a high-quality healthcare provider, post-professional doctoral programs designed specifically for athletic trainers must continue to evolve. The need to expand foundational knowledge requires the preparation of doctoral-educated ATs who have the skills necessary to perform independent research specifically in the area of athletic training and within their own clinical practice. To date, the focus of athletic training education has been on the preparation of clinicians who consume research rather than the investigator who produces the research (Myer, et al., 2009). As such, the creation of doctoral programs in athletic training is driven by the need to develop a theoretical and research knowledge base to validate the clinical practice of athletic training (Hertel et al., 2001).

The Doctor of Athletic Training (DAT) program at the University of Idaho is a vision turned mission to alter the course of post-professional education by providing athletic training (AT) professionals the opportunity to rediscover, redevelop and purposefully work towards advanced practice. Through clinical practice investigation, and residency mentorship, opportunities for independent yet structured examination of the ATs current and future path of advanced practice are provided in the DAT. The DAT degree at the University of Idaho is distinctive in the sense that students are lead to foster educational, theoretical, and philosophical growth through professional practice rather than through educational practice only. In addition, the DAT student utilizes a clinical residency designed to prepare the practicing ATs as advanced practitioners by connecting clinical practice to theory.

Advancing professional practice of AT starts with establishing a higher level of scholarship amongst practicing professionals through research and the use of evidence-based practice (EBP); however a routine search of the evidence for best practices for each patient is seldom performed (Hertel, 2014). Rather than ignore clinical judgment, EBP opens the door for clinicians to combine the best of scientific research with professional experience. The end result is a synthesis of information and a method for improving patient care.

The notion that clinical judgments should be based on the best available research is not new. The concept of EBP was developed from evidence-based medicine as a means to place more emphasis on using the best evidence to guide decisions about patient care. The definition of EBP developed by Sackett et al (1996) stated that it is the ‘‘integration of the best research evidence with clinical expertise and patient values to make clinical decisions.’’ Sackett et al (1996) proposed five steps for incorporating EBM into clinical practice: Defining clinically relevant questions (what is most problematic within your clinical practice?), searching for the best evidence (discovering evidence that will support your endeavor to solve the problem), critically appraising the evidence (is what you are reading as good and applicable at it seems?), applying the evidence (implementing a results oriented plan into your clinical practice to provide a better outcome) and evaluating the performance of EBM (do the measurement outcomes address your clinical needs and provide a more efficient way forward?).

However, Meyer (2000) points out the gap in theory-to-practice in clinical practice and the heavy reliance on intuition and experience since traditional research does not usually fit within the unique setting of athletic training or healthcare. Therefore, EBP is combined with practice based evidence (PBE) which provides an important link between the research and clinical practice gap, providing an opportunity for high-quality patient oriented evidence (POE) to be implemented into clinical practice (Hurley et al., 2011; Sauers et al., 2012). Practice-based evidence is generated by clinicians through the purposeful study of their clinical practice as it informs clinicians of the effectiveness of their interventions (Krzyzanowicz, May, & Nasypany, 2014). The democratic impulse associated with PBE makes the outcomes more meaningful because they are rooted in the day-to-day practice.

Ultimately, the DAT student is tasked with the responsibility to demonstrate their understanding and application of both EBP and PBE through the completion of an applied clinical action research (AR) project.

Action research is a process for improving practice, allowing clinicians to search for and create methods that help them provide enhanced level of healthcare (Koshy et al., 2010; Cohen & Manion, 1994). Waterman et al (2001) states, "the exciting thing about the business of research is that is stimulates people to be self-critical, to ask questions and to analyze what they are doing in an attempt to find a better way to do it." Action research is often powerful for one's own professional development because of the personal nature. The objectives of an AR project fall under three broad but inter-related themes. The first is acquisition of greater critical reflection and self-knowledge by the AT, second it encourages the AT to develop team work skills and ownership from their ability to improve and influence aspects of their clinical practice and third, bringing about enhanced quality of care. Meyer (2000) maintains that the strength of AR lies in its ability to generate solutions to practical problems and to empower practitioners. The point of engaging in AR is not to discover new knowledge or argue theories but rather to obtain insight that has practical applications to the solution of a specific problem.

During my clinical residency, I embraced an AR philosophy and examined my local clinical practice challenges, which led to an improvement in my assessment skills across many pathologies sustained in the intercollegiate athletic population and in my ability to effectively categorize and treat patients. A significant shift in my clinical practice as an athletic trainer came with the integration of patient-reported outcomes collection during my clinical residency. The integration of patient-reported outcomes helped to guide my clinical decision making, gauge patient progress, and determine efficacy of the treatments I chose. During my undergraduate education and throughout my career, I was only exposed to and utilized disease oriented outcomes (DOEs), such as range of motion or manual muscle testing however, these outcome measures are only useful to a clinician as DOEs only assess the patient's response to treatment without considering the patient's perspective (McLeod et al., 2008). Understanding the limitations DOEs can present within patient-centered care, helped me to realize that if I wanted to perform consistent, long lasting and effective patient-centered care, I would need to also incorporate patient oriented evidence (POEs) measures into my clinical practice (McLeod et al., 2008).

By incorporating both DOEs and POEs into my clinical practice and the use of an outcomes based approach to patient care, illuminated the impact my clinical decision making had on patient care. An outcomes based approach also helped me to focus on the areas of my clinical practice that needed strengthening and highlighted a significant local clinical practice challenge, namely my approach to treating patients complaining of low back pain (LBP). My approach to patient care with regards to LBP was little more than what was expected of a junior in a professional athletic training program. My goal was to evaluate the patient just enough to be able to determine whether the patient was experiencing neuropathy associated with a possible disc pathology or whether they were simply experiencing ‘tightness’ as it related to their athletic participation; an approach which proved to be highly unsuccessful. I was often guilty of assuming that my patients were a chiropractic referral, as I was ill equipped to assess much less treat LBP and more specifically, the chronic LBP patient population.

Recognizing that I needed to change this aspect of my clinical practice, I began the Fall-I semester of my clinical residency with the intent to streamline my approach into a more focused and intentional process. I learned that I needed to better understand the symptoms influencing LBP and the mechanisms by which patients were struggling to fully recover. Therefore, I made the decision to incorporate a global assessment approach, the Selective Functional Movement Assessment (SFMA), to help guide my clinical decision making and improve by ability to elicit meaningful change in patient-reported outcomes, especially in my LBP patient population.

Through the duration of my clinical residency, I utilized the SFMA which is designed to clinically assess seven fundamental movement patterns in those with known musculoskeletal pain to systematically find the cause of symptoms, not just the source, by logically breaking down dysfunctional patterns (Cook, 2011). By integrating the SFMA assessment into my clinical practice my ability to identify factors contributing to a patient’s LBP and dysfunction and towards a treatment paradigm dramatically changed. My increased ability to identify dysfunctional movement pattern factors (e.g., positional faults, joint mobility dysfunction, and tissue facilitation regulation) allowed me to effectively classify, and treat each patient. Through the integration of SFMA and new treatment paradigms such as Mulligan Concept (e.g., lumbar SNAGs, Posterior Innominate MWMs) and Total Motion

Release (e.g., trunk extension, prone SLRs), the patients I was treating with LBP were reporting success in days rather than months with and I was quickly becoming a *'de facto'* expert in the treatment of LBP within my clinical practice.

Evidence of my clinical practice progress is presented in Chapter 3 of this DoCPI. There, I discuss and present my advanced practice areas (e.g., low back pain, fear avoidance model) while providing the evidence of changes (e.g., use of POEs) and improvements I have made in my patient care. By adopting an AR philosophy within my clinical practice I collected individual patient outcomes to identify common pathology trends, recognized areas for clinical practice growth, developed *a priori* methods to address local challenges, and assessed patient oriented outcomes. By incorporating AR into my clinical practice, I have become proactive with the ability to recognize everyday phenomenon within my patient population and develop solutions to recalcitrant clinical practice challenges.

The selection of an area(s) of advanced practice is a recent development in AT and is perceived by the Board of Certification (BOC) as being critical if an advanced practitioner is to improve quality of patient care and enhance patient quality of life (Brown, 2012). Developing areas of advanced practice will help athletic trainers establish their careers, become leading experts in the profession, and improve patient care (Brown, 2012). The DoCPI is aimed at providing evidence of my clinical skill and decision making, and my journey towards advanced practice.

Chapter 2 of my DoCPI contains my Plan of Advanced Practice (PoAP), a critical and self-directed component of the DAT which challenges the AT to test preconceived notions, long held clinical practice beliefs and consider new evidence. The PoAP is a theory-driven AR model wherein AT clinicians focus on a specific area of interest to gain advanced practice expertise (Nasypany, Seegmiller, Baker, 2013). The clinician can utilize the PoAP to continually evaluate and re-direct their advanced practice over the course of a career and is a fluid guide for achieving advanced practice which is measurable, and allows for continued reflection. I highlight my journey in the profession for the purpose of reflecting on my personal growth as an advanced practitioner in AT and to illustrate how I have arrived at my current level of knowledge. I also expound on my chosen areas of advanced practice within the AT profession. Additionally, I utilized the PoAPs structure to critically assess my strengths and weaknesses in the profession and to develop a specific and measurable 5-year plan for growth in each area.

In Chapter 3, I examine my clinical skills competence and understanding of selected treatment paradigms, use of EBP, PBE, and POEs, and my continual effort to deepen my foundational knowledge. I demonstrate the AR process by identifying two key challenges in my clinical practice (i.e., low back pain, and fear avoidance behavior) and create a plan for treatment and collection of patient-reported outcomes. Analysis of patient outcomes created the opportunity for me to develop my clinical practice philosophies and clinical decision-making strategies while continually reflecting on my ability to appropriately utilize newly introduced treatment paradigms and the effectiveness of my clinical skills. I prided myself on my ability to collect outcomes on every patient I worked with (n = 42) over the course of my clinical residency and the consistency with which they were collected. Not only did my patients benefit from being able to see for themselves the progress they were making on a weekly basis (based on specific outcome measures) but for myself and knowing that my treatment choices were having an impact of their pain and dysfunction.

Chapter 4 of my DoCPI is a multi-site case series manuscript investigating the utilization of Mulligan Concept thoracic sustained natural apophyseal glides (SNAGs) for the treatment of mechanical neck pain (MNP). Weinberger et al (2001) highlighted numerous benefits to performing multi-site, collaborative research with other professionals, including enhanced external validity, greater statistical power, and rapid subject recruitment. Although there are, potentially, numerous barriers to achieving effective multi-site research; including difficulty in group organization and low internal validity, multi-site research seems to be an effective means of producing high quality research studies (Fuller-Rowell, 2009), chapter 4 is evidence of my ability to collaborate with a colleague to disseminate research to a larger constituency of athletic trainers and serves as an indication of my willingness to participate in scholarly endeavors. The manuscript illustrates how I developed research questions, collected data, and chose appropriate statistical analyses to answer the research questions. This multi-site case series has also helped me to establish a line of scholarly research.

Important to advancing the athletic training profession, expert clinicians must not separate themselves as clinician or academic scholar. Through the creation and completion of my DoCPI, I had opportunity to critically reflect on my evolution as an athletic trainer who had, prior to the DAT, made clinical decisions based on personal experience, information presented at continuing education conferences, and by default rather than on any type of patient oriented evidence or evidence reported in the literature; and who for over eighteen years used unsubstantiated interventions with little evidence of effectiveness. My efforts to become an advanced practice clinician has greatly influenced and forever changed the way I approach patient care as an athletic trainer. As a clinician, I have transitioned past my entry-level education, developed *a priori* areas of advanced clinical practice, and continue to re-invent and re-purpose my personal and professional development goals. In addition, my journey towards advanced practice has changed my perspective of my role as an AT educator and clinical faculty member.

The development of my abilities as a scholar has been important for my career development; as a clinical faculty member in a new employment position, scholarship production will be an expectation. Prior to entering into the DAT program, I possessed little "real" knowledge of the research process and was sheepishly unprepared to meet the demands of academia. As supported by my DoCPI, I have improved my ability to conduct research, answer local and global clinical questions, and communicate my findings through AR and my *a priori* to my colleagues in the AT profession. In addition, my teaching practices must empower students to take ownership of their education and help them realize that they are responsible for their learning outcomes. My goal as an educator is to instill a sense of professional responsibility and desire to provide patient-centered care by mentoring students through the process. I will provide students with information to develop the skills which are necessary to practice effectively and reflectively while creating their own path to advanced practice. Overall, completing the DoCPI provided me with the opportunity to reflect on my career and professional metamorphosis as an athletic trainer. I have not only advanced my knowledge and skills as a clinician, but I have forever changed my approach to patient care. By developing the DoCPI, it has equipped me to reach my fullest potential as a professional who is an expert in her field, generates evidence from patient care, produces scholarship that is clinically relevant, and prepares AT students for their professional careers.

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CHAPTER 2

PLAN OF ADVANCED PRACTICE

John Heywood (c. 1538) an English playwright is credited with the adage, “Rome wasn't built in a day." It takes time, sometimes years to master a skill, craft, or habit. And while it is good to keep perspective, I think it’s better to remember the other side of this story: Rome wasn’t built in a day, but they were laying bricks every hour. The problem is that it can be easy to overestimate the importance of building your Roman Empire and underestimate the importance of laying another brick. Much like the building of the Roman Empire the Plan of Advanced Practice (PoAP) is an individual blue-print to advanced practice using a brick by brick philosophy which utilizes an action research philosophy as the focal point to assess and improve local clinical practice challenges while focusing on *a priori* interests to develop advanced practice expertise.

As I developed my PoAP, I assessed my strengths and weaknesses through honest reflection, and developed a strategy to deepen my theoretical understanding and clinical practice skills. In addition, my PoAP is a personalized program of study which builds a foundation for advanced practice achievement. Through the incorporation of new treatment paradigms, patient-centered care, and the ability to integrate new clinical philosophies and theories; my PoAP is a catalyst to leave apathy and use of unfounded clinical practices behind, to integrate treatment paradigms that address patient pain and dysfunction in days rather than weeks, and to push towards a new standard of care. Critical elements associated with the PoAP include: an action research philosophy which the clinician examines their clinical practice based on patient-reported outcomes; personal reflection on patient care to identify areas of strength and weakness and room for clinical practice growth, and future direction within their clinical practice and professional future.

My current areas of advanced clinical practice include: Mulligan Concept (MC), specifically sustained natural apophyseal glides (SNAGs); treatment of unresolved chronic musculoskeletal pathologies of the lower extremity; treatment of low back pain (LBP) utilizing Mulligan Concept, Reactive Neuromuscular Stabilization (RNS), and Total Motion Release (TMR); and treatment of mechanical neck pain utilizing MC positional SNAGs directed at the thoracic spine. The treatment paradigms listed are selected based on practice based evidence (PBE), specific to my clinical setting and current local clinical practice challenges.

Reflection on Professional Experience and Development

Knowing that athletic training would be my future career, I visited numerous athletic training programs (ATPs) where I assessed the reputation of the program and the professionals that would best position me to excel as an athletic training student and eventual practicing AT. After visiting five academic institutions I chose to attend South Dakota State University (SDSU). My choice of academic institution was determined by several factors; the BOC Exam pass rate, the academic rigor of the athletic training program, the feeling that I was going to succeed at a high level within the program, and the faculty whom I believed were the best of what the profession had to offer at the time. From the athletic training student perspective, course work in anatomy, injury assessment, and clinical practicum helped me develop a starting point for future clinical practice. As a student who progressed through a Commission on Accreditation of Allied Health Education Programs (CAAHEP) athletic training program where direct supervision was not required of AT faculty and AT staff, I was directly responsible for the medical coverage of many practices, allowed to travel with teams unsupervised, and make autonomous clinical decisions on behalf of the patient. As a result, those clinical experiences created feelings of clinical confidence yet, while I embraced and took advantage of all my practical experiences, I concealed my concerns regarding my foundational AT knowledge. During my time as an athletic training student (ATS) at SDSU I believed the value of my practical experience to be far more beneficial than the foundational didactic knowledge. I struggled at times to understand the importance of the classroom components of my education and its relation to my success as a practicing athletic trainer. I believed the more time I spent in the AT clinic as an ATS the more proficient I would become with my clinical skills which would translate into exceptional patient care.

Before I graduated from SDSU, I recognized I needed to obtain additional knowledge, practical clinical experience and continue to mature professionally before entering the workforce. This realization led me to pursuing and accepting a graduate assistantship at Northern Michigan University providing patient care for the football program to best position myself for a career within the intercollegiate setting. However, I continued to place more value on obtaining independent clinical experience rather than formal AT education. My post-professional Master of Science degree was in Exercise Science, and a majority of the coursework did not pertain to AT. At the time, I considered the clinical experience with the football program to be far more valuable than what was missing from my foundational knowledge.

Upon completion of my Master of Science degree, I was hired by my former mentor in high school and returned to my hometown to work at the University of Minnesota Crookston (UMC). I was excited to begin my professional career and demonstrate I had the clinical skills to effectively care for patients utilizing enhanced treatment interventions and advanced didactic knowledge within my clinical setting. In the 5 years I was employed with UMC, I was responsible for performing injury evaluations, providing immediate care, creating rehabilitation and treatment plans, traveling, overseeing budget and supply procurement, creating a policy and procedural manual, managing the weekly on-campus orthopedic clinic and teaching a basic Prevention and Care course for Sport Management majors. I was able to gain experience working with multiple intercollegiate teams and continually worked to improve my clinical and interpersonal skills. Unfortunately, my professional growth came to a standstill during my third year as I was overwhelmed with the amount of responsibility being placed on me which allowed very little time for clinical practice growth or continuing education. While I enjoyed my job, I knew change was necessary if I wanted to avoid professional burnout. Looking back, I realize that this was my first attempt to critically reflect on my clinical practice. I believe my intentions to improve clinically were sincere however I did not know what "good" clinical practice was supposed to look like or how to change my course. My next career step landed me at the Division I level working with Women's Basketball at Saint Joseph's University (SJU). I was excited for a new opportunity, new environment and new challenges. However I slowly started to recognize that although I was surrounded by well versed and experienced athletic trainers, little had changed in my clinical practice. For me, the fallacy of working at the Division I level, was the idea that if I had better modalities, direct access to the best physicians and unrestricted resources, somehow it would transform me into a better clinician. The truth was, working at the Division I level enabled me to respond quicker to my patients and coaches, which gave me a false sense of achievement. In reality, I was failing to provide effective patient-centered care and struggling to become the type of athletic trainer I had always envisioned for myself. Sensing it was time for a change in the trajectory of my career path, I left clinical practice and entered the academic ranks.

My intention upon entering academia was to help shape and mentor the future of the athletic training profession. As an educator, I have prided myself in helping to develop young professionals in undergraduate Commission on Accreditation of Athletic Training Education (CAATE) accredited programs (Central Michigan University, Marist College, University of South Carolina, and Winona State University). I have instructed courses including upper and lower extremity evaluation, pharmacology, therapeutic modalities and clinical practicums and I have been amazed by the unwavering passion my students and I share. Recently, I have also recognized a responsibility for instilling the importance of advancing practice through the integration of reflective practice and practice-based evidence (PBE) related to current clinical experiences my students use to create sound clinical decision making.

Rationale for Pursuing a Doctor of Athletic Training Degree

Prior to the DAT program, I made clinical decisions based on personal experience, anecdotal evidence, and information presented at continuing education conferences, rather than on patient oriented evidence or evidence reported in the literature. As a consequence, many of my clinical decisions lacked clinical reasoning or purpose. My professional path was dedicated to clinical skills and evaluation techniques with little clinical application and even less consideration for clinical implications of the treatment intervention. Recognizing this limitation in my clinical practice and struggling to change the way I was providing patient care; the only way I was to become a better clinician and educator was to re-invest in myself and apply to the DAT program at the University of Idaho.

Reflection on Current Clinical Competence

Through my journey over the past two years I experienced many learning moments in the DAT but none greater than the importance of possessing a strong didactic foundation. Although clinical experience is important, I became painfully aware that without a solid framework of foundational knowledge my ability to make meaningful changes in patient care would continue to suffer. I did not recognize this shortcoming in my clinical practice until I began the DAT. Through curricular instruction, in-depth searches of current research literature, and clinical residency experiences, I have learned how to integrate informed knowledge and patient-reported outcomes into my clinical practice. As I utilize new treatment interventions, I examine current theories and patient-reported outcomes to gain a better understanding of when and why treatments are either successful or non-successful with my patients. As I interpret patient-reported outcomes based on the clinical decisions I make, I am finding more logic as to why my patients report the outcomes they do. The clinical logic that has developed as a result of my increased knowledge and understanding is evidence of my continual progress toward advanced practice.

The integration of formalized outcome measures into my practice has improved my ability to select the treatment intervention which most closely reflects the patient's primary complaint. I utilize patient-reported outcomes to analyze my evaluations and select treatment interventions, which allows me to develop a broader understanding of my clinical decision making. As I incorporate the results of my outcome measures into my practice, I am able to make the necessary corrections to my clinical skills and reasoning and believe this is the most significant impact factor on my clinical practice.

Injury Evaluation

I consider my evaluation skills to be my greatest asset as an athletic training clinician and educator. My understanding and evaluation of chronic musculoskeletal injuries have developed incrementally over the past 20 years. However, over the past 2 ½ years my clinical evaluation skills have grown exponentially as it concerns the cervical, lumbar and pelvic regions, in addition to evaluating other injuries from a regional interdependence (RI) perspective. My assessment knowledge of this region has been reinforced due to new content knowledge and recognition in addition to advanced continuing education. My patient population over the last 2 ½ years has included athletes who have struggled to achieve full and sustained resolution of their chronic pain and dysfunction associated with their cervical, lumbar and pelvic regions. In an effort to provide musculoskeletal assessments based on patient-reported symptoms and their response to selected treatment interventions, I have attended continuing education courses (i.e., Mulligan Concept), relating to the evaluation of the upper extremity and spine/pelvis. I use MC to evaluate my patients utilizing the positional fault theory as my basis for identifying the source of pain and dysfunction.

Brain Mulligan proposed that injuries or sprains might result in a minor positional fault to a joint thus causing restrictions in physiological movement. Mulligan proposed that when an increase in pain-free range of movement occurs with a SNAG it is primarily the correction of a positional fault frequently associated with acute deformity at the zygapophyseal (facet) joint, although a SNAG also influences the entire spinal functional unit (SFU) (Exelby, 2002; Bogduk & Engel 1984; Bogduk & Jull 1984; Mercer & Bogduk 1993; McKenzie 1990). The positional fault theory can be applied to all joints in the body and I use subacute applications of the MC SNAG to determine if in fact a positional fault could be corrected with a specific technique, thus using the MC as both an evaluation and a treatment method especially in the cervical, lumbar and pelvic regions. In addition, I have also incorporated RI evaluations and treatments in my patient population, thus adding to my knowledge of evaluating other regions in the body that may be the primary "driver" of pain and dysfunction in patients complaining of LBP.

Foundational Knowledge

My current foundational knowledge as it relates to overall basic rehabilitative interventions, specifically manual therapy is consistently progressing. An example of my consistent progression has been evident as I instruct my therapeutic exercise course to the second year ATSs at my current site of employment. The course involves introducing multiple rehabilitative theories and exercise progressions. Before I began teaching this particular course, my knowledge of basic therapeutic exercises was fair and I knew enough to perform basic patient injury rehabilitation exercises for acute injuries. Although I knew the basics, I was not aware how much foundational knowledge I was lacking in therapeutic exercise and manual therapy knowledge until I entered the DAT program. I quickly realized I needed to become more advanced in my knowledge of manual therapy treatment paradigms. Through the course of the DAT program my foundational knowledge and clinical skills as it relates to therapeutic exercises (manual therapy) transformed my ability to teach a new approach to an old problem. I am constantly challenged by my students regarding therapeutic exercise theories and philosophies and how considering and integrating treatment paradigms that address functional and dysfunctional movement from a regional interdependence (RI) perspective can forever change the way ATSs approach patient care. I have been given the opportunity to teach therapeutic exercise from a new perspective and to encourage my students to challenge conventional wisdom.

I have introduced Selective Functional Movement Assessment (SFMA), TMR, and MC into the curriculum while balancing CAATE competencies and proficiencies requirements. I view my foundational knowledge in a new light when teaching. First, I begin by introducing a manual therapy paradigm or therapeutic exercise by demonstrating the technique on an actual patient which immediately fosters meaningful questions and discussion about what they just observed. Second, I introduce the theories behind the particular exercise or manual therapy and what the current research literature presents with regards to the physiological effects that are proposed to occur and the patient-reported outcomes that are associated with each intervention (e.g., MC, RNS, Proprioceptive Neuromuscular Facilitation (PNF), Terminal Knee Extensions (TKEs), dynamic stabilization, etc.). Lastly, teaching new concepts requires me to have a depth of understanding beyond my previous novice level and to continue to add to my understanding through continuing education courses.

Global Assessment and Treatment

Based on my current knowledge and ability to generate practice-based evidence, an alternative evaluation process that encompasses numerous evaluation models that I use exclusively with all my LBP patients who are stuck in a chronic state, is the SFMA to identify the region of the body (RI), the joint(s) and/or soft tissue Joint Mobility Dysfunction (JMD)/Tissue Extensibility Dysfunction (TED) or spinal segments that are generating symptoms reported by the patient. Utilizing the SFMA, the clinician examines a patient's ability to perform the required movements and identifies dysfunctions in the body (Cook, Burton, Kiesel, Rose & Bryant, 2010). Based on information obtained during the SFMA assessment and breakout flowcharts, treatment may focus on restoring function by targeting abnormal skeletal shifts and posture, increasing mobility, or improving stability. To address JMD, my first choice is to incorporate MC to address positional faults for restoration of normal arthrokinematic and osteokinematic motion for restriction and pain in the lumbar and SI region. To address TED, my first choice is to begin with primal reflex reactive technique (PRRT) (Iams, 2012) to either inhibit or facilitate a muscle to address the hyper/hypotonicity of the muscle. The second treatment to address TED is TMR (Dalanzo-Baker, 2014) to evaluate and treat body motion imbalances based on the concept that the body is a unified system striving to maintain a dynamic center of gravity. Total Motion Release is designed to addresses restricted movement by identifying specific underutilized movement patterns, and is an ideological shift from traditional theory by most often working to the good side to improve symptoms. Lastly, to ensure that the restoration of motion is maintained, RNS (Loutsch, 2015) is used to facilitate the unconscious process of interpreting and integrating the peripheral sensations received by the CNS into appropriate motor responses typically through the use of trunk flexion (toe touch) or Sahrmann Abdominal Exercises (Sahrmann, 2002).

Reflection on Professional Strengths

Athletic training has been my passion for 19 years, and I have worked tirelessly to pursue professional goals and to improve my clinical practice strengths. The DAT program faculty provide the insight and impetus to evaluate one's own clinical practice to determine whether current clinical strengths meet the standard of care required of an advanced practice clinician and scholar. Recognizing current strengths is a critical component to build future clinical practice which not only benefits the clinician but more importantly the patient, my strengths in athletic training are both varied and diverse. The following table describes my current professional strengths. Each strength listed in the table includes an explanation of impact as related to my PoAP.

Professional Strengths	**Rationale**
Patient Rapport	I continue to value this strength and work every day to improve my ability to reach my patients on a level that is meaningful. Although I have worked in a variety clinical settings, I have maintained the same level of trust and respect through dedication to my craft. I consider myself to be empathetic, realistic, and encouraging which are characteristics that my patients have come to appreciate and recognize as part of my patient care. All too often patients are frustrated by the lack of time devoted to their injury, lack of information being shared in their care, and a lack of meaningful progress towards recovery and return to activity. Conversely, my patients believe my knowledge and clinical abilities along with my engaging personality will assist them in obtaining resolution of symptoms. The knowledge I have gained and the clinical skills I have developed while in the DAT program has helped improve my ability to provide a comprehensive evaluation and treatment approach to every patient interaction.
Collection of Patient-Reported Outcomes	The clinical utility of outcomes collection is the part of my clinical practice I thoroughly enjoy and can easily complete on

	a daily basis. I am able to integrate outcome measures to evaluate the efficacy of my treatment interventions and patient improvement. Collecting outcomes helps assess efficacy in areas of my clinical practice, such as rehabilitation and reconditioning, which are valuable to the patient.
Diversity of Manual Therapy Interventions	I have developed competence in and integrated into my clinical practice: Reactive Neuromuscular Stabilization (RNS), Mulligan Concept Mobilizations with Movement (MWM), Total Motion Release (TMR), and Primal Reflex Release Technique (PRRT). The manual therapy paradigms listed indirect treatments and patients often report immediate improvements. Further, my clinical skills, competence, and pattern recognition has allowed development of effective patient care strategies that are specific to a patient response model which is at the heart of my patient centered care philosophy.
Low Back Pain Assessment and Treatment	When addressing LBP in my patient population, I utilize a multi-faceted approach to patient care derived from my clinical experience and the best available evidence to guide, inform and treat the patient. Understanding my current approach to LBP is not a "one size fits all," rather my goal is to create a systematic evaluation and treatment approach based upon evidence-informed clinical practice. The physical exam for LBP patients involves orthopedic and symptom centralization tests, which leads to treatment selection. Ideally, a mixture between subgroup classifications and a reexamination of treatment effectiveness guides my clinical decision-making process. I have multiple methods for treating LBP and can accurately assess the origin of dysfunction.

Reflection on Professional Weaknesses

Critically reflecting on your professional weaknesses and understanding why certain clinical practice skills and knowledge have never evolved over your career is a necessary step towards advanced practice. During my time in the DAT I realized many of my past clinical decisions were based solely on experience and little else. I rarely used current evidence to guide my clinical practice and continued to use treatment interventions as a way to "manage" the patient and their pathology. Accepting that I want to be an athletic trainer who makes informed decisions, deliver sound treatment founded in practice based evidence patient care, and reach a level of advanced practice, recognizing my weaknesses is critical. I have identified the following areas of my practice that is in current need of improvement:

Professional Weaknesses	Rationale
Acceptance of Constructive Criticism	At times I have found myself in all too familiar situations especially within the DAT program where my ability to "listen" and accept that maybe I really don't know as much as I think I do has at times hindered my ability to move forward as a scholarly clinician. The reason why? Quicksand. As Shane Falco, from the movie *The Replacements* stated, "You're playing and you think everything is going fine. Then one thing goes wrong. And then another. And another. You try to fight back, but the harder you fight, the deeper you sink. Until you can't move... you can't breathe... because you're in over your head. Like quicksand." At some point in time, almost everyone has to deal with the fear that their skills are not good enough and being able to accept that making mistakes and being fearful is just a necessary part of achieving success.
Scholarly Production	Although I developed numerous case studies that have been accepted for presentation during Free Communications sessions at state and district AT symposiums, I have struggled to produce and garner manuscript acceptance in the peer-reviewed process. Before entering the DAT, I had never created or let alone publish a manuscript. Throughout my career I rarely engaged in scholarly activity as I never took advantage of my clinical setting to produce case study or a case series as the importance of publication was not a priority as an AT working within an athletic department. As I transitioned to academic faculty I found myself with an academic appointment that did not necessitate scholarly research as a requirement of employment. Ultimately I have struggled to achieve a level of scholarly production due to lack of research mentorship, and my own culpability. With this awareness, I have worked to better extrapolate meaning from my *a priori* designed patient care research. On this note, I have recently completed a well-designed case series to exam the effects of the MC on patients classified with mechanical neck pain (MNP), and plan to develop a more extensive research network to help improve my scholarly production in the future.

Goals for Professional Practice Future

The path towards advanced practice is guided by personal philosophies, developing who you are as an advanced practitioner and defined by the goals that one establishes. I have identified a number of goals that I plan to engage in and achieve after the DAT in a continual effort to provide complete patient care, advance my scholarly research, increase proficiency with current and novel manual therapy interventions, and shape the future of AT education. The following represents my current areas of advanced practice and clinical practice philosophies.

Specialization within Clinical Practice

Current education standards for athletic training are consistent with other healthcare professions which contribute to the possibility of specialization (Perrin, 2007). Although Perrin (2007) concludes it may not be feasible for athletic trainers to specialize in body regions such as shoulders, knees, and feet, it may be possible to concentrate our knowledge on a particular population and become leading experts in that population. Athletic trainers have begun the process of developing specialization within their own clinical practice as a means to address local clinical practice challenges and are utilizing practice-based evidence to support their areas of specialization.

Published rates of low-back pain in athletes range from 1% to >30% (Videman et al., 1995; Hickey et al., 1997; Granhed & Morelli, 1988) and are influenced by sport type, gender, training intensity, training frequency, and technique (Dreisinger & Nelson,1996; Bartolozzi et al., 1991; Kujala et al., 1998; Johnson et al., 2001). Although most cases are self-limited, many athletes have persistent symptoms. Even though active (i.e., athletes) patients diagnosed with LBP are often highly motivated to return to activity, a specific pain generator is not always found, making their diagnosis and treatment a challenge for any clinician. The apparent lack of treatment effect mentioned above may be partly due to the tendency of clinicians to treat nonspecific LBP as one homogenous condition, rather than a heterogeneous collection of differing conditions that may preferentially respond to different treatments. However, I choose to utilize a mixed model approach for patients complaining of LBP as MC is both a pathoanatomical approach based on the 'positional fault' theory while focusing on a patient response model (PRM) to sub-therapeutic interventions. By continuing to focus on the LBP patient population it allows me to create further depth of knowledge and clinical and treatment expertise while constantly evaluating patient reported-outcomes and my LBP philosophy:

> *Low Back Pain Rehabilitation Philosophy*
>
> *Addressing low back pain (LBP) in my patient population utilizes a multi-faceted approach to patient care derived from my clinical experience and the best available evidence to guide, inform and treat the patient. Understanding my current approach to LBP is not a "one size fits all" my goal is to utilize a systematic evaluation and treatment approach based upon evidence-informed clinical practice. The physical exam for LBP patients involves orthopedic and symptom centralization tests, which leads to selected intervention based on multiple factors. Ideally the use of a mixture between subgroup classifications and a reexamination of treatment effectiveness guides my clinical decision-making process. A directed evaluation utilizing various aspects of the Cyriax, Maitland, McKenzie, Treatment Based Classification (TBC), and SFMA models as well as sub-therapeutic levels of treatments allow for my clinical practice to address each patient and their specific complaints and goals.*

Goals as an Educator

During my final academic semester in the DAT (Spring 2016), I accepted the position of clinical faculty within the undergraduate and graduate AT programs at the University of South Carolina in Columbia, South Carolina. My primary goal in obtaining my doctoral degree was to continue my career as an AT educator who possessed unique clinical skills that would assist in my transition to an educator within a professional Master of Science ATP. I am confident that my clinical practice philosophies, professional experience, unique skill-set, application of evidence-based practice (EBP), action research (AR) philosophy, and practice-based evidence (PBE) will greatly enhance learning experiences of my students by developing their clinical skills and critical appraisal of patient care as maturing novice practitioners.
My students will benefit from the experiences I have with new and innovative treatments paradigms through the DAT and through continuing education. Infusing MC, TMR, and PRRT along with the guiding principles within each paradigm will help develop professional students that are ready to meet the needs of patient care within a collaborative healthcare system. Students will also be able to evaluate patients from an RI perspective with the SFMA working to identify the patient's source of pain and dysfunction rather than a myopic focus on the symptoms. Creating environments where true clinical practice and learning can occur provides the necessary template for clinical practice advancement. I believe that my

knowledge and skills make me an atypical educator with a unique perspective. Over the course of the last 10 years, I have enjoyed serving as a faculty member in an undergraduate Bachelor of Science ATP. I also have 9 years of clinical experience which allows me to provide information which is both current and accurate while letting the students examine the individual characteristics of complex intervention theories and diagnostic problems to determine how the information applies to their own clinical practice which is reflective of my teaching philosophy:

> *Teaching Philosophy*
>
> *My philosophy on teaching is to provide an atmosphere for critical analysis and problem solving. My responsibility to my students is to provide information which is both current and accurate while letting the students examine the individual characteristics of complex intervention theories and diagnostic problems to determine how the information applies to their personal strengths and abilities. My intention is to teach students how to make choices based on the best evidence available and critical analysis of their own clinical practice. Beyond striving to ensure students learn the fundamental content of the courses I teach, my objectives as an educator are: to foster critical thinking skills; to help students develop evidence-based clinical problem-solving strategies; and to prepare students to function as highly skilled and competent athletic training clinicians. My teaching practices should empower students to take ownership of their education and help them realize that they are responsible for their learning outcomes. My goal as an educator is to instill a sense of professional responsibility and desire to provide patient-centered care by mentoring students through the process. I will provide students with information to develop the skills which are necessary to practice effectively and reflectively while creating their own path to clinical practice competence.*

Treatment Goals

The integration of multiple treatment paradigms and a global assessment method has created the impetus for continual clinical skill proficiency and renewed passion for the AT profession and patient-centered care. My goal is to continue learning and improving upon the current treatment interventions I use while deepening my understanding beyond the novice practitioner and become an athletic trainer who becomes adept with their clinical skills and can demonstrate the power of manual therapy to address multiple musculoskeletal conditions. My treatment philosophy is as follows:

Treatment Philosophy

I utilize manual therapy treatments such as MC to address abnormal musculoskeletal shifts and posture, TMR to evaluate and treat body motion imbalances that are related to the concept that the body is a unified system striving to maintain a dynamic center of gravity, and RNS to reinforce a comfortable body position. These interventions allow for a variety of injuries to be treated within a shortened timeframe leading to optimal results and decreased time away from activity. My goal as an athletic trainer is to provide manual therapy treatment interventions for each patient that enhance healing and promote optimal performance after injury based on their specific goals.

Plan of Advanced Practice Professional Goals

Primary Focus Area		**Completion Timeline**
Continuing Education Advancement	▪ Total Motion Release (TMR) Level I, II, III	▪ Spring 2015
	▪ Mulligan Concept (MC) Upper Quarter Course	▪ Summer 2014
	▪ Mulligan Concept (MC) Upper Quarter Course	▪ Spring 2015
	▪ Mulligan Concept (MC) Lower Quarter Course	▪ Summer 2015
	▪ Mulligan Concept (MC) Upper Quarter Course	▪ Fall 2016
	▪ Mulligan Concept (MC) Advanced Courses	▪ Fall 2017 (anticipated)
	▪ Selective Movement Functional Assessment (SFMA) Level I Course	▪ Fall 2017 (anticipated)
	▪ Selective Movement Functional Assessment (SFMA) Certification	▪ Summer 2018 (anticipated)
	▪ Primal Reflex Release Technique (PPRT) Home Study	▪ Fall 2015
	▪ McKenzie Mechanical Diagnosis and Therapy (MDT) Lumbar Spine	▪ Spring 2018 (anticipated)

Utilization of Mulligan Concept SNAGs to Treat Mechanical Neck Pain in the Athletic Population	▪ Explore all literature related to Mulligan Concept SNAGs to the cervical spine and thoracic spine for mechanical neck pain	▪ Continual
	▪ Develop deeper foundational knowledge, theory, and principals behind the efficacy of the technique	▪ Continual
	▪ Identify and collaborate with experts and peers with regards to SNAGs for mechanical neck pain	▪ Continual
	▪ Conduct formal research of SNAGs for mechanical neck pain in the specific context of athletic training and the athletic population	▪ Continual
	▪ Collect and analyze patient outcomes when utilizing SNAGs for mechanical neck pain	▪ Continual
	▪ Produce Mulligan Concept thoracic SNAGs research and create manuscript for professional publication	▪ Spring 2016
	▪ Present Mulligan Concept thoracic SNAGs research at professional conferences	▪ Spring 2017 ▪ Summer 2017
Utilization of Mulligan Concept SNAGs to Treat Low Back Pain in the Athletic Population	▪ Explore all literature related to Mulligan Concept SNAGs to the lumbar spine for chronic low back pain	▪ Continual
	▪ Develop deeper foundational knowledge, theory, and principals behind the efficacy of the technique	▪ Continual
	▪ Identify and collaborate with experts and peers with regards to SNAGs for chronic low back pain	▪ Spring 2017
	▪ Conduct formal research of SNAGs for chronic low back pain in the specific context of	▪ Spring 2017

	athletic training and the athletic population	
	▪ Collect and analyze patient outcomes when utilizing SNAGs for chronic low back pain	▪ Continual
	▪ Produce Mulligan Concept lumbar SNAGs research and create manuscript for professional publication	▪ Fall 2017 (anticipated)
	▪ Present Mulligan Concept lumbar SNAGs research at professional conferences	▪ Spring 2018 (anticipated)
Professional and Academic Scholarship-Conference Presentations	▪ Present at state, regional, and national professional conferences ▪ Mulligan Concept Thoracic SNAGs and Shoulder Impingement	▪ Spring 2017 (anticipated)
	▪ Present at state, regional, and national professional conferences ▪ Mulligan Concept Thoracic SNAGs and Mechanical Neck Pain	▪ Andrews, D & Odland, K. (2017, June). Invited Feature presentation at National Athletic Trainers Association 67th Annual Symposium, Houston, TX. ▪ Andrews, D & Odland, K. (2016, June). Invited Free Communications presentation at National Athletic Trainers Association 67th Annual Symposium, Baltimore, MD. ▪ Andrews, D & Odland, K. (2016, April). Invited Free Communications presentation at Northwest Athletic Trainers Association Clinical Symposium, Boise, ID.

	▪ Present at state, regional, and national professional conferences ▪ Mulligan Concept Lumbar SNAGs and Chronic Low Back Pain	▪ Spring 2018 (anticipated)
	▪ Present at state, regional, and national professional conferences	▪ Andrews, D & Odland, K. (2016, June). Invited Learning Lab presentation at National Athletic Trainers Association 67th Annual Symposium, Baltimore, MD.

Professional and Academic Scholarship-Publications	▪ Manuscript submission to scholarly journals	▪ "The Utilization Of Mulligan Concept Thoracic Sustained Natural Apophyseal Glides By Novice Practitioners On Secondary Impingement Syndrome: A Multi-Site Case Series"
		    ▪ Submission: July 2016, IJSPT
		▪ "An Exploratory Case Series Examining Mulligan Concept Positional Sustained Natural Apophyseal Glides on Patients Classified with Mechanical Neck Pain"
		    ▪ Submission: January 2017, IJSPT
		▪ "The Mulligan Concept Lumbar SNAGs Technique: An Alternative Approach to Treating Low Back Pain in Division I Collegiate Football Linemen: A Case Series"
		    ▪ Submission: September 2017, IJATT

Develop Specialization Within LBP Patient Population	▪ Development of professional athlete clientele
	▪ Consult with NHL sports medicine staffs
	▪ Continue working exclusively with low back pain
		▪ Zach Parise, Minnesota Wild
		    ▪ Treated: April 2016
		▪ Paul Bittner, Columbus Blue Jackets
		    ▪ Treated: April 2016

Justification for the Plan of Advanced Practice

The PoAP is more than an assignment or a mildly neglected goal sheet; it is the compass for a professional future as an advanced practitioner. Created by the clinician the PoAP is an invaluable and ever changing rubric that helps evaluates learning, influences and compels reflection of current clinical experiences, and identifies and creates opportunities for continual growth. By developing my PoAP, I have expanded my clinical abilities, enhanced my patient care, and discovered my clinical and academic philosophies over the past 2 years. As a result, the PoAP has directly affected my students, my peers, and most importantly my patients. I will continually make changes to my PoAP as dictated by my professional growth; the end result of which is a more skillful clinician and educator. I believe that my most important contributions to AT will be successful patient care and serving as a mentor for ATS. By developing my PoAP, I have equipped myself to reach my fullest potential as a professional who is an expert in her field, generates evidence from patient care, produces scholarship that is clinically relevant, and prepares AT students for their professional careers.

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CHAPTER 3

OUTCOMES SUMMARY, RESIDENCY FINDINGS, AND IMPACT

Over the course of the Doctor of Athletic Training (DAT) curriculum, students complete a clinical residency which provides students with an opportunity to enhance their clinical skills, collect patient-reported outcomes, and conduct research while working to become an advanced and scholarly practitioner. Students are introduced to various treatment paradigms and are then expected to integrate the new paradigms into their daily clinical practice while assessing patient-reported outcomes, in order to develop critical clinical skills and clinical practice philosophies. In this chapter, I discuss the processes of collecting patient outcomes, reflecting on the results, and assessing treatment goals. The delineation of my patient outcomes and residency findings that follow provide the reader with an understanding of my DAT clinical residency experience and its impact on my patient care philosophy.

Development of Patient Care Philosophy

Prior to the DAT program, I made clinical decisions based on personal experience, anecdotal evidence, and information presented at continuing education conferences, rather than on patient oriented evidence or evidence reported in the literature. As a consequence, many of my clinical decisions lacked clinical reasoning or purpose. My professional path was dedicated to clinical skills and evaluation techniques with little clinical application and even less consideration for clinical implications of the treatment intervention. Recognizing this limitation in my clinical practice and struggling to change the way I was providing patient care; the DAT program faculty empowered me to change my professional identity, address clinical practice challenges and foundational knowledge gaps, and offered me the needed direction to create a more effective patient care philosophy.

As my journey towards advanced practice took shape and my foundational knowledge was challenged daily, I began to move away from utilizing a pathoanatomical model and became more focused on a patient-response model. In the pathoanatomical model, clinicians often rely on a clinical diagnosis which defines the type and location of a lesion without identifying the cause which often leads to an abbreviated evaluation and poor patient-reported outcomes. While this approach can be valuable during a musculoskeletal evaluation, I have adopted an approach concentrated on the response of each patient to the treatment intervention selected. The patient-response model complements evidence based practice (EBP) by placing more emphasis on the patient's response to individual treatments than on a specific structural abnormality (Chevan & Clapis, 2013). As a result, I have focused on paradigms that include global assessments (e.g., SFMA, TMR) to better identify the source, and not the site, of pain.

The patient response model also considers other associated aspects of the healing process such as the emotionally-based system. During the Fall-I semester in the DAT program I created and presented on the pain neuromatrix, a term used to describe the various brain mechanisms that define the pain experience (Melzack, 2001). Exploring the pain nueromatrix theory enhanced my understanding of the philosophies behind the Fear-Avoidance Model and the behavioral responses patients' exhibit during treatment interventions which sometimes lead to poor clinical outcomes in instances involving chronic pain. By utilizing patient-reported outcomes (e.g., FABQ, AFAQ, PSC, TSK-11) that are designed to assess behaviors of fear avoidance and pain-related fear, I am able to better understand the behaviors towards patient pain early in care and avoid potential long-term complications regarding the patient fear of activity and perceived disability.

Ultimately, the success of a clinician or paradigm is decided by the patient outcomes reported in clinical practice. Through clinical practice reflection and scholarly research, I am developing into a clinician who now focuses on a patient-centered care philosophy utilizing the patient-response model of evaluation and treatment. I now base each clinical decision on the culmination of my patient outcomes, the needs of my patient and current research literature.

Identifying and Overcoming Barriers

The changes I began to implement into my clinical practice during Fall-I were a direct result of the experiences I had during my first summer in the DAT program, when I began to identify barriers that were preventing me from evolving as a clinician. I was eager to make changes in my clinical practice; however, I continued to attribute a patient's lack of improvement, lack of motivation, failure to perform the exercises appropriately, or simply blame the patient for not responding to treatment. I had a difficult time accepting the treatment interventions I had utilized for the past 18 years were generally ineffective and most often lacked any type of clinical meaningfulness.

As I began to integrate the new treatment paradigms into my clinical practice I was struggling initially to achieve positive patient-reported outcomes. When I failed to achieve the same immediate results within my own clinical practice based on experiences during Summer-I, I found myself quickly shifting from one treatment paradigm to the next in hopes of finding the “right” treatment, or just ending the patient visit early. However, as my focus shifted from a treatment-only approach to a global assessment approach, I began to more readily recognize the driver of pain and/or dysfunction and formulate a clinical impression based on a classification system and select a treatment intervention based on patient response versus a clinical diagnosis. Overcoming this barrier took time and personal growth as a clinician. After a significant amount of clinical practice reflection, I began to understand more about the theories behind each intervention and application of each technique, which led to observed improvements in the patient-reported outcomes of my patients and improved my confidence with clinical reasoning.

The personal barriers and clinical practice challenges I overcame during my clinical residency helped influence who I have become as a clinician today. I now see myself as an athletic trainer turned scholarly practitioner who has embraced the changes within her clinical practice. Although I am far from being considered an advanced practitioner, I believe that my patient-reported outcomes have vastly transformed my clinical practice during my time in the DAT program which is demonstrated, analyzed and discussed throughout this chapter.

Data Analysis, Results, and Reflections

Fall I

To begin the process of becoming a scholarly clinician I began to study my clinical practice through a lens previously unused and began the collection of patient-reported outcomes and I began the dissemination of evidence that supported the changes I was making in my patient care. Students in the DAT program have the opportunity to produce evidence on the effectiveness of newly introduced treatment paradigms and analyze the effects of the treatments as they are incorporated into clinical practice. Known as practice-based evidence (PBE), it provides an important link between the research and clinical practice gap, as it provides an opportunity for high-quality patient oriented evidence (POE) to be implemented into clinical practice (Hurley et al., 2011; Sauers et al., 2012). The integration of PBE into my clinical practice has positively impacted my clinical decision making as I use PBE to continually develop my clinical practice philosophies and theories to assess the effectiveness of my evaluation and treatment techniques.

My initial goal was to integrate many interventions I had been introduced to during my initial summer semester into my clinical practice. I was most comfortable utilizing Mulligan Concept (MC), Total Motion Release (TMR) and Selective Functional Movement Assessment (SFMA) as the ease of integration into the initial assessment, application and short time required to complete treatment was appealing. I was extremely excited to implement these new treatment paradigms and based on the patient population that I would be treating, MC, TMR and SFMA seemed to be an ideal fit. Of the three new treatment paradigms I wanted to utilize during the Fall-I semester, I believed the MC would have the greatest impact on my clinical practice. The MC is a manual therapy technique that utilizes various joint mobilizations to address subtle joint misalignments, known as positional faults (Mulligan, 2010). Mulligan Concept, sustained natural apophyseal glides (SNAGs) are joint (facet) mobilizations that involves the application of an accessory passive glide at the spine while the patient simultaneously performs the reported painful active movement (Mulligan 2004; Wilson, 2001; Exelby, 2002). Passive end-of-range overpressure is then delivered without pain as a barrier. The direction of the glide is argued to be along the plane of the facet joints and the technique is performed in a weight-bearing position (i.e. sitting, standing). When performed correctly, MC is a pain-free treatment that results in an immediate, positive change in a patient's pain and dysfunction (Mulligan, 2010).

My first opportunity to collect patient-reported outcomes while utilizing MC occurred with Patient #3, a 21-year-old female track and field thrower, initially diagnosed by the team physician with insidious chronic low back pain (CLBP) and subsequent paraspinal irritation. History indicated complaints of low back pain two years in duration with increasing symptoms and level of dysfunction, while periods of rest, chiropractic manipulations, modalities, nonsteroidal anti-inflammatory medication, and core strengthening exercises failed to demonstrate any discernable change in symptoms or function. During the initial evaluation, she reported a 29 on the DPA Scale (range 0 – 64, with 64 indicating severe disability), an 8 on the PSFS (range 0 - 10, with 10 indicating full function), a 19 on the Fear Avoidance Beliefs Questionnaire (FABQ) (range 0 - 42, with 19 or less indicating likelihood of treatment success), and a 6 on the NRS (range 0 – 10, with 10 indicating extreme pain) (Farrar et al., 2001; Vela & Denegar, 2010b; Waddell et al., 1993). Additional outcomes measures collected during the first and discharge visit included; Oswestry Low Back Pain Disability questionnaire, McGill Pain questionnaire, and FABQ which have shown positive clinical correlation and prediction rules for successful CLBP treatment (Melzack,1975; Stein & Mendl, 1988; Fairbank &, Pynsent , 2000; Davidson & Keating, 2002; Flynn et al, 2002; Fritz, George & Delitto, 2001; Waddell et al, 1993). After completing the SFMA and breakouts, I identified the patient's primary source of pain and dysfunction as; Lower Extremity Posterior Chain Tissue Extensibility Dysfunction (TED), Lumbar Locked Internal Rotation, Hip Extension Joint Mobility Dysfunction (JMD), and Core Stability Motor Control Dysfunction (SMCD). Orthopaedic special tests positive for pain were; Sacroiliac Compression and Distraction, Gaenslen's, Gillet/Stork, and H & I. The patient demonstrated limited hip and pelvis mobility with right lateralization for stability and AROM revealed pain with lumbar flexion, extension, and left rotation which influenced movement to the involved side.

The patient's presentation and objective findings led to my decision to utilize MC SNAGs to improve painful active weight bearing lumbar extension movements as SNAGs have been demonstrated to address subtle joint misalignments, known as positional faults (Mulligan, 2010) and are effective in reducing pain and increasing range of motion in patients with LBP (Moutzouri et al., 2008). After the initial three treatments of 3 sets of 10 repetitions with overpressure utilizing Mulligan Concept SNAGs, the patient started to report improvements with her outcome scores on the NRS (2-point improvement), PSFS (2-point improvement) and DPAS (5-point improvement). The clinical decision to add TMR derived from modest clinical gains with pain and disability utilizing MC SNAGs as the sole intervention, increased hypertonicity of the lumbar and pelvic musculature and the desire of the patient to see greater relief of symptoms and return to full activity.

Total Motion Release is an innovative paradigm used to evaluate and treat body motion imbalances as the body is a unified system striving to maintain a dynamic center of gravity (Dalanzo-Baker, 2014). I implemented a series of TMR disc herniation exercises during treatment #4, which included the patient performing prone extensions using both arms with their legs extended behind them while rotating the trunk to the right, prone straight leg raises (SLR) at 20^{o} of hip abduction and at 40^{o} of hip abduction, and finally a seated trunk rotation. Upon completing all prescribed TMR movement patterns to address the patient's asymmetries between the left and right side, TMR provided the needed effect for the patient to improve as demonstrated by the minimal clinically important difference (MCID) achieved on the NRS (6-point improvement) and DPAS (7-point improvement), and minimal detectable change (MDC) on the PSFS (4-point improvement) following the 4th treatment (Figures 3.1-3.3). The patient also reported having an easier time performing activities of daily living and physical activity associated with her sport. I treated the patient using MC SNAGs combined with TMR three times a week over the course of 9 treatments. The addition of TMR exercises appeared to be the cornerstone for Patient #3 overcoming pain and mechanical dysfunction. Hypothesized reasons for the noted improvements include; identifying specific underutilized movement patterns, and an ideological shift from traditional theory (e.g., treating the involved side will improve symptoms) to treating the good side (e.g., performing movement) may have a cross educational effect (Baker, Hansberger, Warren & Nasypany, 2015) resulting in bilateral improvements.

Although I experienced moderate success with MC; when I reflect on the overall outcome of Patient #3, it is clear that I should have followed the MC PILL (**P**ain-free, **I**mmediate results, and **L**ong **L**asting) effect (Mulligan, 2010) more closely as perhaps it would not have taken until the 4th visit and an additional treatment paradigm to see significant progress with the patient. The first mistake I made was violating the principles of the MC by continuing with the treatment over a course of three days even though the patient was minimally responding to SNAGs. At the time of evaluation and treatment, I felt that MC SNAGs was the treatment needed to successfully eliminate Patient #3's pain and dysfunction, and the need to consider other treatment paradigms was overlooked. Over the course of the first 3 treatments, however, Patient #3 continued to demonstrate small clinical improvements. Because I did not follow the principles of the MC PILL effect, I did not know if her pain was returning because I did not address the source of the problem, or if it was because of my inexperience with the MC treatment paradigm. My second mistake was I was unable to identify which treatment; MC or TMR, reduced her symptoms. Although the patient reported complete resolution of pain and dysfunction, the combination of treatments did not allow for deeper understanding of the individual treatment effect. While this was apparent, I did learn that chronic pain could be impacted rather quickly when focusing an intervention to address the source rather than the symptom.

Prior to my introduction to MC and TMR, I would have expected comparable outcomes to occur over the course of a month or more of treatments consisting of McKenzie extension and Williams flexion exercises, core strengthening, and modalities such as e-stim and ice; however, by incorporating MC SNAGs and TMR into treatment, the patient reported meaningful changes in pain and dysfunction within 9 treatments (13 total) over the course of 4 weeks compared to her previous 2 years of failed intervention.

Within one semester of being in the DAT program, I added two of the most effective interventions (i.e. MC, TMR) I had ever experienced in my practice and was amazed by the results. The effects were also instrumental in improving my confidence in using the MC and TMR on future patients. Embracing a patient-centered approach completely changed my expectations when treating any type of chronic pathology, specifically low back pain. For the first time I connected my clinical decision making to patient-related outcomes, and utilizing a broader range of treatment interventions available such as MC, TMR, and SFMA, along with traditional therapies. Ultimately, my patients were reporting immediate changes as demonstrated through disease-oriented outcomes (DOEs) (e.g., range of motion and strength) and patient-oriented outcomes (POEs) (e.g., DPAS, NRS) and I was beginning to feel more competent with my clinical decision making.

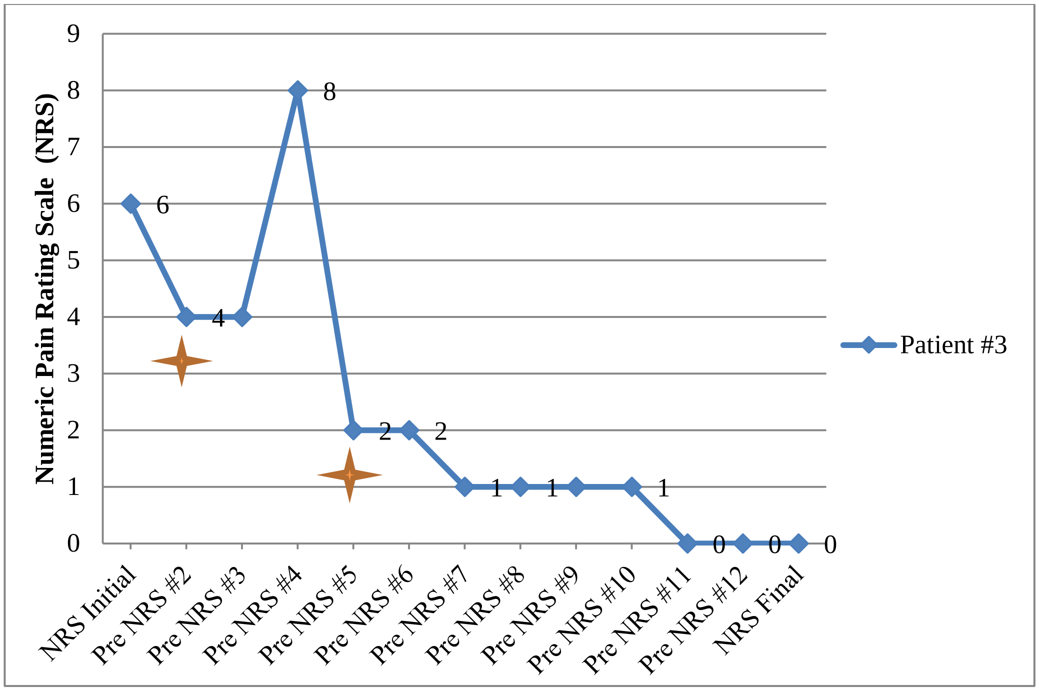

Figure 3.1. Patient #3 Pre-Treatment NRS Scores.

Denotes MCID for NRS Scores

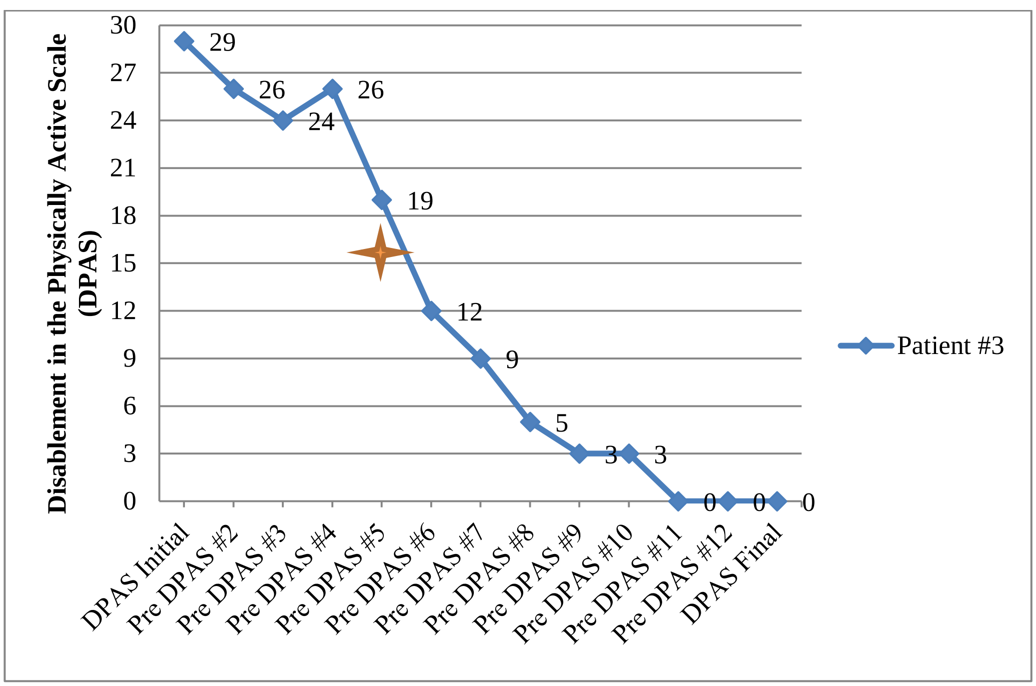

Figure 3.2. Patient #3 Pre-Treatment DPAS Scores.

Denotes MCID for DPAS Scores

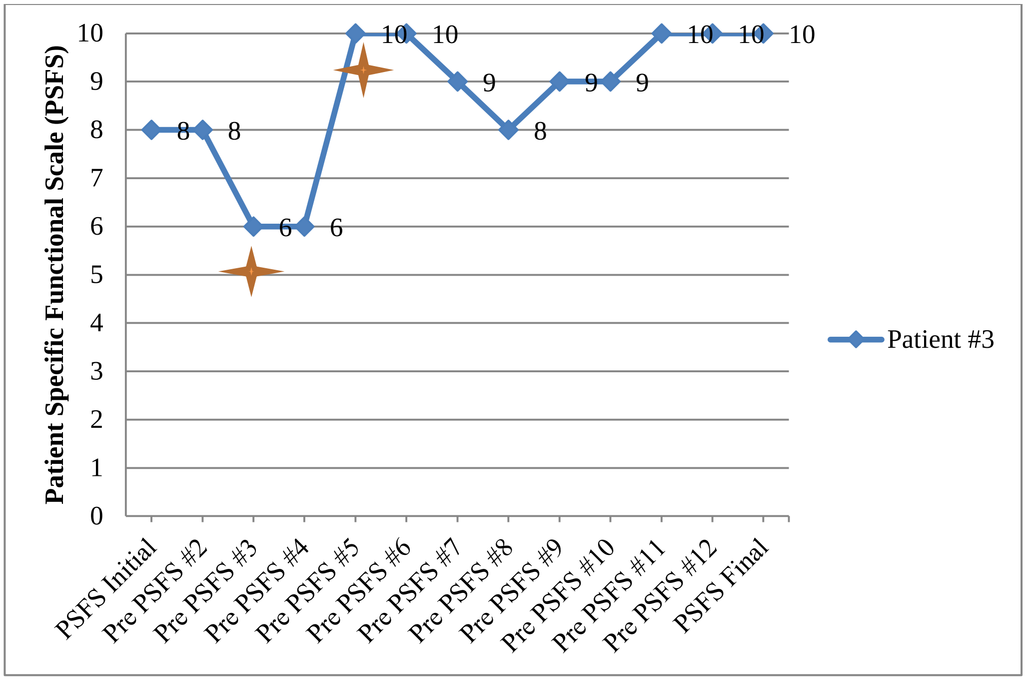

Figure 3.3. Patient #3 Pre-Treatment PSFS Scores.

Denotes MCID for PSFS Scores

Spring I

During Spring-I, I worked to improve my clinical competence regarding global patient assessments. To accomplish this task I chose to implement the SFMA as an assessment tool. The SFMA provides a systematic, detailed and reliable method for assessing movement dysfunction (Voight & Cook, 2001; Cook, 2010; Gribble, 2013; Glaws, 2014). Initially I found the SFMA to be challenging and time intensive, but over time, I was able to get beyond this perceived barrier. Clinically, I utilized the SFMA seven times over the Spring-I semester and I was able to accurately and more efficiently identify the primary driver of pain and/or dysfunction. The needs of my patients were being met by better identifying the driver of pain and/or dysfunction which provided a more refined level of care. Utilizing the SFMA helped me recognize the importance of this assessment and how it can bring about change in a global sense versus a continual focus on addressing a local complaint which often produces minimal success. Reflecting on notes that I had taken during the FMA/SFMA course prior to Summer-I, I wrote the following statement:

> *With respect to musculoskeletal problems, regional interdependence refers to the concept that seemingly unrelated impairments in a remote anatomical region may contribute to, or be associated with, the patient's primary complaint. This idea stopped me in my tracks. After all this time someone finally was able to explain to me in such simplicity that the body has alternated segments which are mobile and stable joints. The regional-interdependence examination model and its role in the management of patients with musculoskeletal disorders have to be considered within the context of the biomedical model of disease that characterizes Western medicine (Wainner et al., 2007). There are many injuries and pathologies I now understand better, based on this idea of how the body functions (i.e., interconnected). With regard to the regional-interdependence examination model, there have been a number of high-quality randomized clinical trials dealing with various musculoskeletal problems in which this model has been incorporated (whether defined as such or not) as an impairment-based treatment approach resulting in positive patient-centered outcomes (Whitman et al., 2006). I know from this point forward as a clinician I will never look at another chronic injury the same way again. I now believe that I have the ability to treat many injuries that have not responded to traditional treatments.*

Reflecting back on this statement at the beginning of the Spring-I semester, I realize that I had unknowingly begun to transform and inform my clinical practice utilizing the concept of regional interdependence (RI), an approach involving the evaluation and treatment of patients who present with pain in a manner that allows the clinician to consider other areas and systems of the body that may be causing or contributing to patient symptoms (Sueki et al., 2013; Wainner et al., 2007). I underestimated the impact a global assessment approach such as SFMA could provide in my clinical practice and was absent prior to the DAT.

In addition to my focus on the SFMA and on incorporating an RI approach into my clinical practice, I also investigated *a priori* LBP pathology as part of my clinical residency and studied the effect of treating LBP patients with MC MWMs for the lumbar spine. Although most LBP cases are self-limited, many athletes have persistent symptoms. Despite these patients being highly motivated to return to activity, a specific pain generator is not always found, often making diagnosis and treatment a challenge (Deyo& Tsui-Wu, 1987; Loney & Stratford, 1999; Leboeuf-Yde & Lauritsen, 1993). My goal was to expand my competence in treating LBP with a single intervention. Accordingly, the following patient examples demonstrate my successful application of SFMA top tier screen and breakouts as an assessment and classification tool. All patients were assessed with SFMA, and as a result, my ability to accurately select an appropriate treatment intervention based on the SFMA findings was improving.

Four patients (#15, #16, #17, #22)(Figures 3.4 - 3.6), 18-21 year-old female track and field middle distance runners presented to the AT Clinic with complaints of hip, pelvis, and/or knee pain approximately 6 months in duration with sporadic un-resolved symptoms and mild increases in their level of musculoskeletal dysfunction. Periods of rest, modified mileage, restricted strength training, modalities, nonsteroidal anti-inflammatory medication, and core strengthening exercises failed to demonstrate any long term sustainable change in reported musculoskeletal strain recurrence or function. Utilizing SFMA during each patient assessment, all four patients were classified with limited hip and pelvis stability while AROM with lumbar flexion and extension, knee flexion, hip flexion and adduction were reported as painful. Further, each patient demonstrated Core Stability Motor Control Dysfunction (SMCD) while all orthopaedic special tests were negative for pain.

Patient presentations and objective findings led to treating each patient with Reflexive Neuromuscular Stabilization (RNS) to better address their stability and motor control deficits at the core, and Total Motion Release (TMR) to address their body motion imbalances between the left and right side. Individualized RNS techniques are thought to correct motor pattern dysfunctions by applying a light external load to exaggerate the dysfunctional movement and cause the patient to reflexively correct the subconscious dysfunctional movement pattern (Cook, 2010; Loutsch, Baker, May, Nasypany, 2015). Individualized TMR techniques are thought to correct movement imbalances as a result of neural coupling (coordination of sensation and movement) utilizing six motions (i.e., arm raise, bent arm wall push, trunk twist, single-leg sit-to-stand, leg raise, and weight-bearing toe-reach) where movement of the trunk or extremities promotes neuromuscular activation via cross education (Dalanzo-Baker, 2014).

The patients were treated using a RNS technique in which the patient reflexively resisted a manual anterior to posterior (AP) force at the abdomen and at the hips while simultaneously bending forward at the hips in an attempt to touch their toes. I first provided an AP force to the patient’s abdomen for approximately 10 repetitions with the force being re-applied prior to each repetition and an additional 10 repetitions were performed while I provided the AP force at the level of the hips (anterior superior iliac spines). The patients were able to perform RNS with relative ease after the first set of repetitions as they were able to "feel" the correction of the movement and the unconscious response to an outside stimuli. Patients also recognized that they were no longer struggling with foam-rolling techniques which rarely changed their ROM and mobility in a meaningful way. The TMR® SLR technique utilized involved standing SLRs (hip flexion) with 2 sets of 15 repetitions being performed on the patient's reported "good side" (less restriction) with their feet shoulder width apart. After the completion of the standing SLRs, the patient went back to their "bad" side (more restriction) and performed one straight leg raise to assess the effect TMR had on their reported hamstring "tightness". Treatment continued until the patient reported equal measures (balance) between right and left sides.

All patients received 6 treatments of RNS and TMR over the course of 2 weeks. Pain scores using the NRS, functional scores using the PSFS, and disablement scores using the DPAS were taken before each treatment session. After the 1st treatment of RNS and TMR, patients reported on average a 5-point reduction in disablement (DPAS), a 3-point reduction in pain (NRS), and a 1-point increase in function (PSFS) where MCID was reported for pain (2-point improvement) (Figures 3.4-3.6). Mean changes after the completion of 6 treatments with all patients illustrate MCIDs for pain (6-point improvement) and disablement (19-point improvement) and a MDC for function (2.5-point improvement).

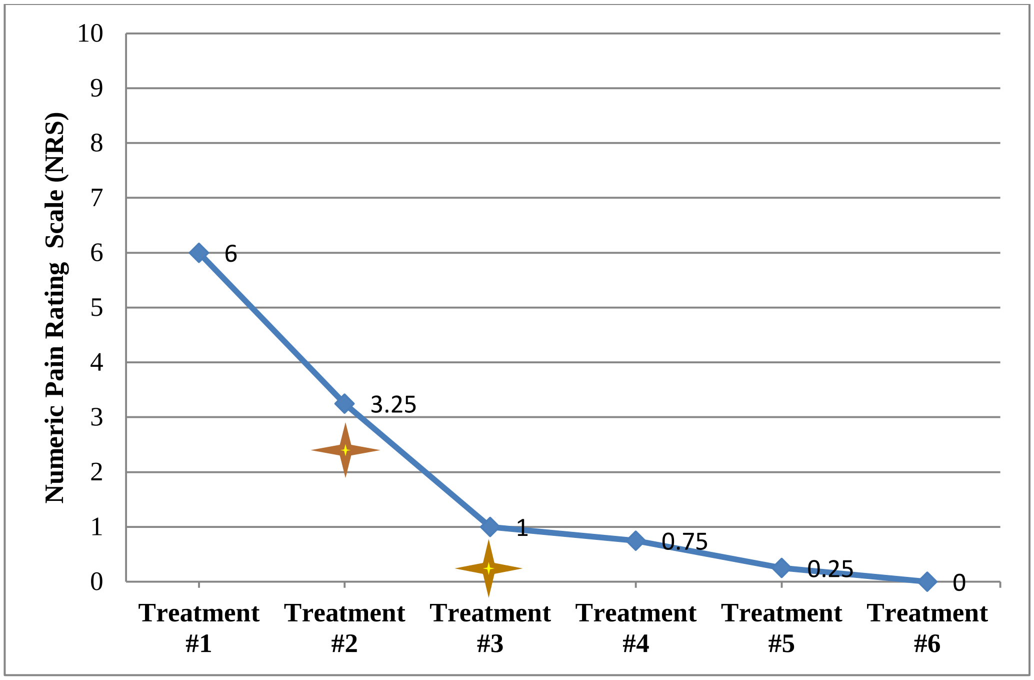

Figure 3.4. Mean Pre-treatment NRS Scores.

Denotes MCID for NRS Scores

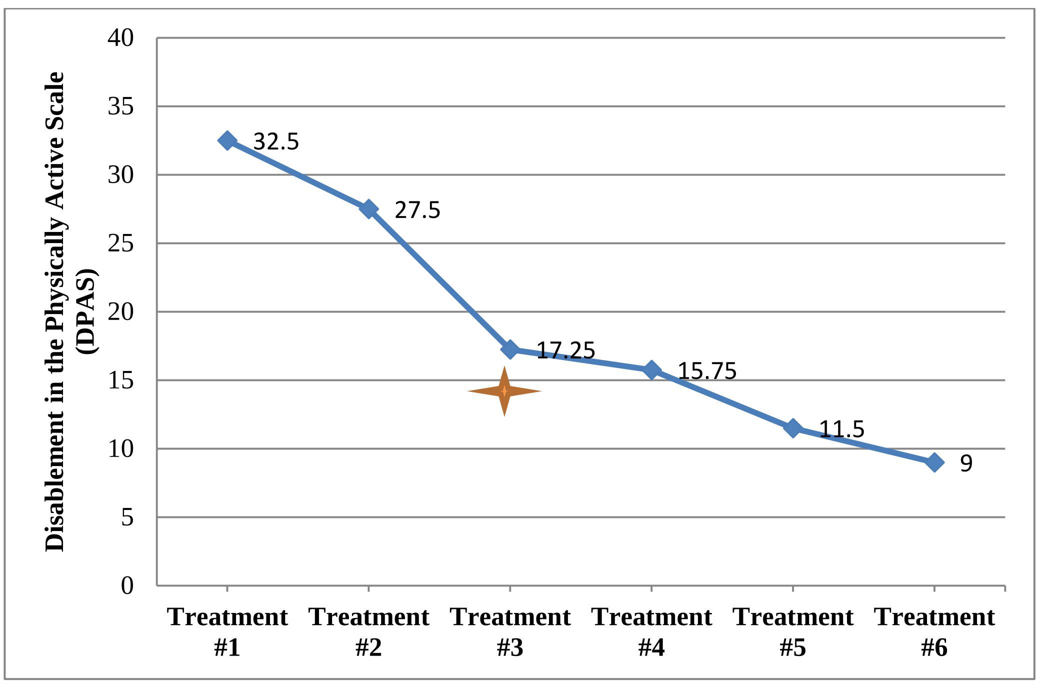

Figure 3.5. Mean Pre-Treatment DPAS Scores.

Denotes MCID for DPAS Scores

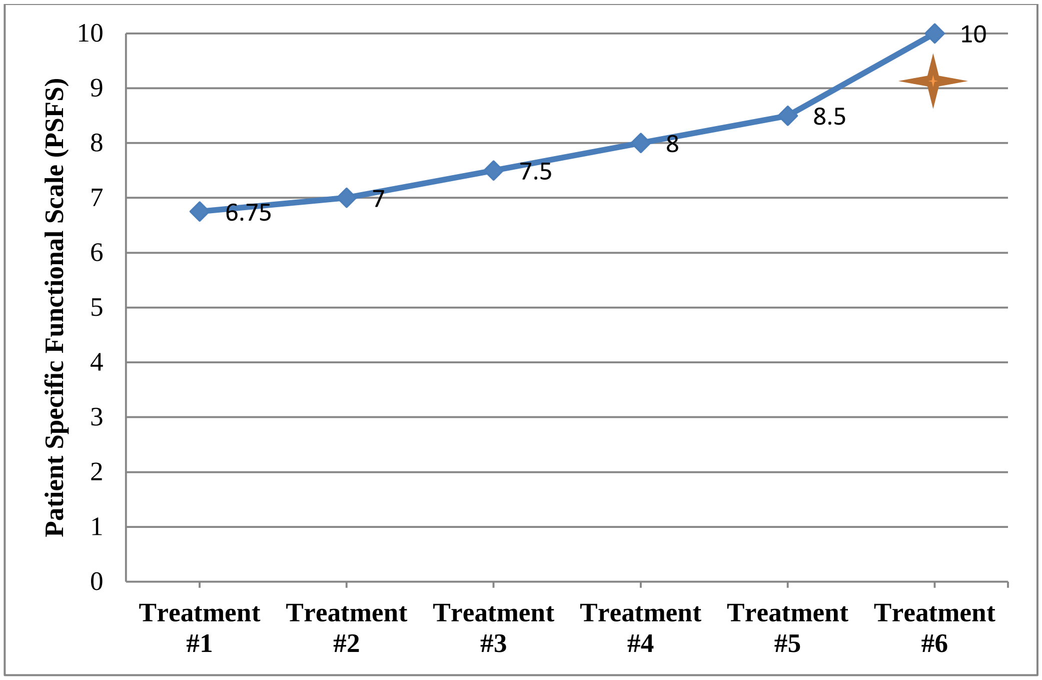

Figure 3.6. Mean Pre-Treatment PSFS Scores.

Denotes MDC for PSFS Scores

Another significant change in my clinical practice that occurred during the Spring-I semester was my *a priori* investigation into LBP and the reported response to treatment utilizing MC SNAGs. I had become increasingly competent using MC SNAGs and my patients were now reporting successful intervention via resolution of symptoms. More specifically, two patients who presented with low back pain of an idiopathic nature and chronicity were treated successfully with my growing confidence and competence related to the MC. With my continued refinement and successful interventions utilizing the MC I was becoming a big believer in this treatment intervention as it has proven highly effective with minimal effort.

The first patient (#13) complained of chronic LBP lasting approximately 3 months, during which time she completed traditional rehabilitation with minimal resolution of pain. Three months prior to my initial examination, the patient, who was diagnosed with a disc herniation, (i.e., protrusion) at L3-4 that was confirmed through magnetic resonance imaging (MRI), received an epidural in an attempt to reduce nerve root symptoms to relieve her chronic back pain. The patient reported pain relief for approximately one month following the injection, but pain, neuropathy and disability eventually returned to pre-injection status.

Patient #13 was classified as having moderate disability (OSW = 30%), and she reported 46 on the DPAS and 6 on the NRS. Her initial SFMA top tier evaluation revealed DP Multi-Segmental Extension and DP Single Leg Stance and a Fundamental Extension SMCD during the breakouts. The patient's presentation and objective findings led to my decision to utilize MC Sustained Natural Apophyseal Glides (SNAGs) directed at the L3 segment. I chose to incorporate MC Lumbar SNAGs to address positional faults for restoration of normal motion for restriction and pain in the lumbar region. During the first five visits I performed central MC Lumbar SNAGs with the patient in a prone position as the she was not able to perform trunk extension in a seated or standing position without the return of her neurological symptoms. Upon completion of the initial treatments Patient #13 was able to perform trunk extension while standing without pain or neurological symptoms while her Single Leg Stance improved as well. The patient was treated a total of 18 times (3 sets of 10 repetitions each treatment session) over 5 weeks, resulting in full resolution of pain, neuropathy and dysfunction. Progression of these positive findings is presented in Table 3.1.

Table 3.1.
Patient #13 Outcomes with MC Lumbar SNAGs Treatment of Low Back Pain.

	Week1	**Week 2**	**Week 3**	**Week 4**	**Week 5**
Outcome Measure					
NRS	6	4*	2*	2	0*^
DPAS	45	33	28	19	8^
PSFS	5	5	6	7	8^
OWS	30%				14%
MPQ	48/78				31/78
FABQ	20				
GROC					+6

*Denotes weekly MCID; ^Denotes MCID from initial visit to discharge; NRS = Numeric Pain Rating Scale; DPAS = Disablement in the Physically Active Scale; PSFS = Patient Specific Functional Scale; OWS = Oswestry Disability Index; MPQ = McGill Pain Questionnaire; FABQ = Fear Avoidance Beliefs Questionnaire; GROC = Global Rating of Change

The second patient (#19) complained of chronic LBP lasting approximately 24 months, with an unknown mechanism of injury. The patient had received several chiropractic treatments since her initial onset of pain, but the pain relief only lasted for one day following each treatment during which time she also completed rehabilitation with minimal resolution of pain. During my initial evaluation, Patient #19 was classified as having moderate disability

(OSW = 26%), and she reported 35 on the DPAS and 8 on the NRS. Her initial SFMA top tier evaluation revealed DN Multi-Segmental Extension and DN Single Leg Stance. I chose to treat her with MC Lumbar SNAGs to restore motion and decrease pain in the lumbar region. During the first ten visits I performed central MC Lumbar SNAGs at the L5 level while the patient performed trunk extension. Although the patient did report decreases in pain and disability, she continued to demonstrate losses in trunk extension ROM after gymnastic practices/competition. I subsequently decided to have the patient perform trunk extension in a prone position as I hypothesized removing the weight bearing aspect of treatment much like McKenzie's mechanical diagnosis therapy (MDT) approach where the patient only experiences pain during static loading, may provide a longer lasting effect on ROM. Upon completion of the next seven treatments utilizing a modified treatment position, Patient #19 was able to maintain ROM gains with trunk extension and improve her Single Leg Stance. However, Patient #19 had plateaued with her reports of NRS, DPAS, and PSFS scores. After considering the events she participated in (parallel bars & floor exercise), I again adjusted the treatment by having Patient #19 perform trunk extension while utilizing a Posterior Innominate Glide in addition to the L5 lumbar SNAG for the last seven treatments. This addition appeared to be the final step to full resolution of her reported symptoms. The patient was treated a total of 24 times over 5 weeks, resulting in full resolution of pain and dysfunction. Other positive outcomes are recorded in Table 3.2.

Table 3.2.
Patient #19 Outcomes with MC Lumbar SNAGs Treatment of Low Back Pain.

	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**
Outcome Measure					
NRS	8	6*	4*	3	1*^
DPAS	35	20	17	16	10^
PSFS	5	6	7	6	9*^
OWS	26%				9%
MPQ	60/78				42/78
FABQ	19				
GROC					+5

*Denotes weekly MCID; ^Denotes MCID from initial visit to discharge; NRS = Numeric Pain Rating Scale; DPAS = Disablement in the Physically Active Scale; PSFS = Patient Specific Functional Scale; OWS = Oswestry Disability Index; MPQ = McGill Pain Questionnaire; FABQ = Fear Avoidance Beliefs Questionnaire; GROC = Global Rating of Change

The patient-reported outcomes highlighted by these two patients provides preliminary evidence for the utilization of MC SNAGs as a successful treatment for the condition of chronic LBP. My LBP patients achieved MCIDs on the DPAS, NRS, and PSFS by the 3rd week. I believe that these improvements were a result of a greater understanding of the MC paradigm and its intended application, which was demonstrated by the application in isolation and documented results. I was also encouraged by developments in my clinical skills. As I began to focus more on applying a single intervention rather than using a "guess which one will work" approach, I discovered when and why each MC SNAG treatment was effective without interference from other interventions. Although the data suggests that my treatments were effective at reducing Patient #13 and #19 pain and disability, the results indicate that the treatment effects did not significantly impact the patient's functional abilities as quickly as I had expected between treatments. Hypothesized reasons include; longevity of unresolved symptoms, altered biomechanical compensations, and physiological deconditioning over an extended period of time. I believe that these two patient experiences exhibit my growth towards advanced practice and demonstrate the success that can be achieved when a patient is appropriately matched with a single treatment intervention. Doing so allowed me to study the effect the MC SNAGs had on my patients while providing me with patient-reported outcomes to inform clinical practice.

After the spring semester ended and Summer-II approached, I was beginning to see evidence that my clinical practice had improved over the past year. I recognized that there were still areas of my practice in which I needed to further develop if I were going to become a scholarly practitioner. For instance, I needed to invest more time in expanding my understanding and improving my skills in treatment paradigms that I had already integrated into my clinical practice. While keeping this in mind, my goal for the upcoming Summer-II semester was to focus on the subtleties of MC (e.g., use of lumbar SNAGs vs. Spinal mobilization with limb movement (SMWLM) vs. traction straight leg raise MWMs for LBP) and delve deeper into the use of the MC belt as an adjunct/enhancement to the MC treatment being utilized with specific patient reported symptoms. I hoped to gain deeper insight and an increased 'comfortableness' with the paradigm by keeping an open mind to the clinical benefits this paradigm offered and taking advantage of the time set aside for class to work on my technique, as I planned to utilize MC exclusively within my clinical practice during my Fall-II clinical residency.

Fall II

Fall-II proved to be my most productive and meaningful semester as a clinician. My *a priori* goal was to understand the presentation and symptom manifestation in patients complaining of LBP. By closely exploring this musculoskeletal epidemic (i.e., LBP) and through my interaction with patients complaining of LBP, I was becoming a clinician who could confidently and competently treat patients complaining of LBP. I have become increasingly comfortable treating LPB and have enjoyed the journey to improving a rehabilitative aspect of my clinical practice that had suffered for years as evidenced by my refined LBP Treatment Philosophy:

> *Addressing low back pain (LBP) in my patient population utilizes a multi-faceted approach to patient care derived from my clinical experience and the best available evidence to guide, inform and treat the patient. Understanding my current approach to LBP is not a "one size fits all", rather, my goal is to capture a systematic evaluation and treatment approach based upon evidence-informed clinical practice. The physical exam for LBP patients involves orthopedic and symptom centralization tests, which leads to accurate treatment selection. Ideally the use of a mixture between subgroup classifications and a reexamination of treatment effectiveness guides my clinical decision-making process. A directed evaluation utilizing various aspects of the Cyriax, Maitland, McKenzie, TBC, and SFMA models as well as sub-therapeutic levels of treatments allow for my clinical practice to address each patient and their specific complaints and goals.*

Three patients (#26, #29, #34) with LBP were evaluated in the AT clinic. Patient #26 reported to the AT clinic after sustaining an acute musculoskeletal injury to the lumbar region after weightlifting. During my initial evaluation, Patient #26 was classified as having severe disability (OSW = 42%), and he reported 30 on the DPAS and 6 on the NRS. His initial SFMA top tier evaluation revealed DN Multi-Segmental Extension, DN Multi-Segmental Flexion, and DN Single Leg Stance. The patient demonstrated moderate deficits with trunk extension and flexion along with a visual assessment of the patient's inability to fire the hip flexors moving from a seated to standing position as the movement began with an increased moment at the L4-L5 vertebrae. I chose to incorporate MC Lumbar SNAGs and Posterior

Innominate Glides to address positional faults for restoration of normal arthrokinematic and osteokinematic motion for restriction and pain in the lumbar and SI region. During the first three visits I performed central Mulligan Concept Lumbar SNAGs and Posterior Innominate Mobilizations with Movement (MWMs) for fixed SI joint positional faults. Initially overpressure was not utilized until the patient demonstrated pain-free ROM with just the MWM's. Upon completion of the initial three treatments Patient #26 was able to perform trunk extension without pain and hip extension also improved. However, I felt as though his progress had been slowed due to not being able to work into end-range of motion. I made the concerted effort to make sure the patient understood how to finish the treatment pattern by going as far as they could with the movement. After 3 sets of 10 repetitions on the 4th day of treatment, the patient was able to demonstrate full trunk extension and flexion without pain and had full resolution of mechanical symptoms within 6 treatments (Table 3.3).

Table 3.3.
Patient #26 Outcomes: MC Lumbar SNAGs Treatment of Low Back Pain.

	Day 1 Initial	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6 Discharge**
Outcome Measure						
NRS	6	3*	3	3	1*	1^
DPAS	30	25	17	17	12	9^
PSFS	3	8*	5	5	7*	9*^
OWS	42%					22%
MPQ	55/78					36/78
FABQ	17					
GROC						+5

*Denotes weekly MCID; ^Denotes MCID from initial visit to discharge; NRS = Numeric Pain Rating Scale; DPAS = Disablement in the Physically Active Scale; PSFS = Patient Specific Functional Scale; OWS = Oswestry Disability Index; MPQ = McGill Pain Questionnaire; FABQ = Fear Avoidance Beliefs Questionnaire; GROC = Global Rating of Change

Patient #29 presented with chronic LBP lasting approximately 12 months. The patient had received several chiropractic treatments since her initial onset of pain, but the pain relief only lasted intermittently following each treatment during which time she also completed rehabilitation with minimal resolution of pain. Patient #29 was classified as having minimal disability (OSW = 16%), and she reported 29 on the DPAS and 5 on the NRS. Her initial SFMA top tier evaluation revealed DN with Multi-Segmental Flexion and Single Leg Stance. The patient was treated a total of 6 times over 2 weeks, resulting in full resolution of pain and dysfunction utilizing a central Mulligan Concept lumbar SNAG over the L1 vertebrae (Table 3.4). I chose to treat her with MC Lumbar SNAGs to restore motion and decrease pain in the lumbar region. During the first two visits I performed central MC Lumbar SNAGs at the L1 level while the patient performed trunk flexion. Although the patient did report decreases in pain and disability, she continued to demonstrate minimal losses in trunk flexion and hip flexion (SLRs) ROM after softball practices/competition. I subsequently moved to a unilateral SNAG on the right L1 transverse process while the patient performed trunk flexion. Upon completion of the next two treatments utilizing a modified (unilateral vs. central) SNAG Patient #29 was able to maintain ROM gains with trunk flexion and improve her Single Leg Stance. However, Patient #29 had somewhat plateaued with her reports of NRS, DPAS, and PSFS scores. After considering the position she played (right outfield), I again adjusted the treatment by having Patient #29 perform trunk rotation to the right while utilizing a unilateral L1 lumbar SNAG for the last two treatments. This subtle change in direction appeared to be the final step to full resolution of her reported symptoms.

Table 3.4.
Patient #29 Outcomes: MC Lumbar SNAGs Treatment of Low Back Pain.

	Day 1 Initial	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6 Discharge**
Outcome Measure						
NRS	5	4	3	2	2	1^
DPAS	29	25	19	17	16	14^
PSFS	4	7*	8	8	7	8^
OWS	16%					7%
MPQ	40/78					19/78
FABQ	21					
GROC						+6

*Denotes weekly MCID; ^Denotes MCID from initial visit to discharge; NRS = Numeric Pain Rating Scale; DPAS = Disablement in the Physically Active Scale; PSFS = Patient Specific Functional Scale; OWS = Oswestry Disability Index; MPQ = McGill Pain Questionnaire; FABQ = Fear Avoidance Beliefs Questionnaire; GROC = Global Rating of Change

Patient #34 was classified as having moderate disability (OSW = 40%), and he reported 39 on the DPAS and 7 on the NRS. His initial SFMA top tier evaluation revealed DP Multi-Segmental Extension, DN Multi-Segmental Rotation, and DN Single Leg Stance. The patient demonstrated moderate deficits with trunk extension and rotation along with an inability to fire the hip flexors when performing a straight leg raise when performing the windup motion during the throwing progression as the movement began with an increased moment at the S1/S2 vertebrae demonstrating a decreased lumbar lordosis. The patient was treated a total of 6 times over 2 weeks, resulting in full resolution of pain and dysfunction. During the first three visits I performed central Mulligan Concept Lumbar SNAGs and Posterior Innominate MWM's for fixed SI joint positional faults. Initially the patient could not perform the treatment in a full weight bearing position so the treatment was performed while seated until the patient demonstrated pain-free ROM with just the MWM's. Upon completion of the initial treatments Patient #34 was able to perform trunk extension without pain and hip flexion also improved. After 3 sets of 10 repetitions on the 3rd day of treatment, the patient was able to demonstrate full trunk extension and rotation without pain and had full resolution of mechanical symptoms within 6 treatments (Table 3.5).

Table 3.5.
Patient #34 Outcomes: MC Lumbar SNAGs Treatment of Low Back Pain.

	Day 1 Initial	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6 Discharge**
Outcome Measure						
NRS	7	4*	2*	2	0*	0^
DPAS	39	25	28	16	11	7^
PSFS	3	7*	6	7	9*	9^
OWS	40%					20%
MPQ	62/78					32/78
FABQ	18					
GROC						+6

*Denotes weekly MCID; ^Denotes MCID from initial visit to discharge; NRS = Numeric Pain Rating Scale; DPAS = Disablement in the Physically Active Scale; PSFS = Patient Specific Functional Scale; OWS = Oswestry Disability Index; MPQ = McGill Pain Questionnaire; FABQ = Fear Avoidance Beliefs Questionnaire; GROC = Global Rating of Change

In order to become experts in specific areas, clinicians need to focus on local problems within their clinical practice; therefore, I appreciated the opportunity to become more advanced in my knowledge and use of Mulligan Concept. The experience also reinforced my belief that in order to develop proficiency with an intervention, I need to spend time treating patients solely within that paradigm. The positive outcomes reported with patients complaining of LBP (#26, #29, #34) this semester provided me the confidence to effectively treat my patients based on their primary symptoms, and confirmation Mulligan Concept

Lumbar SNAGs is a highly effective manual therapy intervention. After one week of Mulligan Concept SNAGs treatment interventions the patients reported MCIDs/MDCs with their outcome scores on the NRS, PSFS, and DPAS. More importantly, I was no longer wandering in the LBP treatment wilderness. Instead of referring patients complaining of LBP or struggling through treatments with limited outcomes, I was developing a treatment philosophy for the first time in my clinical practice and providing evidence for my clinical decisions.

Spring II

During Spring-II, I achieved another level of confidence and competence in my clinical skills and foundational knowledge as an AT clinician. My primary focus for Spring-II was to continue to treat *a priori* unresolved low back pain and dysfunction using only MC treatment paradigm. I made this decision as the MC has been shown to be an effective treatment for the reduction of pain and disability in LBP patients (Vicenzino, Paungmali, Teys, 2007) and my previous patient reported outcomes on patient complaining of LBP were positive and encouraging. I collected 3 complete patient outcomes on this *a priori* and was slowly becoming the *'de facto'* expert in the treatment of CLBP within my AT clinic.
In addition, during the Spring-II semester, my secondary focus was to identify patients to include in my Fear Avoidance *a priori* research and collect outcome measures. This investigation was a combined effort with a fellow 2016 Cohort member to investigate, *a priori*, fear-avoidance in patients demonstrating with acute and chronic injuries. The purpose of the investigation was to examine the relationship between fear avoidance behavior in chronic and acute pain patients in an attempt to identify specific behavioral characteristics (e.g., irrational pain intensity as it relates to injury severity, patient's continual focus on pain, fear of making injury worse, fear of activity, lack of acknowledgement towards injury state) athletes exhibit during a musculoskeletal injury and why some athletes develop fear avoidance behaviors and pain-related fear while others do not.

The following patient examples demonstrate my successful application of MC SNAGs as a treatment intervention for LPB, and as a result, my ability to apply MC was improving exponentially. Patient #36 is a 20 year-old gymnast who was referred to the AT clinic with reports of recurrent low back pain over the past 4 months, especially during specified activity. Prior treatment had not resolved the patients' primary complaint and their athletic participation had been mildly limited. Patient #36 attempted rehab with traditional therapies such as Graston, ultrasound, ice, ROM and strengthening exercises all of which only minimally reduced her symptoms. Her initial SFMA top tier evaluation revealed DN Multi Segment Extension, DN Single Leg Stance, and DN Overhead Deep Squat. To address the multi segment extension dysfunction I utilized MWMs for the Posterior Innominate with a bridge-up to see if I could improve prone straight leg raise on the right side. The patient performed 3x10 of bridge-ups and the patient's prone SLRs on the right side demonstrated large increases in ROM. I also had her perform multi segment extension again to see whether her ASIS would now move forward over the toes, which it did and there was now increased trunk extension as well. In addition, she also repeated the overhead deep squat and was now able to break parallel and not shift weight to her toes in order to squat lower. I continued treating Patient #36 for 3 additional days with the above stated protocol. After 4 total days of treatment and the patient meeting the discharge criteria for pain, and function, I wanted to assess the patients ability to perform a backwards layout and a full to gauge the extension of the posterior chain and to also gauge if she would under-rotate her tumbling passes. The patient was now able to perform the exercises (tumbling passes) pain free and did not under-rotate due to shortened posterior chain musculature (Table 3.6).

Table 3.6.
Patient #36 Outcomes: MC Lumbar SNAGs Treatment of Low Back Pain.

	Day 1 Initial	**Day 2**	**Day 3**	**Day 4 Discharge**
Outcome Measure				
NRS	4	0*	0	0^
DPAS	19	9	1	1^
PSFS	5	9*	10	10^
OWS	25%			11%
MPQ	36/78			9/78
FABQ	8			
GROC				+6

*Denotes weekly MCID; ^Denotes MCID from initial visit to discharge; NRS = Numeric Pain Rating Scale; DPAS = Disablement in the Physically Active Scale; PSFS = Patient Specific Functional Scale; OWS = Oswestry Disability Index; MPQ = McGill Pain Questionnaire; FABQ = Fear Avoidance Beliefs Questionnaire; GROC = Global Rating of Change

Patient #39 who was under the care of another athletic trainer was referred to me as a result of unresolved low back pain. He rated his pain at rest as a 3/10 on the NRS and an 8/10 during football activity. The patient had received several chiropractic treatments since his initial onset of pain, but the pain relief only lasted intermittently following each treatment. The patient demonstrated moderate deficits with trunk extension and left rotation in addition to an inability to initiate appropriate movement patterns in the lower extremity, and shortened posterior chain musculature. During the first three visits I performed left unilateral Mulligan Concept Lumbar SNAGs at L5 and Posterior Innominate MWM's for fixed left SI joint dysfunction. Initially overpressure was not utilized until the patient demonstrated pain-free ROM with just the MWM's. Upon completion of the initial treatment the patient was able to perform trunk extension and rotation without pain and hip flexion (SLR) also improved. After 3 sets of 10 repetitions on the 4th day of treatment, the patient was able to demonstrate full trunk extension and rotation without pain and had full resolution of mechanical symptoms within 4 treatments (Table 3.7).

Table 3.7.
Patient #39 Outcomes: MC Lumbar SNAGs Treatment of Low Back Pain.

	Day 1 Initial	**Day 2**	**Day 3**	**Day 4 Discharge**
Outcome Measure				
NRS	5	2*	1	1^
DPAS	35	24	18	14^
PSFS	5	7*	9	10^
OWS	46%			13%
MPQ	43/78			22/78
FABQ	19			
GROC				+6

*Denotes weekly MCID; ^Denotes MCID from initial visit to discharge; NRS = Numeric Pain Rating Scale; DPAS = Disablement in the Physically Active Scale; PSFS = Patient Specific Functional Scale; OWS = Oswestry Disability Index; MPQ = McGill Pain Questionnaire; FABQ = Fear Avoidance Beliefs Questionnaire; GROC = Global Rating of Change

Based on continual improvement and utilization of Mulligan Concept, I have grown extremely comfortable with its use for unresolved chronic pain especially as it concerns the lumbar spine, and SI joint. Being able to determine which patients will respond favorably based on sub-therapeutic levels of treatment during the evaluative process have allowed my patients to achieve MCIDs. As result, my clinical residency, *a priori* design, and new LBP philosophy (described above) has helped enhance my competence and I now embrace those patients where traditional interventions have failed to resolve their CLBP.

Another significant addition to my clinical practice that occurred during the Spring-II semester was my *a priori* investigation into the Fear-Avoidance Model and its association with poor clinical outcomes. In the search for factors associated with development of musculoskeletal pain, two psychological components have been identified: First, pain-related fear associated with avoidance behaviors and the avoidance of movement and physical activity in particular and second, pain-related fear associated with increased body awareness and pain hypervigilance (Waddell, 2004). This highlights the question of what causes some athletes to develop fear avoidance behaviors along with pain-related fear while others do not.

A total of 28 participants (16 females, 12 males; mean age = 18.25±2.11) identified with either an acute musculoskeletal injury resulting in at least 24 hours of painful stimuli or a chronic musculoskeletal injury resulting in 3 months or more of treatment intervention (rehab) with no or minor resolution of pain and dysfunction; and any loss of playing/practice time, were eligible for inclusion in this study. Participants completed a study packet including 6 psychometrically-based instruments: Numeric Rating Scale (NRS), Pain Catastrophizing Scale (PCS), Tampa Scale of Kinesiophobia (TSK-11), Fear Avoidance Behavior Questionnaire-Physical Activity (FABQPA), McGill Pain Questionnaire (MPQ), and the Athlete Fear Avoidance Questionnaire (AFAQ). Utilizing an independent-t and a Pearson's product moment correlation to determine the relationship between fear avoidance, pain and duration of pain state; a significant difference was found between the acute and chronic groups (Table 3.8).

Table 3.8.
Independent T-test of Fear Avoidance between Acute and Chronic Pain Patients.

	t	*df*	Sig. (2-tailed)	95% Confidence Interval of the Difference		Cohen's *d*	Effect Size
Outcome Measure				Lower	Upper		
FABQPA	3.130	26	.004*	1.728	8.338	1.20	.52

*** = Clinical Significance at .01 level; FABQPA = Fear Avoidance Beliefs Questionnaire - Physical Activity subsection**

Once we determined a difference was present between acute and chronic musculoskeletal groups we investigated the correlations between the different measures of fear avoidance, pain-related fear and pain catastrophizing in an effort to determine whether these scales captured the same psychological phenomena between the two groups. The relationship between Tampa Scale of Kinesiophobia (TSK-11) and Athlete Fear Avoidance Questionnaire (AFAQ) scores ($r = .669$, $p = 0.034$), in the acute musculoskeletal injury group was statistically significant ($p = .05$) whereas the relationship between TSK-11 and AFAQ ($r = .613$, $p = .007$) in the chronic musculoskeletal injury group was statistically significant $p = .01$). In addition, the relationship between TSK-11 and AFAQ ($r = .605$, $p = .001$) for combined groups was statistically significant ($p = .01$). The relationship between the Pain Catastrophizing Scale (PCS) and AFAQ ($r = .802$, $p = .000$) in the chronic musculoskeletal group was statistically significant ($p = .01$) however, the relationship between PCS and AFAQ ($r = .567$, $p = .087$) was not a factor within the acute pain population suggesting catastrophizing contributes to heightened levels of pain and emotional distress, and also increases the probability that the pain condition will persist over an extended period of time. Additionally, the relationship between PCS and AFAQ ($r = .648$, $p = .000$) for combined groups was statistically significant ($p = .01$) suggesting when acute and chronic groups combined results become more indiscriminate and fear avoidance behaviors, kinesiophobia and pain catastrophizing are present from the beginning of a musculoskeletal injury and as such, should be identified early in the recovery stages by the clinician to decrease the likelihood that fear avoidance behaviors do not impede the recovery process (Table 3.9).

Table 3.9.
Pearson's Correlation of Kinesiophobia, Fear Avoidance and Pain Catastrophizing between Acute and Chronic Pain Patients.

	Acute Pain Population (N=10)	Chronic Pain Population (N=18)	Combined Pain Population (N=28)
Outcome Measure			
TSK-11 and AFAQ	.669^	.613*	.605*
PCS and AFAQ	.567	.802*	.648*

*** = Clinical Significance at .01 level; ^ = Clinical Significance at .05 level; TSK-11 = Tampa Scale; AFAQ = Athlete Fear Avoidance Questionnaire; PCS = Pain Catastrophizing Scale**

As I reflect back on the Spring-II semester, my clinical practice and growth, and patient outcomes illustrate my transition into a moderate novice clinician in regards to my understanding and competence as it relates to practice-based evidence, outcomes and future action research. My focus on gaining depth of MC and Fear Avoidance allowed me to enhance my clinical skills, reasoning, and confidence, and my patient care dramatically changed, as a result. Using my *a priori* has been a strong resource when considering the Fear Avoidance Model and CLBP in my clinical practice. Prior to the DAT program, I would have never considered or explored the psychological markers that may impede recovery from injury, as I often blamed the patient for their lack of response to treatment. I believe the evidence supports my ability to improve clinical care and practice. I am proud of my clinical practice growth and the continued impact I have on my patients and peers.

Final Reflection and Impact on Clinical Residency

Prior to enrolling in the DAT program, I was at a point in my career where I needed to make a decision. I could continue as an educator within a transitioning CAATE accredited AT undergraduate program to a professional Master of Science program or re-enter the clinical setting with stagnant clinical skills and modest abilities. I thoroughly enjoy teaching but I found myself becoming further removed from clinical practice and my ability to effectively educate students with current EBP and PBE was beginning to wane. Enter the DAT program.

I am not sure what I thought about the first day of the DAT program in July 2014 other than I knew “I was not in Kansas anymore.” Initially, I was concerned with the curricular expectations as I was someone who was extremely intelligent but had to work extraordinarily hard to achieve academic success in the classroom. What I quickly realized was the primary focus of the DAT program is on the advancement of clinicians, as scholarly practitioners. The DAT program dared me to overcome my fears, clinical practice weaknesses, and personal barriers. As a result, I became a more competent and confident athletic trainer.

I have grown monumentally as a clinician and I am confident I will one day reach advanced practitioner status. As an athletic trainer, conducting action research and creating *a priori* within my clinical practice has provided the platform to address numerous local clinical practice challenges. I no longer “go through the motions” when evaluating and treating patients. I have implemented a systematic approach that includes an algorithm, global assessments, and outcome measures.

What I have learned during my time in the DAT program, such as: completely re-thinking my approach to the way I evaluate and treat patients, to slowly mastering treatment paradigms, to constantly challenging my clinical reasoning and foundational knowledge, were some of the most valuable elements in my journey towards advanced practice. Since beginning the DAT, my ability to deliver sound and effective patient care has grown incrementally over the past 2 years and I have come to realize good clinical practice does not happen overnight, does not happen by attending every state and district convention, does not happen by attending “pseudo” workshops and does not happen simply by chance. The decision to pursue advance practice through the DAT has allowed me to become an athletic trainer who will finish their career by delivering patient care grounded in sound theory, clinical efficacy, reflective practice, and PBE. Overall, my clinical residency and time in the DAT program has fostered changes in my approach to clinical practice, and left me more fulfilled and passionate about my ability to deliver the type of patient care I always believed existed and can now provide.

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CHAPTER 4

An Exploratory Case Series Examining Mulligan Concept Positional Sustained Natural Apophyseal Glides on Patients Classified With Mechanical Neck Pain

By

Kari Odland, Dawn Andrews, James May, Alan Nasypany, Russell Baker, Eric Dinkins

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Abstract

Background and Purpose: Mechanical neck pain (MNP) is a common complaint in the athletic population. While symptoms may present at the cervical spine for patients complaining of MNP, thoracic spinal alignment or dysfunction may influence cervical positioning and overall cervical function. Traditionally, cervical high-velocity low-amplitude (HVLA) thrust manipulations have been utilized in the treatment of MNP, albeit a small level of inherent risk. Mulligan Concept positional sustained natural apophyseal glides (SNAGs) directed at the cervicothoracic region are an emerging treatment intervention utilized to treat patients with cervical pain and dysfunction as the evidence supporting an interdependent relationship between the thoracic spine and the cervical spine is growing. The purpose of this a priori case series was to evaluate disease and patient-oriented outcome measures of patients classified with MNP who were treated with the Mulligan Concept positional SNAGs while utilizing the thoracic Cleland et al. HVLA MNP CPRs. **Case Descriptions:** Ten consecutive patients classified with MNP were treated utilizing Mulligan Concept positional SNAGs. The Numeric Rating Scale (NRS), Patient Specific Functional Scale (PSFS), Neck Disability Index (NDI), Disablement in the Physically Active (DPAS), and Fear Avoidance Based Questionnaire – Physical Activity (FABQPA) were collected for inclusion criteria and identify patient-reported pain and dysfunction. **Outcomes:** Investigators conducted a one-way repeated measures ANOVA to evaluate the null hypothesis of no change in pain and function within treatment and between the three treatments of positional SNAGs. Positive patient-reported changes in pain (NRS), function (PSFS), and cervical range of motion (CROM) were observed immediately post-treatment (all sessions) as well as between treatments. **Discussion:** Based on the results of this case series, investigators conclude positional SNAGs directed at the cervicothoracic region may address a variety of patient reported symptoms for MNP, and the number of treatment sessions needed for symptom resolution may be closer to a single session rather than multiple treatments.

Key Words: Neck Pain, Treatment Intervention

Level of Evidence: 4 (Case Series)

Background and Purpose

Mechanical neck pain (MNP) is a musculoskeletal disorder that commonly affects the weekend warrior and high-level athlete alike. Patient-athletes report spinal pain and dysfunction at an equal or greater rate than the general population with estimates of up to 15% of all sports-related injuries.[1] Surveillance efforts in the athletic population have traditionally focused on traumatic cervical spine injuries[2,3] rather than pathology categorized as MNP. Mechanical neck pain is defined as: nonspecific pain in the area of the cervicothoracic junction without an identifiable pathoanatomical cause and most frequently requires that the pain be exacerbated by motion.[4-7] The subset of the athletic population hampered by MNP has been approximated at 36% of all neck pain,[8] and poses unique treatment challenges to the sports medicine clinician as limited evidence supporting effective interventions is available.[9] Although cervical spine manipulation, also referred to as high-velocity low-amplitude (HVLA) thrust is commonly employed in the treatment of patients with MNP, disagreement persists over the efficacy of the application.[10]

Compared to the cervical and lumbar regions, the thoracic spine is largely neglected in the research literature. Thoracic spine dysfunction is often overlooked due to complicated anatomy, biomechanics, function, proximity to vital organs, and articulation with ribs which can result in a number of false diagnoses and insufficient treatment.[11] Manual therapy intervention strategies such as HVLA thrusts are frequently based on theoretical models of mechanical dysfunction and elucidating symptoms which do not present at the thoracic spine.[12] As such, researchers and clinicians alike theorize that disturbances in joint mobility in the thoracic spine may be an underlying contributor to musculoskeletal disorders in the cervical spine providing the rationale to include HVLA thrust manipulation and/or non-thrust mobilization to the thoracic spine in the treatment of patients with MNP.[13]

Childs et al.[4,14] and Cleland et al.[15] investigated the utilization of thoracic HVLA thrusts on patients presenting with MNP to determine combinations of variables obtained from self-report measures, patient history, and clinical examinations that may lead to patients receiving long-term benefits from thoracic manual therapy. The result of the investigations was a set of clinical prediction rules (CPRs) which have yet to be validated, allowing further investigation of alternative manual therapy interventions for the treatment of MNP including the Mulligan Concept Mobilization with Movement (MWM).

The Mulligan Concept MWM treatment approach which combines passive accessory glides (i.e., mobilizations) with active movement is indicated to increase joint range of motion (ROM), decrease pain and enhance muscle function when treating musculoskeletal pain and/or dysfunction.[16-22] The rapid pain-relieving mechanical effect is primarily based on the presence of articular positional faults and realignment through MWMs to correct said faults.[22,23] Similarly, the Mulligan Concept sustained natural apophyseal glide (SNAG) technique has been reported to create sympathoexcitatory effects[24] and increases in ROM[25] when treating musculoskeletal dysfunction at the spine. As the neurophysiological effects of SNAGs such as immediate hypoalgesia and an increase in pressure pain thresholds have been highlighted in the research,[26,27] the use thoracic SNAGs is recommended as a suitable manual therapy technique to treat patients classified with MNP.[19,23]

At this time, no attempts have been made to examine the effect of positional SNAGs directed at the cervicothoracic region on pain and disability in patients classified with MNP. Additionally, limited comparisons have been investigated between SNAGs and HVLA treatment interventions for the treatment of MNP.[19,23] The purpose of this a priori case series was to evaluate disease and patient-oriented outcome measures of patients classified with MNP who were treated with the Mulligan Concept positional SNAGs while utilizing the thoracic Cleland et al.[15] HVLA MNP CPRs.

Description of Cases: Participant History and Systems Review

The primary investigators of this multi-site case series included 10 consecutive patients (7 males, 3 females) representing a variety of sports ranging in age from 14-20 years (mean = 16.5 ±1.78) who presented to the clinic with complaints of MNP (Table 1). All patients reported neck pain of a non-traumatic musculoskeletal nature within the previous 30 days but did not seek treatment for the current presentation of MNP. All patients were evaluated in the same manner to determine eligibility for inclusion. Outcome measures and range of motion (ROM) were collected for all consenting patients enrolled in the study. The same Mulligan Concept positional SNAG treatment protocol was utilized for all patients. No other intervention (e.g., stretching, modalities) was applied and no modifications of activity were imposed. Each participant provided informed consent to use their patient case and data for publication. Participant confidentiality was protected according to the United States' Health Insurance Portability and Accountability Act (HIPPA).

Clinical Impression #1

Mechanical Neck Pain (MNP) treatments commonly focus on reducing soft tissue (e.g., muscle, tendon) irritability to improve facet joint function**.** As the patients had not reported any previous treatment for the current presentation of MNP and experienced symptoms of a non-traumatic cervical musculoskeletal injury within the last 30 days, the cause of the patient's chief complaint was hypothesized to be a result of an articular 'positional fault'. Further evaluation needed to be performed to determine whether the subjects presented with a 'positional fault' versus a soft tissue restriction based on traditional evaluation techniques.

Examination

Investigators began the examination by administering the Numeric Rating Scale (NRS), Neck Disability Index (NDI), Patient Specific Functional Scale (PSFS), Disablement in the Physically Active Scale (DPAS), Fear Avoidance Based Questionnaire – Physically Active (FABQPA) outcomes measures as well as collecting patient-reported history relating to duration, mode of onset, nature of symptoms, and aggravating/relieving factors. Physical examination included postural assessment, special tests for the cervical spine (Table 2), and cervical ROM (Table 3). Inclusion in the study occurred if patients met 2 or more of the classification-based inclusion criteria established by Cleland et al.[15] (Table 4) plus specified scores on the NDI, NRS, and PSFS (Table 5). Patients were excluded from the study if they met any of the exclusion criteria listed in Table 6.

The treating athletic trainers have an average of 12 years of clinical experience, and both completed 3 Mulligan Concept Upper Extremity courses that included practical training in the use of cervical and thoracic positional SNAGs. To ensure that all examination, outcome assessments, and treatment technique were performed in a standardized fashion, both investigators submitted video recordings to the principle investigator as well as separate video recordings to a Mulligan Concept Teachers Association (MCTA) certified practitioner to establish face validity and consistency between the investigating clinicians performing positional SNAGs. In addition, investigators consistently implemented procedures, such as establishing a standard body position with a neutral head and neck position at the start of each motion measurement, to minimize variability in CROM measurement.

After consent was obtained and inclusion was established, each patient assessment to determine the vertebral level of treatment began by the clinician first assessing spinous process tenderness at C2-T4 vertebral levels, followed by the patient performing cervical flexion, extension, and rotation while the clinician palpated for vertebral hypomobility. The matched level of spinous process tenderness and hypomobile segment was deemed the initial treatment level. The clinician completed a single sub-therapeutic dose of the positional SNAG, at the established treatment level (assessed hypermobile segments) and corresponding side of the most painful cervical ROM self-selected by the patient. The clinician started by placing thumb on the higher ipsilateral side (ROM restriction) segments and opposite thumb on the lower contralateral side of the spinous process and provided the translational direction of the glide (Figure 1) while patient actively performed previously reported restricted ROM. In the event the patient did not report a pain-free, immediate and long-lasting (PILL) effect to the sub-therapeutic treatment the clinician made adjustments (e.g., re-directed angle and/or intensity) to the positional SNAG to meet the necessary PILL effect. Inability to elicit a pain-free response at the originally assessed level caused the clinician to move to the next vertebral level directly adjacent to the originally assessed segment and provide another single sub-therapeutic positional SNAG. A maximum of three consecutive vertebral levels was assessed, and the treatment level was determined as the level in which the sub-therapeutic dosage of the positional SNAG the patient reported the PILL effect.

Clinical Impression #2

Investigators developed the working clinical diagnosis of MNP based on ROM measurements, mechanism for onset of symptoms, and patient-reported history. Investigators focused treatment to the cervicothoracic region theorizing that the utilization of Mulligan Concept positional SNAGs may assist in treating dysfunction of the cervicothoracic region related to MNP.

Outcome Measures

To evaluate the effect of treatment for MNP, clinicians utilized patient-reported outcome measures to assess perceived levels of pain (NRS) and functional disability (PSFS) as well as disease-oriented outcomes (i.e., active cervical ROM) to measure cervical function and global efficacy of treatment (GRoC Scale). Investigators utilized minimal clinically important differences (MCIDs) and minimal detectable change (MDC) to interpret patient-reported outcomes measures including the benefits derived from treatment, the impact upon the patient, and the implications for clinical management of the condition. Outcome measurements were collected at the initial evaluation, post 3rd treatment, and two-week follow-up visits. A description of each outcome measure is listed in Table 7.

Intervention

Treatment began at the vertebral level determined during the patient evaluation and sub-therapeutic positional SNAG assessment (Table 8). The investigator provided verbal instructions for the patient to move into the previously restricted motion and provide over-pressure at the end-range of motion while the investigator maintained the transverse glide for a set of 10 repetitions (Figure 2). After the patient clearly understood treatment parameters and the importance of a pain-free treatment, each patient was treated therapeutically. Upon completion of the first set of 10 repetitions, the patient rested for one minute. The clinician then re-applied the positional SNAG at the previously identified level for a total treatment of 3 sets of 10 repetitions with one-minute rest between sets. Total treatment time was less than 5 minutes.

Each patient was treated three times with at least 24 to 72 hours separating each treatment. During each treatment session, both pre and post treatment outcome measures for NRS, and PSFS were collected while CROM was recorded before each treatment session only. All patients returned after 24 hours and two weeks following the third treatment to assess both short term and long term effects on pain and function.

Data Analysis

All data was analyzed using SPSS version 22.0 (SPSS Inc., Chicago, IL, USA). One-way repeated measures analysis of variance (RM-ANOVA) tests were conducted to evaluate the effect of MC SNAGs on the NRS, PSFS, and CROM across time. Mean differences from the initial visit scores and 95% confidence intervals (CIs) were calculated for the NRS, PSFS, and CROM for post 3rd treatment and a two-week follow-up. Significant changes were further analyzed with Bonferroni post hoc testing. Prior to data analysis, normality of distribution was assessed and the alpha level was set at $p < .05$. Effect size differences were computed with partial eta squared (η_p^2). A small effect size is $\eta^2 = 0.02$; medium effect size is $\eta^2 = 0.\ 13$; large effect size is $\eta^2 = 0.26$.[28]

Outcomes

Numeric Rating Scale

Application of Mulligan Concept SNAGs resulted in statistically significant improvements in pain (NRS) over time [Wilks' Lambda = .075, F (3, 7) = 28.97, $p < .001$, η_p^2 = .925, power = 1.00] (Table 10). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated χ^2 (5) = 18.11, p = .003); therefore, a Greenhouse-Geisser correction was applied [F (2.054, 18.48) = 42.31, p = .000, η_p^2 =.825, power = 1.00]. The mean changes in NRS scores from initial visit to post 1st treatment (M = 4.40, 95% CI [2.14 - 6.65], p = .001), from initial visit to post 3rd treatment (M = 5.30, 95% CI [3.48 - 7.11], p = .001), and from initial visit to two-week follow-up visit (M = 5.07, 95% CI [3.12 - 7.02], p = .001) were significant. Further analysis revealed 8/10 patients achieved significant clinical and statistical improvement in pain (4-point reduction) exceeding the minimal clinically important difference (MCID)[29] post 1st treatment. An additional 0.90-point improvement was achieved post 3rd treatment, and all patients (10/10) maintained their clinical gains at the two-week follow-up examination. Overall effect size for pain was 0.91 (Table 10).

Patient Specific Functional Scale

Application of Mulligan Concept SNAGs also produced statistically significant improvements in function (PSFS) over time (Wilks' Lambda = .075, F (3, 7) = 28.89, p = .001, η_p^2 = .925, power = .1.00) (Table 11). The mean changes in PSFS scores from initial visit to post 1st treatment (M = 2.35, 95% CI [4.28 - .414], p = .05), from initial visit to post 3rd treatment (M = 4.60, 95% CI [6.26 - 2.94], p = .001), and from initial visit to two-week follow-up (M = 4.80, 95% CI [6.35 - 3.25], p = .001) were significant. The mean change in PSFS scores from initial exam to two-week follow-up exam exceeded the MDC value on the PSFS.[30] Of greater clinical relevance for the MDC values, 6/10 of patients reported a PSFS score that exceeded the MDC value (3.5-point improvement) after the 1st treatment. After the

3rd treatment, 9/10 of patients reported a score of 9 or higher, with 10 representing the highest score possible. At the two-week follow-up, 10/10 of patients reported a score of 10. Overall effect size for function was 0.91 (Table 11).

Active Range of Motion

The Mulligan Concept SNAG treatment produced statistically significant changes in overall cervical extension over time (Wilks' Lambda = .157, F (3, 7) = 12.51, p = .003, η_p^2 = .646, power = .989) (Table 12). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated χ^2 (5) = 20.82, p = .001; therefore, a Greenhouse-Geisser correction was applied [F (1.463, 13.16) = 16.39, p = .001, η_p^2 =.646, power = .989]. The mean changes in overall cervical extension scores from initial visit to post 1st treatment (M = 13.44, 95% CI [33.31 - 6.43], p = .05) was not significant. However, mean changes from initial visit to post 3rd treatment (M = 27.05, 95% CI [46.86 - 7.23], p = .01), and from initial visit to two-week follow-up visit (M = 28.68, 95% CI [50.47 - 6.88], p = .01) were significant.

Overall cervical flexion also improved over time as statistically significant changes were reported (Wilks' Lambda = .213, F (3, 7) = 8.63, p = .01, η_p^2 = .787, power = .905) (Table 12). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated χ^2 (5) = 16.87, p = .005; therefore, a Greenhouse-Geisser correction was applied [F (1.340, 12.05) = 7.71, p = .012, η_p^2 =.462, power = .794]. The mean changes in overall cervical flexion scores from initial visit to post 1st treatment (M = 12.60, 95% CI [30.50 - 5.30], p = .05), from initial visit to post 3rd treatment (M = 23.12, 95% CI [44.14 - 2.09], p = .05), and from initial visit to two-week follow-up visit (M = 16.07, 95% CI [41.89 - 8.49], p = .05) were significant. Patient-reported cervical flexion restriction (N=4) when isolated, produced greater changes over time (Wilks' Lambda = .047, F (3, 1) = 6.759, p = .001, η_p^2 = .899, power = 1.00) than overall cervical flexion. Additionally, the mean changes in patient-reported cervical flexion restriction scores from initial visit to post 1st treatment (M = 29.20, 95% CI [73.74 – 15.34], p = .05), from initial visit to post 3rd treatment (M = 40.45, 95% CI [86.67 – 5.74], p = .05), and from initial visit to two-week follow-up visit (M = 37.20, 95% CI [80.33 – 5.93], p = .05) were significant.

In addition, statistically significant changes in overall cervical right rotation were produced utilizing Mulligan Concept SNAGs (Wilks' Lambda = .152, F (3, 7) = 13.04, p =

.01, η_p^2 = .848, power = .982) (Table 12). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated χ^2 (5) = 11.99, p = .036; therefore, a Greenhouse-Geisser correction was applied [F(1.648, 14.83) = 21.51, *p* = .000, η_p^2 =.705, power = .999].The mean changes in overall cervical right rotation scores from initial visit to post 1st treatment (*M* = 12.50, 95% CI [26.26 - 1.26], *p* = .05), from initial visit to post 3rd treatment (*M* = 19.82, 95% CI [30.91 - 8.72], *p* = .001), and from initial visit to two-week follow-up visit (*M* = 22.15, 95% CI [35.69 - 8.60], *p* = .001) were significant.

The Mulligan Concept SNAG treatment also produced statistically significant changes in overall cervical left rotation (Wilks' Lambda = .122, *F* (3, 7) = 16.74, *p* = .001, η_p^2 = .878, power = .996) (Table 12). The mean changes in overall cervical left rotation scores from initial visit to post 1st treatment (*M* = 8.65, 95% CI [19.20 - 1.90], *p* = .05), from initial visit to post 3rd treatment (*M* = 17.22, 95% CI [30.21 - 4.22], *p* = .01), and from initial visit to two-week follow-up visit (*M* = 26.55, 95% CI [39.72 - 13.38], p = .001) were significant. Patient-reported cervical left rotation restriction (N=5) when isolated, produced greater changes over time (Wilks' Lambda = .010, *F* (4, 1) = 24.17, *p* = .001, η_p^2 = .990, power = .992) than overall cervical left rotation. Mauchly's test of sphericity indicated that the assumption of sphericity had not been violated $\chi 2$ (9) = 13.09, p = .248; therefore, a Greenhouse-Geisser correction was applied [F(1.796, 7.183) = 8.920, p = .001, η_p^2 =.690, power = .864]. Additionally, the mean changes in patient-reported cervical left rotation restriction scores from initial visit to post 1st treatment (M = 8.70, 95% CI [32.63 – 15.23], p = .05), from initial visit to post 3rd treatment (M = 18.30, 95% CI [60.60 – 23.88], p = .05), and from initial visit to two-week follow-up visit (M = 28.50, 95% CI [65.20 – 8.20], p = .05) were not significant. Medium to large effect sizes were reported for overall AROM (CEXT = 0.64, CRROT = 0.70, CLROT = 0.87), while a medium effect size was reported for overall AROM (CFLEX = 0.46) which demonstrates that 46 to 87% of the variance in AROM measurements could be explained by MC SNAG treatment.

Secondary to investigating the effects of positional SNAGs on MNP, we examined whether the 6 predictor variables identified by Cleland et al. (2007) correspond to current patient-reported symptoms and outcomes. The results of this case series illustrate that the Cleland et al.[15] CPR did not need to be fully satisfied to achieve a positive outcome. Cleland recommends for a successful treatment utilizing HVLA thrusts to occur a minimum of 4 predictive variables (93% posttest probability of success) should be present, however the subjects in this case series reported a mean of 3 predictor variables (Table 12) and reported treatment success.

Discussion

In this exploratory multi-site case series two novice practitioners of the Mulligan Concept utilized positional SNAGs at the cervicothoracic region to treat patients complaining of pain and disability at the cervical spine initially classified with MNP. All participants in this case series reported both clinically and statistically significant improvement across outcome measures of pain, function, and CROM. The evidence provided in this case series significantly outperformed evidence previously reported[31-36,39] on the effects of treating MNP utilizing thoracic HVLA manipulations after the 1st treatment. Those previous investigations reported effect sizes ranging from .17 to .54 (small to moderate) for pain scores on the NRS whereas a .91 effect size (large) was achieved during this case series investigation. Direct comparison of pain scores in the previous studies is difficult due to the time intervals in which post 1st treatment results were reported. The time intervals ranged from 24-hour, 48-hour, and 1-week time intervals[31-36,39] whereas pain scores during this case series were collected immediately post 1st treatment session.

Important to daily activity and sport specific activities, all participants reported clinically and statistically significant improvements with function (PSFS) and CROM at both post 1st treatment and at two-week follow-up (Tables 11,12,13). Investigators of previous studies did not report measures of function making comparison difficult; however, a .92 (large) effect size and improvement in patient reported function in this case series exceeded the established MDC[30] for the PSFS immediately post 1st treatment, at post 3rd treatment, and the improvement was maintained at 2-week follow-up (Table 9). The improvements in CROM were similar. After the first treatment, ROM improvements met previously established MDCs of 7.0º for extension, 9.6º for flexion, 7.6º for right rotation, and 6.7º for left rotation.[37,38] El-Sodany et al.[36] reported a “significant difference” in range of motion in flexion, extension and rotation after 6 weeks of treatment, and Izquierdo-Perez et al.[39] applied a total of 4 cervical SNAG treatment sessions over 2 weeks, reporting increases in flexion by 8.3º, extension by 13.3º, and rotation (combined) by 12.6º after the initial treatment. In this case series, overall CROM measurement increases (12.6° for flexion, 13.4° for extension, and 10.5° for combined rotation) as well as effect size were equal to the results reported by Izquierdo-Perez et al.[39] within the first treatment session. However, our overall CROM measurement increases (23.1° for flexion, 27° for extension, and 18.5° for combined rotation) as well as effect size outgained those of Izquierdo-Perez et al.[39] post 3rd treatment (11.5° for flexion, 20° for extension, and 11.6° for combined rotation) (Table 13).

Isolation of the patients' reported direction of CROM restriction for cervical flexion revealed a trend toward a greater increase in ROM and effect size over time whereas cervical left rotation demonstrated only minimal clinical gains (Table 14). Hypothesized reasons for the reported large clinical gains for those with restricted cervical flexion include: 1) the mobilization with movement towards the restricted area utilizing positional SNAGs technique, 2) possible increase in one direction of motion leading to a carry-over effect to the other CROM through restoration of normal biomechanics within the cervicothoracic region, 3) and a "ceiling effect" to the increased range of motion within the overall cervical flexion ROM group as those patients who did not demonstrate significant losses in the overall cervical flexion ROM group under-valued clinical improvement demonstrated in cervical flexion restriction group.

The current case series also reports the longest follow-up period to date for Mulligan Concept SNAGs in the clinical population. Following the third treatment session patients returned to full activity without restriction and reported maintained clinical gains at the two-week follow-up session for pain, function, and CROM (Tables 10, 11, 12, 13). Patients also reported improvement on the GROC at the 2-week follow-up (Figure 3) which indicate the lasting clinical effects of positional SNAGs.

A potential predictor for the success of the SNAG intervention in MNP may be the duration of symptoms. Flynn et al.[13] identified duration of current episode as the strongest predictor for identifying patients with low back pain who are likely to experience a rapid and dramatic response to lumbar HVLA thrusts, and Cleland et al.[40] also demonstrated that a shorter duration of symptoms was predictive for identifying patients with cervical neck pain who would respond to thoracic HVLA thrusts. During this case series, intervention for the majority (n = 7) of MNP occurred within 24 hours of symptom onset, and in some cases (n = 3) immediately after sustaining non-traumatic cervical trauma. The clinical and statistical improvement reported after the first treatment session may indicate that intervention within 24 hours of onset of symptoms utilizing the positional SNAG technique directed at the cervicothoracic region may result in greater reduction of symptoms, as SNAGs reduce soft tissue inflammation, induce relaxation and improve function before restricted movements, tissue irritability, and compensatory patterns set in.[41] This may be especially meaningful for clinicians who provide acute assessment and care on patients by providing immediate changes that are long lasting in patient outcomes opposed to the previously reported timeline of 4-6 weeks of treatment intervention if access to treatment is delayed.[31-36]

Limitations and Further Investigation

The primary limitation of this study is the lack of two comparison groups receiving HVLA manipulations and a control group along with those receiving positional SNAGs to treat MNP. The majority of current information and data regarding SNAGs are in the form of randomized control studies utilizing unilateral cervical SNAGS, and no research has been completed to determine the effects of positional SNAGs on patient complaining of MNP. Further examination in the form of controlled trials is necessary to determine whether different SNAGs application procedures (e.g., increased or decreased load and treatment length) produces similar patient outcomes.[39,42]

Potential bias of practitioners and patients is also a limitation of this study. In situations of Mulligan Concept positional SNAGs, it is difficult if not impossible to prevent bias associated with blinding, as each clinician knows which treatment they are providing. One example of subjective measurement bias is named the “hello-goodbye” or “Hawthorne” effect, in which the patient initially exaggerates symptoms to justify their request for treatment. Subsequently, the person may minimize any problems that remain, either to please the clinician or out of cognitive dissonance in which patients modify or improve an aspect of their behavior in response to their awareness of being observed.[49-51]

In this study, a CPR proposed by Cleland et al.[15] was utilized as a guide to identify patients complaining of MNP who may benefit from positional SNAGs directed at the cervicothoracic region. While this study utilized the Cleland et al. (2007) CPR, two limitations must be discussed: 1) The CPR was originally intended as a means of predicting variables to identify patients with neck pain likely to benefit from HVLA manipulation not SNAGs; and 2) The CPR has not been validated in subsequent studies.[43] Numerous clinical guidelines are present in the literature regarding spinal pain, yet a lack of consensus exists regarding their effectiveness due to wide variability of spinal therapy interventions. Further research is needed to identify a valid CPR for the treatment of MNP using the positional SNAG technique.[44-46]

Utilizing the Cleland et al.[15] CPR may also have limited the population size, however utilizing a multi-center approach improves the likelihood of finding subjects matching the inclusion criteria.[47] The danger of a small number of patients is the label of "pilot study" indicating a study is conducted to determine the feasibility of a larger scale study rather than evaluating the effect of a treatment.[47] While the sample size in our case series was small, we feel it was sufficient to produce statistically significant and clinically meaningful outcomes keeping in mind a that larger sample size is preferable to narrow confidence intervals and be more representative of the population. In addition, we chose to be conservative with our statistical analyses and used a Bonferroni correction. Despite this approach, our results demonstrated significant differences within-subjects on outcome measures at all follow-up points.

We conducted this case series to serve as a preliminary step in the investigation of the effects of positional SNAGs in patients classified with MNP in the athletic population. The statistically significant and clinically meaningful changes occurred over a short time frame among patients who received positional SNAGs which bolsters the argument that these changes are likely relevant for patients with MNP, providing impetus for future research in this area.

Conclusion

While further research is necessary, the positive results reported in this case series provide support for Mulligan Concept positional SNAGs as an efficacious treatment option for patients presenting with MNP, regardless of a patient's status on the CPR. Our results support and reinforce the fact that positional SNAGs have positive effects on patients classified with MNP. Those who received positional SNAGs exhibited substantial reductions in pain after 1 treatment and meaningful improvements in function after 3 treatments that were both statistically and clinically significant.

Figure 4.1. ***Hand Placement direction of glide for (Left Side) Positional SNAG***

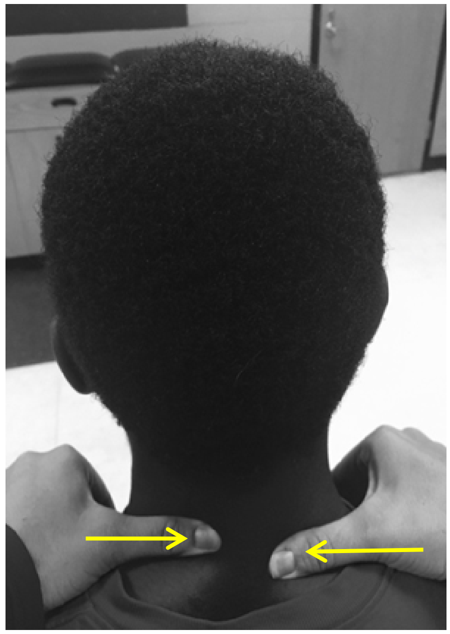


Figure 4.2. ***Positional SNAG with Patient Applied Over-Pressure***

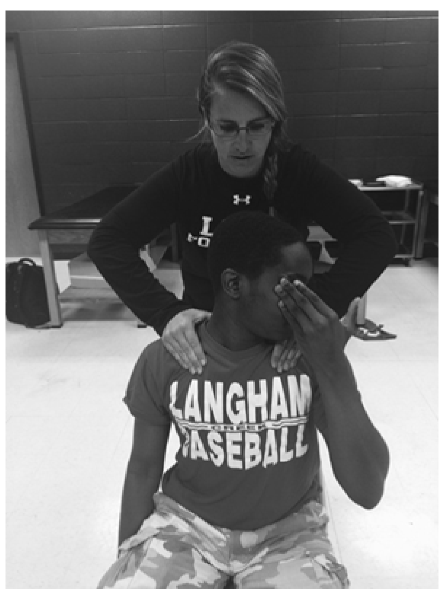
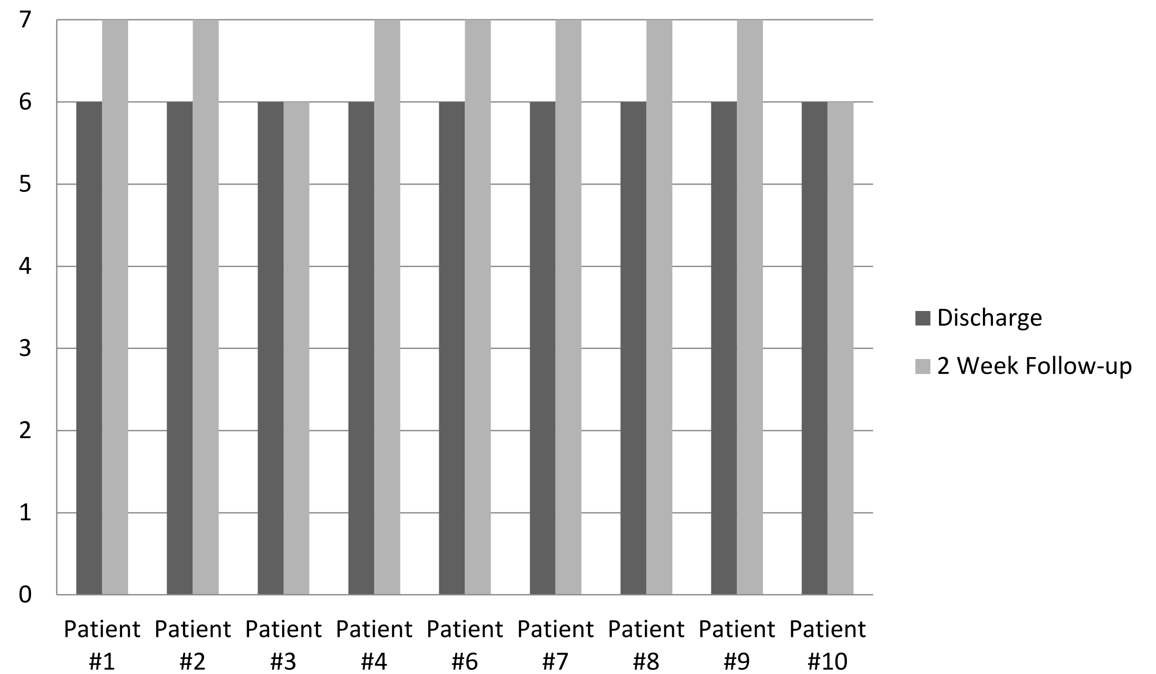


Figure 4.3. *Global Rating of Change Scale (GROC)*



0 = About the same; 1 = A tiny bit better; 2 = A little bit better; 3 = Somewhat better; 4 = Moderately better; 5 = Quite a bit better; 6 = A great deal better; 7 = A very great deal better

Table 4.1. *Demographic Information for Patients Complaining of Mechanical Neck Pain*

Patient	Athletic Participation Level	Sex	Age	Sport	Mode of Onset	Mechanism of Injury
1	SS	Male	17	FB	Mechanical	Unknown
2	SS	Male	17	FB	Mechanical	Unknown
3	SS	Male	16	FB	Mechanical	Flexion
4	SS	Male	14	WR	Mechanical	Extension
5	SS	Female	14	XC	Mechanical	Rotation
6	SS	Female	17	WR	Mechanical	Flexion
7	SS	Female	16	WR	Mechanical	Flexion
8	SS	Male	16	WR	Mechanical	Flexion
9	SS	Male	18	WR	Mechanical	Flexion
10	COL	Male	20	BSB	Static	Flexion

Note: SS =Secondary School; COL= Collegiate; FB = Football; WR = Wrestling; XC = Cross Country; BSB = Baseball

Table 4.2. *Baseline Physical Examination Results of Postural Examination and Special Tests for Cervical Spine*						
Patient	**Postural Examination**	**Special Tests for Cervical Spine**				
		Spurling's	**Cervical Distraction**	**Cervical Flexion-Rotation**	**Spring**	**Upper Limb Neural Tension**
1	Normal	Negative	Negative	Negative	Negative	Negative
2	Normal	Negative	Negative	Negative	Negative	Negative
3	Normal	Negative	Negative	Negative	Negative	Negative
4	Normal	Negative	Negative	Negative	Negative	Negative
5	Normal	Negative	Negative	Negative	Negative	Negative
6	Normal	Negative	Negative	Negative	Negative	Negative
7	Normal	Negative	Negative	Negative	Negative	Negative
8	Normal	Negative	Negative	Negative	Negative	Negative
9	Normal	Negative	Negative	Negative	Negative	Negative
10	Normal	Negative	Negative	Negative	Positive	Negative

Table 4.3. *Physical Examination Results of Cervical Range of Motion Measurements at Baseline*				
Patient	**CFLEX**	**CEXT**	**CROT R**	**CROT L**
1	82.8°	85.4°	81°	66°
2	70.6°	74.9°	70°	70°
3	37.2°	61°	61°	61°
4	14.7°	30°	50°	48°
5	34.5°	54.6°	72°	53°
6	68.8°	53.9°	62°	71°
7	56.6°	40.9°	52°	51.5°
8	59.1°	45.8°	79°	41°
9	45.1°	82.8°	69°	56°
10	31°	51°	77°	67°
Mean	50.04°	58.03°	67.30°	58.45°

CFLEX = Cervical Flexion; CEXT = Cervical Extension; CROT R = Cervical Rotation Right; CROT L = Cervical Rotation Left

Table 4.4. *Patient Responses to Inclusion Criteria*

Patient	Absence of Symptoms Distal to Shoulder	Symptoms < 30 Days	Looking Up Does Not Aggravate Symptoms	FABQPA < 12	Diminished Upper Thoracic Spine Kyphosis	Cervical Extension < 30º
1	Positive*	Positive*	Positive*	Positive*	Negative	Negative
2	Positive*	Positive*	Positive*	Positive*	Negative	Negative
3	Positive*	Positive*	Positive*	Negative	Negative	Negative
4	Positive*	Positive*	Positive*	Positive*	Negative	Negative
5	Positive*	Positive*	Positive*	Negative	Negative	Negative
6	Positive*	Positive*	Positive*	Negative	Negative	Negative
7	Positive*	Positive*	Positive*	Negative	Negative	Negative
8	Positive*	Positive*	Positive*	Negative	Negative	Negative
9	Positive*	Positive*	Positive*	Negative	Negative	Negative
10	Positive*	Negative	Positive*	Negative	Negative	Negative

* = Meets Cleland et al (2007) CPR

Table 4.5. *Inclusion Criteria*

Inclusion required 2 or more of criteria from column A and all from column B	
A (Cleland et al. 2007)	**B**
Absence of upper extremity symptoms distal to shoulder	Neck Disability Index ≥ 10%
Onset of symptoms < 30 days	Numeric Rating Scale ≥ 3
Looking up does not aggravate symptoms	Patient Specific Functional Scale ≤ 7
FABQPA score < 12	
Diminished upper thoracic spine kyphosis	
Cervical extension ROM < 30º	

Table 4.6. *Exclusion Criteria*
Exclusion Criteria
Medical “red flags” indicating non-musculoskeletal etiology (e.g., suspected fracture)
Positive Spurling’s or Cervical Distraction Test
History of whiplash within 6 weeks of examination
Diagnosis of cervical spinal stenosis
Evidence of CNS involvement (e.g., decreased neurological response distal to shoulder)

Table 4.7. *Description of Outcome Measures*	
Outcome Measure	**Description**
Numeric Rating Scale (NRS) (Downie, Leatham, Rhind, et al., 1994; Jensen, Karoly & Braver, 1986; Jensen, Miller & Fisher, 1998; Jensen, Turner & Romano, 1994; Katz & Melzack, 1999; Price, Bush, Long, et al., 1994; Farrar, Young, LaMoreaux, Werth & Poole, 2001)	A unidimensional 11-point scale to measure pain intensity in adults and is anchored on the left (score of 0) with the phrase "no pain" and on the right (score of 10) with the phrase "worst imaginable pain". Numeric pain rating scales have been shown to yield reliable and valid data and shown to be the most responsive (effect size 0.86) Normative data values of the NRS have not been reported in the current literature. Intraclass correlation coefficient (ICC) for test re-test is 0.68 for the NRS in a broad population of patients with various musculoskeletal conditions. The NRS will be used to capture the subjects' perceived level of pain as a result of their mechanical neck pain.
Patient Specific Functional Scale (PSFS) (Novak, Anastakis, Beaton, Mackinnon & Katz, 201; Chatman et al., 1997)	Provides a method for eliciting, measuring, and recording descriptions of patients' disabilities. The 11-point scale allows patients to rate their ability to complete an activity (0-10) at a level experienced prior to injury or change in functional status. The lower the score the greater the functional impairment. Normative data values of the PSFS in patients with upper extremity nerve injury included a mean score of 3.1 with a range of 0-10. Intraclass correlation coefficient (ICC) for test re-test is 0.92
Fear Avoidance Beliefs Questionnaire (FABQ) (Fritz & George, 2002; Lethem, Slade, Troup, Bendey, 1983; Waddell, Newton, Henderson, Somerville, & Main, 1993; Dedering & Borjesson, 2012; George & Stryker, 2011; Nederhand et al., 2004; Waddell, et al., 1993)	Attempts to explain why some patients with acute painful conditions can recover while other patients develop chronic pain from such conditions. The FABQ measures patients' fear of pain and consequent avoidance of physical activity because of their fear. This questionnaire consists of 16 items, with each item scored from 0-6. Higher scores on the FABQ are indicative of greater fear and avoidance beliefs. Normative data values in patients with cervical radiculopathy reported a FABQ-W mean score of 25 and a FABQ-PA mean score of 18. Intraclass correlation coefficient (ICC) for test re-test is 0.97. The FABQ will be used to quantify the subject's belief about the influence of work and activity on their MNP.
Neck Disability Index (NDI) (MacDermid, Walton, Avery, et al., 2009; Vernon & Mior, 1991; Kato, et al., 2012; Cleland et al., 2007; Jette & Jette, 1996; Riddle & Stratford,1999; Stratford et al., 1999; Vernon & Mior, 1991; Westaway et al., 1998)	Is the most widely used condition-specific disability scale for patients with neck pain and consists of 10 items addressing different aspects of function, each scored from 0 to 5, with a maximum score of 50 points. Higher scores represent increased levels of disability. The NDI has been demonstrated to be a reliable and valid outcome measure for patients with neck pain. Normative data values for the NDI include a mean score of 6.98 and cut-off value to detect neck pain associated with disability to be 15. Intraclass correlation coefficient (ICC) for test re-test is 0.68 for the NDI and has been shown to be a valid health outcome measure in a patient population with mechanical neck pain. The NDI will be used to capture the subjects' perceived level of disability as a result of reported MNP.
Global Rating of Change (GROC) (Jaeschke, Singer & Guyatt, 1989; Kamper, 2009; Hurst & Bolton, 2004; Jaeschke et al., 1999; Stratford, Binkley, Riddle, 1998; Costa, 2008)	Is a retrospective, patient-report, 15-point rating scale used to report the degree of perceived change in status). The scale involves a single question that asks the patient to rate their change with respect to a particular condition over a specified time period. The scale ranges from -7 ("a very great deal worse") to 0 ("about the same") to +7 ("a very great deal better"). It has been reported that scores of +4 and +5 are indicative of moderate changes in patient-perceived status and that scores of +6 and +7 indicate large changes in patient status. Intraclass correlation coefficient (ICC) for test re-test is 0.90 and correlation with the NRS is moderate (r = 0.49). The GROC will be used to establish whether a participant has experienced clinically meaningful change over time.

Table 4.8. *Positional SNAG Treatment Level*	
Patient	**Treatment Level**
1	C7
2	C5
3	C5
4	T1
5	C6
6	C6
7	T1
8	T4
9	C6
10	C5

Table 4.9. *Numeric Rating Scale (NRS) and Patient Specific Functional Scale (PSFS) Data from Initial Evaluation to 2 Week Follow-up*

	Numeric Pain Rating Scale (NRS)				**Patient Specific Functional Scale (PSFS)**			
Patient	**Initial Evaluation**	**Post 1st Treatment**	**Post 3rd Treatment**	**2 Week Follow-up**	**Initial Evaluation**	**Post 1st Treatment**	**Post 3rd Treatment**	**2 Week Follow-up**
1	8	0*	0	0	2	5†	10‡	10
2	4	0*	1	1.3	7	7.7	10‡	10
3	4	3	0**	0	4	10†	10‡	10
4	6	0*	0	0	5.5	7.8†	10‡	10
5	6	4*	0	0	5.5	6.5	10‡	10
6	7	3*	0	0	5	6	8‡	10
7	6	0*	0	0	5	8.5†	10‡	10
8	6	0*	0	0.16	6	6	10‡	10
9	4	0*	0	0	5	9†	10‡	10
10	3	0*	0	0.16	7	9†	10‡	10
Mean	5.4	1	0	.16	5.2	7.5	9.8	10

* - MCID Achieved after first treatment; MDIC = 2-point change for NRS
** - MCID Achieved by Post 3rd Treatment
† - MDC Achieved after first treatment; MDC = 2-point change for PSFS Average Activity Score
‡ - MDC Achieved by Post 3rd Treatment

Table 4.10. *Statistical and Clinical Significance for Pain from Baseline to 2-Week Follow-up*

	Initial Evaluation	**Post 1st Treatment**	**Post 3rd Treatment**	**2-Week Follow-up**	**Total Mean Change**	**MDIC**	***p*-value**	**Partial Eta Squared**
NRS	5.40	1.00	.100	.330	5.07	2	<.001*	0.91

NRS = Numeric Pain Rating Scale; MDIC = Minimal Clinically Important Difference

Table 4.11. *Statistical and Clinical Significance for Function from Baseline to 2-Week Follow-up*

	Initial Evaluation	**Post 1st Treatment**	**Post 3rd Treatment**	**2-Week Follow-up**	**Total Mean Change**	**MDC**	***p*-value**	**Partial Eta Squared**
PSFS	5.20	7.55	9.80	10.00	4.80	2	<.001*	0.92

PSFS = Patient Specific Functional Scale; MDC = Minimal Detectable Change

Table 4.12. *Cervical Range of Motion Mean Values and Within-Subjects Effects of Positional SNAGs*

	Initial Evaluation	**Post 1st Treatment**	**Post 3rd Treatment**	**2-Week Follow-up**	**Total Mean Change**	**MDC**	***p*-value**	**Partial Eta Squared**
CROM-EXT	58.0°	71.4°	85.0°	86.71 °	28.6°	7.0°	.003**	0.64
CROM-FLEX	50.0°	62.2°	73.1°	66.74 °	16.7°	9.6°	.009**	0.46
CROM-ROT L	58.4°	67.1°	75.6°	85.00 °	26.5°	6.7°	.001**	0.87
CROM-ROT R	67.3°	79.8°	87.1°	89.45 °	22.1°	7.6°	.002**	0.70

MDC = Minimal Detectable Change

Table 4.13. *Cervical Range of Motion Mean Change Values and Effect Size*

	Post 3rd Treatment Mean Change	**Partial Eta Squared**	**Izqueirdo-Perez et al. (2014)**	**Partial Eta Squared**
CROM-EXT	27°	.64	20°	.31
CROM-FLEX	23.1°	.46	11.5°	.31
COMBINED CERVICAL RIGHT/LEFT ROTATION	18.5°	.78	11.6°	.25

Table 4.14. *Cervical Range of Motion Mean Values for Cervical Flexion Restriction Only*								
	Initial Evaluation	**Post 1st Treatment**	**Post 3rd Treatment**	**2-Week Follow-up**	**Total Mean Change**	**MDC**	***p*-value**	**Partial Eta Squared**
CROM-FLEX	32.0º	61.2º	72.4º	69.2 º	37.2°	9.6º	.001**	0.89
MDC = Minimal Detectable Change								

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