ANALYSIS OF AN INDIVIDUAL CLINICIAN'S PATIENT OUTCOMES WHEN APPLYING THE MULLIGAN CONCEPT INTERVENTION STRATEGY TO TREAT LATERAL ANKLE SPRAINS IN AN INTERCOLLEGIATE ATHLETIC TRAINING CLINIC:

A DISSERTATION OF CLINICAL PRACTICE IMPROVEMENT

A Dissertation

Presented in Partial Fulfillment of the Requirements for the

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by

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AUTHORIZATION TO SUBMIT DISSERTATION

This dissertation of James M. May, submitted for the degree of Doctor of Athletic Training with a Major in Athletic Training and titled "ANALYSIS OF AN INDIVIDUAL CLINICIAN'S PATIENT OUTCOMES WHEN APPLYING THE MULLIGAN CONCEPT INTERVENTION STRATEGY TO TREAT LATERAL ANKLE SPRAINS IN AN INTERCOLLEGIATE ATHLETIC TRAINING CLINIC: A DISSERTATION OF CLINICAL PRACTICE IMPROVEMENT," has been reviewed in final form. Permission, as indicated by the signatures and dates given below, is now granted to submit final copies to the College of Graduate Studies for approval.

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ABSTRACT

Creating a Dissertation of Clinical Practice Improvement (DoCPI) is intended to provide evidence of an Athletic Training Clinician's progressive journey of working towards a scholarly Advanced Practice (AP). A Doctor of Athletic Training (DAT) student begins by self-assessing clinical competence through clinical reflective practice and patient outcomes, which initiates the development of a Plan of Advanced Practice (PoAP). Fluid in nature, the PoAP provides structure to an individualized clinical plan developed from personal beliefs, clinical philosophies, clinical evidence, patient population, and preferred area of clinical focus. Said clinical reflective practice and patient outcomes are expressed in an outcome summary, residency findings, and impact. Scholarly developed to share clinical growth, change and understanding from the perspective of an evolving clinician, residency findings descriptively highlight global outcomes, case studies, action research, blogs, and scholarly reflection. With an emphasis on authentic patient care an a priori investigation was created to examine the use of the Mulligan Concept (MC) Mobilization With Movement (MWM) intervention strategy to treat patients who were diagnosed with a grade I or II lateral ankle sprain. Combining the action research manuscript with a corresponding thorough literature review and dissemination of information represents a body of work, which is representative of an Advanced Practice Athletic Training Clinician.

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DEDICATION

To my wife, Shannon and editor, we accomplished this goal together and as a family. I have a difficult time expressing how much I love you and value the support you have provided. Thank you!

To my boys, Cayden and Taylor, I'm a lucky dad, and I hope you understand the sacrifices I have chosen to make were for you and our family. Both of you make me proud.

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CHAPTER 1

Narrative Summary

A professional practice dissertation (PPD) is often designed as a capstone dissertation for professionals who are completing a terminal or advanced professional practice degree (Willis, Inman, & Valenti, 2010). Often times the PPD is created with the integration of coursework, research, and field work to examine professional practice in the field (Willis et al., 2010). Similarly, as a portfolio of advanced professional practice, this Dissertation of Clinical Practice Improvement (DoCPI) was designed for practicing athletic trainers working towards advanced athletic training skills. Achieved through a broad and interdisciplinary approach well beyond entry-level, Doctor of Athletic Training (DAT) students work to create an individualized DoCPI as evidence of achievement in progressing towards advanced expertise in a chosen focus area of athletic training practice.

Uniquely, the DAT provides a platform and method for practicing athletic training clinicians to grow clinically, professionally, and personally. DAT students are expected to critically assess clinical skills through reflection of patient outcomes and scholarly reflection while being exposed to a broad spectrum of clinical paradigms. Paradigm exposure is facilitated through class readings, lectures, discussions, presentations, symposiums, research, conferences, and assignments. This allows the student to identify clinical philosophies that match their clinical interests and enable further pursuits in clinical practice. More specifically, the student clinically applies intervention strategies in a scholarly way, collects patient outcomes (PO's), reflects on outcomes, and progressively utilizes this information to inform future clinical

decisions. From my perspective there are several themes that make up the DAT framework: creating advanced clinical thought, skills, athletic training action research, translational researchers, and producing scholarly practice-based evidence (PBE).

Crucial to clinical progression and corresponding change, the DAT student must comprehend, synthesize, and work their way through the DAT framework to facilitate success. As such, understanding evidence-based medicine (EBM) is essential. In 1996 EBM was described as: "The conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of EBM means integrating individual clinical expertise with the best available external clinical evidence from systematic research. By individual clinical expertise we mean the proficiency and judgment that individual clinicians acquire through clinical experience and clinical practice" (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996, p. 71). When this article was published, the intent was to encourage health care providers to use current evidence in conjunction with clinical expertise, which was a philosophy applied by a few rather than a majority. Health care continued to progress; evidence-based practice (EBP) has replaced the term EBM, and subsequently gained popularity in guiding clinical decision-making. Unfortunately, a trend of "evidence only" practice has slowly manifested and become a popular theme (Krzyzanowicz, May, & Nasypany, June 2014). A major concern is that an "evidence only" philosophy does not allow for pursuits of new practice or evidence. As the clinical utilization of EBP became more common in clinical practice, it became clear that there were two issues present. First, there emerged a presumption of a one way "pipeline" of translating bench research to clinical practice, which has an associated lag-time that has been estimated at upwards

of 17 years (Green, 2008). Second, although EBP was described and created with pure intentions of patient care improvements through the best use of evidence and the use of clinical practice experiences, fostering an evidence only philosophy creates limitations.

As the DAT emphasizes patient care through research, the philosophy of PBE is captured through fostering research on "real" or "authentic" patients. Descriptively portrayed by Swisher (2010) as: "In the concept of Practice-Based Evidence, the real, messy, complicated world is not controlled. Instead, real world practice is documented and measured, just as it occurs, 'warts' and all". This quote by Swisher brings context to the realistic and raw nature of patient care in clinical care environments opposed to more sterile randomized research that occurs in controlled laboratory facilities. Also, PBE was described in a poster at the 2012 National Athletic Trainers Associations Educators Conference as "the process by which a practitioner collects research on their own clinical practice while incorporating the best of what is known from the scientific evidence" (Nasypany, Seegmiller, & Baker, 2012), with more of an emphasis placed on the use of best evidence available. Engaging in PBE is a crucial advancement in EBP because practicing clinicians do not have the leisure of waiting for this one-way "pipeline" of randomized, controlled, and somewhat sterile information that may or may not be applicable to their specific patient or patient population.

Also central to the DAT framework, Action Research (AR), which is a mechanism to create local or global PBE can be defined as "a process that involves healthcare practitioners conducting systematic enquiries in order to help them improve their own practices, which in turn can enhance their working environment and the working

environments of those who are part of it – clients, patients, and users" (Koshy, Koshy, & Waterman, 2011, p. 1). Contrary to the limited one-way pipeline approach to EBP, AR is the mechanism that allows the practicing clinician to develop PBE. When conducted properly AR uses the best available evidence and thoughtful research designs, which allows rich, authentic, local, and contextual evidence to emerge. When new authentic and rich data is shared in a scholarly fashion, this new AR changes the one-way pipeline into a two-way pipeline of shared evidence. This two-way flow of EBP and PBE provides balance and a more appropriate evidence-centered practice (ECP), ultimately enhancing patient care outcomes and scholarly research.

As I share this two-way pipeline philosophy, we must understand the importance of communication. Traditionally in the health profession, this flow of information has been mostly disseminated by the basic science researchers then received, processed, and applied by practicing health care practitioners creating a "top-down" feel which does not promote feelings of ownership in practicing clinicians. Vital to the success and efficiency of PBE and EBP, neither can be mutually successful without an understanding from translational research. A Translational researcher, "who is knowledgeable in multiple research paradigms and has practiced in both the laboratory and clinical worlds thus being able to translate relevance from the laboratory to the clinic and the clinic to the laboratory" (Nasypany et al., 2012) functions as a conduit in maintaining the flow of information or bridging the gap between the "benchside" to the "bedside" and vice versa (Keramaris, Kanakaris, Tzioupis, Kontakis, & Giannoudis, 2008). Crucial to the translational (T)-phases of translational health research, the Institute of Translational Health Sciences (ITHS)

describes 5 "T-phases" designated as T_0-T_4 (ITHS, 2014). Generally, T_0 begins by identifying health problems, T_1 and T_2 discover and apply foundational research to discover efficacy of EBP guidelines, T_3 implementation of applied research and T_4 describes the practice to population health impact (ITHS, 2014; Khoury et al., 2007).

My immediate reaction to discovering the DAT was relief, as I felt as though I finally found a terminal degree that was designed to enhance the clinical practice of practicing athletic trainers. Professionally, I have always worked to process and digest journal articles, symposiums, and conferences to find the most clinical transferability into my practice. More times than not, I found myself frustrated with the lack of immediate clinical transferability. Without knowing it, I had been looking for a model of PBE and translational research. Although I lacked the structure, terminology, and specifics I had been unintentionally operating in a range of T_0 through T_2.

The DAT has provided a personal and professional avenue to create a path of becoming an Advanced Practice AT Clinician or simply termed, Advanced Practitioner. Recognized by the work group formed to examine Professional Education in Athletic Training (Richardson et al., 2013), an advanced practitioner is described as "A board certified athletic trainer who has developed a focused area of clinical practice through the attainment of knowledge and skills both academically and through critical reflection of their patient care outcomes. Advanced practice AT clinicians have mastered general athletic training practice and accumulated depth of practice in a more limited area of clinical practice" (Nasypany et al., 2012).

This DoCPI will also provide perspective to my DAT journey. I will provide descriptive personal details of my professional development and starting point as a

DAT student in chapter 2. Contextually, this will allow the reader to comprehend and relate to the clinical improvements associated with my DAT journey. Also in chapter 2, I developed a plan of advanced practice (PoAP) based on my area of focus and intended post professional path for the next 5-10 years. Critically evaluating my strengths, understanding areas in need of improvement, and a strategically quantified path moving towards clinical advanced practice in the focus area of treatment and rehabilitation of athletic injuries. As an integral component to the DAT, an outcomes summary, final residency findings and impact will be thoughtfully described in chapter 3. Organized in chronological order, I have highlighted specific patient outcomes, time sensitive journals and associated scholarly reflection, which provides rich objective and subjective thoughts on my residency findings. This summary and accompanying critical scholarly reflection exemplifies the successes and struggles associated with the realities of a practicing athletic trainer working to improve and better understand their patient outcomes and clinical practice. The described philosophies, clinical intervention paradigm investigations, and outcomes allow for a meaningful progression to a literature review in chapter 4 and corresponding a priori investigation regarding the application the Mulligan Concept (MC) of Mobilization with Movement (MWM) and the treatment of lateral ankle sprains in my athletic training clinic in chapter 5. This a priori investigation and AR demonstrates a thorough understanding of a practicing clinician who comprehends the philosophies of PBE and EBP, can decipher between the two, and can produce clinically meaningful research from a local clinical practice, which may be accepted as meaningful to the athletic training profession as a whole (T_4).

The AT profession seems to be steadily moving towards an educational model of a master's level professional education and post-professional doctorally trained advanced practice clinicians (Richardson et al., 2013). Matching this professional progression, this DoCPI provides individual evidence of an AT clinician who is on a meaningful scholarly path towards advanced practice.

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CHAPTER 2

Plan of Advanced Practice: Developed February 2, 2014

Current Clinical Competence

Rationale for Pursuing a Doctorate of Athletic Training

My rationale for pursuing a doctorate degree through University of Idaho's DAT program was primarily based on my professional future and how a terminal degree relates to my immediate family and quality of life. I believed I was an above average competent athletic trainer, and the fact that I did not have a terminal degree was my limiting factor and not a lack of experience, knowledge, or clinical skills.

Although the DAT's primary focus is based on our clinical skills and patient outcomes, I do not spend all my time focusing on patient outcomes. I have been the Head Athletic Trainer or Director of Athletic Training Services at the collegiate level since the fall of 2000 and must work to balance focus between my administrative tasks and clinical skills. While I separated administrative tasks and clinical skills, I believe they are both intertwined and define my success as a clinician. I have a sincere desire to create a successful model of longevity, quality of life, and advanced patient outcomes associated with working in the traditional intercollegiate athletic training setting and the DAT was the best option to make this possible.

Clinical Competence: Reflection on Professional Experience and Development

In order for me to reflect on my professional experience and development, I must first begin when I started my athletic training education. Importantly, when I started athletic training, the Internet was not fully developed which limited one's

ability to easily access information and the Athletic Training Profession was still functioning in the internship model. Since the time of my professional training, technology and athletic training have evolved tremendously. I was a first generation college student, who was lacking direction and clarity, and I stumbled upon the profession of athletic training when I was injured as a student athlete. I had been introduced to athletic trainers in the past, but after asking a few questions I now knew pursuing athletic training was going to be my career path. I applied to the program, was accepted and began my internship route of collecting hours of experience through the direction of my mentor and Head Athletic Trainer.

The basic premise of the relationship between the athletic training student and head athletic trainer, at that time, was that the student needed to be present and perform duties the head athletic trainer deemed appropriate (a true apprenticeship model). Little structure existed specific to educational competencies or direct supervision requirements. The students completed a predetermined course load, collected 1500 hours of practice, and the head athletic trainer would then sign off for the student to take the certification examination with the end goal of becoming a Certified Athletic Trainer. My understanding at the time was the student works hard, did what they were told and when they graduated, the head athletic trainer would use his connections to help the student with their next step. I proved to be a hard worker and was able to garner the guidance and professional assistance of my head athletic trainer and mentor.

Being accepted in the Athletic Training Program in the second trimester of my freshman year, I quickly got to work as I had already completed two important classes;

Introduction to Athletic Training and First Aid and Cardiopulmonary Resuscitation (CPR). I started collecting hours in the athletic training clinic and was autonomously covering weekend home intercollegiate tennis contests by the third trimester my freshman year. Interestingly, this was a product of the times. I earned the trust of the head athletic trainer, was given a key to the athletic training clinic and was able to collect what was considered valuable hands on skills and experience to prepare myself for my professional future. Gaining the trust of the head athletic trainer, making professional connections, and acquiring valuable hands on skills was the accepted formula of becoming a successful athletic trainer during at the time I developed my athletic training foundation.

During my sophomore year, I was assigned to work with men's basketball, which was a premier assignment to receive as a student. This entailed covering all practices and contests. Unusual to this particular year, the head athletic trainer had surgery on his wrist, which put me into the position of being the primary provider of athletic training services to the men's basketball team. My learning curve was steep, and I managed to gain the respect of the coaches and athletes by being proficient with taping, modalities, and being reliable with all other duties. Reflecting back on this experience, I did a good job, gained valuable experience, and made professional connections. Interesting to this experience, I can still feel how uncomfortable I was covering away games and sometimes practices knowing I did not really know what to do if something serious happened.

The remainder of my assignments and duties at my primary clinical site during my undergraduate experiences were similar to my men's basketball experiences. I was

a hard worker, reliable, trustworthy, and was able to function proficiently on my own. Being left alone and covering practices or traveling by myself was a complement in my mind and that is what I strived for. Typically, when I was covering practices or games, my scope of treatments included taping, wrapping, moist heat packs, electrical stimulation, ultrasound, stretching, and set-up duties. Post practice duties typically included treatments of ice and electrical stimulation. This pre and post routine was the norm of what I understood and what I was exposed to as a model of what athletic training services provided to there patient populations based on my experiences until my senior year. This all changed when I was assigned to work with football at a local Junior College. When I arrived, I quickly noticed this athletic trainer ran his athletic training clinic much differently than what I had been exposed to previously. The athletic training room was organized and busy. The athletes all had rehabilitation and treatment charts that almost always included therapeutic exercises to be performed. We progressed the athletes through exercises and complemented these therapeutic exercise progressions with modalities. This was a refreshing experience and one that laid the foundation of my athletic training philosophy for my professional career until I began the DAT. I believed in the active process of rehabilitation through movement and exercise. I found value in this experience and knew this new way of running an athletic training clinic was the way I wanted to provide athletic training services for my professional future.

I made the decision to apply for and attend graduate school as a graduate assistant because this was the commonly accepted pathway of an athletic trainer, and not necessarily for improving my scholarly activity. I believed I had gained plenty of

hands on experience as an athletic training student, and I was ready to work as an athletic trainer. Gaining more experience would then allow me to become a better athletic trainer. This was a simple cause and effect relationship in my mind, but I wanted to work in the intercollegiate setting and obtaining a job in that setting would in my mind, require a Masters of Science degree. I accepted a graduate assistant position, which allowed me to work as the head athletic at a high school in conjunction to fulfilling my academic pursuits.

Since the main purpose of pursuing graduate school was to increase my chances of obtaining a collegiate athletic training position, I worked hard to complete my course work and gain experience as an athletic trainer. After two years, I completed a thesis, completed my Masters of Science in Physical Education, developed positive relationships with local orthopedic team physicians, and gained valuable hands on experience. Educationally, classes specific to athletic training or patient care were limited with a majority of the subject matter related to physical education. For my thesis, I measured joint range of motion and stability of ankles prior to the start of football season and compared the results to ankle injury results in an effort to find predictors of ankle injuries. My graduate school experience was positive and paved the way for the next step in my career.

After completing my graduate degree and working as an athletic trainer, I accepted a position as an Assistant Athletic Trainer at a small private liberal arts college that sponsored intercollegiate athletics through the National Collegiate Athletic Association (NCAA) division III level. My primary sport coverage responsibilities included football, men's basketball, and baseball. This was the perfect job for me. At the

time, as I was more than willing to work hard with long hours, the head athletic trainer was at the end of her career and was not a physical presence in the athletic training clinic. I was soon promoted, after two years, to the position of head athletic trainer as a result of hard work and the current head athletic training stepping down. I have continued to function in the same role since then (now titled director of athletic training services) for over 13 years.

My undergraduate and graduate experiences built my athletic training clinical foundation, which guided me through my professional career. Reflecting upon my foundational development and professional career, whether it was a product of the times, my own personality traits, or chance, I had little clinical mentorship specific to patient care. As previously described, my mentor for most of my experiences in my professional training was valuable and important but little direct supervision occurred. My mentor for my rotation with football my senior year was unquestionably the biggest clinical influence and provided a structure to patient care, philosophy, and organization. I wanted to treat patients in an active fashion, heavy on movement and therapeutic exercise. I wanted an organized athletic training clinic that utilized technology, was positive, and where the certified athletic trainers were hard working. Since this (senior year football rotation) point in my professional experience, I had self-guided my clinical path of patient care. Over the years, I read journal articles, attended district national conferences; I functioned as a preceptor, and was involved in the profession. Although this is how I was taught to keep up and stay relevant professionally, I wondered if my apprenticeship route was sufficient in training me to be a competent AT.

Clinical Competence: Reflection on Current Professional Knowledge

Embracing professional growth through critical evaluation, I consider myself self-aware, honest, and socially intelligent. Through more than 15 years of practicing as an ATC, I have also recognized a pattern of underestimating myself in areas of professional knowledge. As I was taught to stay professionally current, I believed in the value of continuing education and working to stay current with the trends in literature, almost fearful of getting left behind. Unfortunately, as I reflect, I am not sure I explored any one area with any specific intent or depth. I read articles, attended conferences, reflected on the content, but I seemed to remain at a superficial level. Through my pursuits of the DAT, I have explored and investigated a broad spectrum of athletic training topics and philosophies, which has facilitated a further depth of knowledge. This exploration combined with a new educational mind-set that focuses on action research, patient outcomes and scholarly activity has laid the foundation and understanding of pursuing the clinical approach of practicing as an advanced practitioner. This change in understanding has been constantly reinforced by the following quote:

> *"We live on an island surrounded by a sea of ignorance. As our island of knowledge grows, so does the shore of our ignorance". -John Archibald Wheeler*

Connecting these thoughts to the above quote by John Archibald, my DAT experience has provided much growth in my shores of ignorance. As such, I rate myself as having intermediate professional knowledge on a three-point scale of novice (entry level), intermediate, or advanced. Specific to my area of focus, treatment and rehabilitation of athletic injuries, and comparing myself to the profession, I rate myself close to

advanced but above the intermediate level. As this depth of knowledge and focus is the centerpiece of my path to advanced practice, please consider this chapter and DoCPI as a means of understanding my clinical competence and plan for growth.

Clinical Competence: Reflection on Strengths

The focus of the DAT in my opinion is focused around the clinical practice improvement of practicing athletic trainers. As a Director of Athletic Training Services and preceptor within an intercollegiate athletic training clinic, I fit nicely into the DAT target student population. Positive or negative, I am in a position of influence, direction, or change as it relates to the athletic training clinic I oversee. I work with other certified athletic trainers, athletic training students, and influence the patient care philosophy and structure of our athletic training clinic. Understanding my strengths assist me in creating a defined path to improved clinical practice and striving towards advanced practice. The following represents my interpretations of my broad professional strengths along with an objective measure of my personality strengths.

- *Clinical Reasoning* – With the combination of clinical experience, clinical knowledge, pattern recognition, and evaluation skills, I have the ability to treat and care for athletic injuries and illnesses skillfully.
- *Decision-making skills* – I feel that consistently make good decisions over-time. Based on problem solving, risk analysis, experience, interpersonal skills, and non-verbal communication skills, I effectively make good decisions. This translates into all facets of my work and life, and directly defines success.

- *Administration and organization* – I have an ability to see and successfully work towards both short-term (day to day) and long-term goals (big picture) pertaining to my intercollegiate clinic.
- *Evaluation, Treatment, & Rehabilitation* – This is what I do the most of and enjoy most as I work with my patient population. This is also how I work to bring the most value to our AT clinic. For several years, I have worked to create a model of athletic training that focuses on service rather than coverage. Specifically, this is the main area of my focused clinical practice that is heavily influenced my athletic training and rehabilitation philosophy.
- *Preceptor & Educator* – Although I am not compensated for my role as a preceptor, I believe this is important, and I put much effort into being a preceptor and educator. I typically focus on the bigger context of AT, hands-on repetition, and critical thought process rather than check off sheets. I find enjoyment in challenging my athletic training student population while sharing my clinical skills and scholarly knowledge in the clinical setting.
- *Handling skills* – Understanding this is somewhat of a non-definable skill, I have many years of experience, repetition, and feedback within my hands as diagnostic tools. I believe this translates to more finite feel or sensitive competence with evaluations and therapeutic interventions. This is described best in an excerpt from Brian Mulligan's explanation of CROCKS specific to handling skills: "Sense through your fingers what you are doing. Handling skills are necessary. To be a successful manual therapist you must have excellent handling skills." (Mulligan, 2010)

- *Leadership* – I consider myself best at leading by example. I listen, have character, believe in commitment and process, have the ability to develop trust, and present passion in my actions.

StrengthsQuest (Gallup, 2010), an assessment tool and program developed under the positive psychology philosophy identified my top five personality characteristic strengths as: Achiever, Relator, Responsibility, Learner, and Command (Summer 2013). The following represents a brief description from StrengthQuest of each trait or theme.

- *Achiever* – "People who are especially talented in the Achiever theme have a great deal of stamina and work hard. They take great satisfaction from being busy and productive."
- *Relator* – "People who are especially talented in the Relator theme enjoy close relationships with others. They find deep satisfaction in working hard with friends to achieve a goal."
- *Responsibly* – "People who are especially talented in the Responsibility theme take psychological ownership of what they say they will do. They are committed to stable values such as honesty and loyalty."
- *Learner* – "People who are especially talented in the Learner theme have a great desire to learn and want to continuously improve. In particular, the process of learning, rather than the outcome, excites them."
- *Command* – "People who are especially talented in the Command theme have presence. They can take control of a situation and make decisions."

Comparing my perceived strengths with the StrengthsQuest objective (self-report) measures provides unique insight into evaluating my strengths. Linking the two approaches reinforces my honest and accurate approach to self-reflection. For example, my perceived strengths in clinical reasoning, decision-making, and leadership correlate well with responsibility and command, while being assessed as an achiever and learner may be a positive indicator to successfully completing the DAT. Understanding one's personal and professional strengths is important to developing an achievable PoAP.

Clinical Competence: Reflection on Areas of Improvement

In a similar context, being aware of my areas of improvement is also an important self-appraisal tool when working to move forward in a positive professional direction. Understanding my limiting factors can allow me to overcome said barriers through various forms of axillary research, reading or interdisciplinary discussions, providing that I have accurately assessed my areas of weakness and also understand how to rectify areas in need of improvement. I have identified the following as my areas of clinical need of improvement:

- *Foundational Sciences* – Although this is quickly changing, combining my professional education and the evolution of AT education and the "use it or lose it principle", my foundational sciences are not the strongest component to my professional package.
- *Paperwork & documentation* – Although I perform tasks in this area competently, I view this area more as work rather than enjoyment. I understand the importance especially as it pertains to my success in the DAT, my path to advanced practice and

future action research, but I tend to spend more time and energy towards treating and providing therapy to my patient population than documenting. I continue to work and develop habits and patterns to facilitate success in this area. Ultimately, I tie scholarly reflection and scholarly activity into this category, which can enhance my ability in moving towards AP.

- *General Medical* – Due to the evolution of athletic training competencies over time and my lack of exposure in areas of pharmacology, dermatology and internal medical evaluation, I would not label these areas as my strengths.

Path to Advanced Practice

Athletic Training and Rehabilitation Philosophy – James May (February 2, 2014)

"I believe in a patient-centered approach, focused on being an advocate for the patient by listening and communicating effectively. Furthermore, I believe in applying pathoanatomic, mechanical, and neuromuscular approaches to examination, treatment and the rehabilitation processes that will focus on practice-based evidence, clinical expertise, and sound research. To continue this process throughout my career, I will pursue scholarly activity and work to question and evaluate current practice standards.

My rehabilitation philosophy involves a continued individualized patient centered approach, which focuses on patient symptoms, pattern recognition, movement, and pattern development. Rehabilitation decisions are structured after obtaining baseline movement assessments, and thorough evaluation of tissue involvement, combined with interdisciplinary communication, and patient feedback.

Progressions and return to activity decisions are individually developed according patient activity, tissue healing, pattern development, patient readiness, and functional measures. Considered this approach to be: systematic, reliable, quantifiable, scholarly, mechanical, and active, which hinges on basic fundamental movement. Lastly, I work to maintain appropriate work-life balance."

Area of Advanced Practice Focus: Treatment and Rehabilitation of Athletic Injuries

As the Director of Athletic Training Services of an intercollegiate athletic training clinic, I spend a majority of my time focusing on the treatment and rehabilitation of athletic injuries within our patient population. The following list is intended to highlight components I have chosen to pursue for my path to AP. The choices have been calculated and personally measured to insure clinical appropriateness, patient care, and a diverse approach to match future care in clinical athletic training clinical care environments. Specifically, this focus helps in progressing away from my past pathoanatomic and tissue healing only model of patient care and moving toward a model of patient care that combines pathoanatomic, tissue healing, mechanical, neuromuscular, and even biopsychosocial considerations in patient care. This clinical approach will help to define my philosophy of patient care as an athletic trainer working in an AT clinic as clinician, educator, which coincides with my scholarly interests.

- *Mulligan Concept* (Mulligan, 2010; Vicenzino, Hing, Rivett, & Hall, 2011)– As my area of action research, I have incorporated the Mulligan Concept and intervention strategy into my clinical practice, and I have been able to demonstrate positive results through patient outcomes. Although my action research has specifically

focused on treating patients with lateral ankle sprain, I am versed in many techniques including the spine and extremities. I believe this is an important area of focus as both diagnostic and treatment based intervention strategies and will continue to improve and provide a unique approach to manual therapy while producing positive patient outcomes in my intercollegiate athletic training setting.

- *Selective Functional Movement Assessment (SFMA)* (Cook, 2010)– The SFMA has been a great addition to my clinical practice. With a systematic and repeatable approach to evaluating patients with pain, the SFMA is designed to diagnose movement patterns and dysfunction. Specifically, as I broaden my ability to diagnose injury and dysfunction, I become better equipped to treat the cause of the symptoms rather than simply treating the symptoms. Working towards clinical competence with the SFMA has allowed my clinical decisions and patient care to improve.
- *Reactive Neuromuscular Training (RNT) & 4X4 Matrix Approach* (Cook, 2010; Voight, Hoogenboom, & Prentice, 2007)– As a means to treat dysfunction and address pattern development RNT and the 4X4 matrix are the hub of the SFMA treatment philosophy. Acquiring a systematic rehabilitation approach, which focuses on progressively returning normal movement patterns to basic human movements is an integral component to my treatment and rehabilitation continuum. Continuing my RNT and 4X4 rehabilitation approach will assist my path to advanced practice.
- *Action Research* (Koshy, Koshy, & Waterman, 2011; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996; Swisher, 2010)– Having the ability to use the best

scientific evidence, formulating research questions, and insightful reflection to develop practice-based evidence through patient outcomes will help define the future of clinical care in Athletic Training. Embracing action research will help define my professional success through my research endeavors and educational pursuits. I have continued to improve in this area within my DAT progression and believe working to become an expert or sub-expert in this area would be beneficial to my professional future.

- *Diverse Intervention Options* – I have been exposed to many intervention strategies and believe having diversity in my approach to clinical care in turn creates improved patient care. Being clinically competent in the following intervention strategies will be a component in the pursuits of functioning as an advanced practitioner:
    - Positional Release Therapy (PRT) or Strain-CounterStrain (SCS) (D'Ambrogio & Roth, 1997; Jones, Kusunose, & Goering, 1995)
    - Primal Reflex Release Technique (PRRT) (Iams, 2013)
    - Total Motion Release (TMR) (Dalonzo-Baker, 2008; Moseley, 2007)
    - Trauma Releasing Exercise (TRE) (Berceli, 2005)
    - Understanding Fascia Connection (Myers, 2008)
- *Balanced Clinical Athletic Training Organization Model* – Although creating and maintaining an appropriately balanced clinical model is more of an administrative entity, this helps to define my ability to follow my path to advanced practice. Work-life balance must be maintained for longevity and fulfillment to be achieved. Much

of my success will be dependent on my ability to create and maintain an appropriate wellness-based clinical athletic training organization model.

Represented in outline form, table 1 provides a detailed mechanism highlighting and tracking past, current and planned components of the PoAP. Fluid in nature, the clinician evaluates and restructures this outline to properly reflect chosen scholarly path.

Table 1. Objective and Subjective Measures for Plan of Advanced Practice

Area of Focus	**Intent**	**Method & Status**
Mulligan Concept	Scholarly Advanced AT Practitioner	• Clinical Practice - Ongoing • Northeast Seminars Videos – Complete • Read Book – Manual Therapy: Nags, Snags, MWM's etc. (Mulligan, 2010) – Complete, Fall 2012 • Read Book - MWM: The Art and Science (Vicenzino et al., 2011) – Complete, Summer 2013 • MC Introductory Conference – Complete, May 2013 • MC Conference – Lower Complete, Fall 2013 • MC Action Research – Progressing • MC Patient Outcomes –Progressing • MC Reflective Practice – Progressing • 2014 NATA Annual Symposium Special Topic Presentation " Patient Outcomes: Treating Ankle Injuries Using the Mulligan Concept of Mobilization with Movement", Accepted • MC AR Manuscript for publication – Spring 2014 • MC Conference, Upper – Fall 2014 • MC Conference Advanced – Fall 2015
SFMA	Scholarly Advanced AT Practitioner	• Read Movement Book (Cook, 2010) – Complete, January 2013

		• NES Video – Completed & Ongoing review, Fall 2012 • Action Research – Ongoing • Patient Outcomes – Ongoing • Peer Mentoring – Complete, and Ongoing • Preceptor Mentoring – Ongoing • SFMA Conference – desirable, TBD
RNT and 4X4 Matrix	Scholarly Advanced AT Practitioner	• NES SFMA/FMS Videos – Completed, Fall 2012 • Read: Movement (Cook, 2010) – Complete, January 2013 • DVD instruction – Summer 2013 • Chapter 11, RNT (Voight et al., 2007) Complete, Spring 2013 • Action Research – Ongoing • Patient Outcomes – Ongoing • Peer Mentoring – Ongoing • Preceptor Mentoring – Ongoing
Action Research	Scholarly Advanced AT Practitioner	• Complete DAT – In progress • Complete Dissertation – In progress • NATA Learning Lab – Joint Mobilizations in the Treatment of Ankle Sprains: Recent Research and Clinical Recommendations – Compete, Summer 2013 • NATA Annual Symposium Mini-course – Bridging the Clinical-Academic Gap with Outcomes-Based Research – Complete, Summer 2013 • AR/DAT Presentation – Lynchburg College ATP – Complete, Spring 2013 • NATA Webinar – Outcomes Following Lateral Ankle Sprains: Update and Challenges – Completed, Spring 2013 • Reflective Practice – Ongoing • MC AR Manuscript Submit for Publication – Spring 2014 • NATA Webinar Presentation "Nuts & Bolts: A practical guide to collecting patient outcomes from a clinician's perspective" Board of Certification

		(BOC) EBP, Recorded for Spring 2014
Diverse Intervention Strategy **PRT** **PRRT** **TMR** **TRE's** **Understand Fascia Connection**	Scholarly Practitioner	• Read: Positional Release Therapy, Assessment & Treatment of Musculoskeletal Dysfunction (D'Ambrogio & Roth, 1997) – Complete • Attend PRT-1 conference – Complete, Summer 2013 • Attend PRT-2 conference - TBD • Online Introductory PRRT Course – Complete, Fall 2013 • PRRT – Live Training Seminar - TBD • Graston MI certification – Complete, Fall 2013 • Read: Jones Strain-CounterStrain (Jones et al., 1995) – Ongoing • Read: Outsmart Pain! Teaching you how to fix you. (Dalonzo-Baker, 2008) – Complete, Fall 2013 • Read: The Science Behind Total Motion Release (Moseley, 2007) – Complete, Spring 2013 • Utilize The Neurodynamic Techniques (Butler) - Ongoing • Read: Anatomy Trains (Myers, 2008) – Ongoing • Read: TRE's: A revolutionary new method for stress and trauma recovery (Berceli, 2005) - TBD • Patient Outcomes – Ongoing • Reflective Practice – Ongoing
Clinical AT Organization Model	Aware	• Continued Coworker Communication and Education – Ongoing
Clinical Competence - Weakness	Aware	• Awareness – Ongoing • Scholarly reading – As needed

Goals for Professional Future

From the time I was an athletic training student, my primary career and professional objectives were to become the Head Athletic Trainer at a college or

university and serve the athletic training profession. I was able to become the Head Athletic Trainer at a university early in my career and over the years, have held various volunteer positions within the profession at the regional and national levels. When I reflect on the past and present, as the Director of Athletic Training Services, I am currently working in the position I want and have a passion for. As a person, husband, father, and AT, I want to insure as time transpires I have the clinical skills and the educational degree that will enable me to pursue career opportunities I find more appealing than my current role which will create new professional challenges and improved work life balance. Although difficult to talk about, depending on how the profession evolves over the next 10 years, I would be strongly suited as a faculty member in a professional level masters athletic training program serving as a professor, clinical coordinator, clinician, and preceptor or working with a post professional athletic training program. This would suit my personality, clinical strengths, and scholarly interests.

Importantly, this possible change in employment would also enable my continued clinical action research and publication pursuits. I believe in scholarly practice, action research and working to disseminate this clinical approach and associated patient outcomes for my professional future. In my appraisal scholarly products are rarely considered as of primary value outside of academia (e.g., most clinics do not reward you in meaningful ways for being a clinical scholar, either in release time or compensation)

Justification of Plan of Advanced Practice

This path of advanced practice enables true and diverse clinical skills that will have a positive impact on patient outcomes in my clinical setting. Globally, this PoAP is also an example of what the athletic training profession could look like in the future. Advanced practitioners making clinical decisions based upon sound evidence through both practice-based evidence and evidence-based practice while possessing the ability to treat with a variety of clinical intervention strategies. Further, the clinicians would continue to track patient outcomes and disseminate results in a scholarly fashion. This simple description of the advanced practitioner cycle in my opinion is the purpose of the DAT, the future of the athletic training profession, is what the profession needs, and I feel fortunate to be on the front end and a member of creating a movement and clarity of AT advanced clinical practice. Locally, my PoAP is meaningful to my patient population and my education role as a preceptor. My patients are the beneficiaries of improved patient care and the athletic training students are the beneficiaries of being exposed to a clinician moving in a direction of AP. More will be discussed in my outcomes summary and impact.

This PoAP is also achievable, realistic and will prepare me for my professional life after the completion of the DAT. Realistically, I am not sure I will ever consider myself an AP. I find it more comfortable for others to evaluate my skills as a clinician and scholarly products while I foster the concept of always working to become an AP as I find the journey most valuable. Further, I developed this plan of advanced practice to match my clinical ideology, to be practical, and to be achievable. A plan must fit these previous components to be authentic and transferable to other practicing clinicians. I am excited for the future.

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CHAPTER 3

Outcome Summary, Residency Findings and Impact

Purpose

The design of this outcome summary was to provide a transparent description of my DAT clinical residency evolution. Through rich reflections, thoughts, and analysis of clinical outcomes, each semester of residency will be progressively highlighted as a mechanism to allow the reader to experience clinical investigation and growth. This descriptive clinical narrative summary of my clinical practice and patient outcomes, similar to action research, will enable the reader to decipher meaning and infer potential clinical impact.

Starting Point

Upon entering the DAT, I worked to understand and respect the designed learning process. Finding success meant being uncomfortable and vulnerable while remaining critically open for personal and professional growth to occur. This somewhat opposing open and critical philosophical approach to the DAT enabled a substantial amount of positive change for me as a clinician. I also believe this was possible because clinically, I understood who I was and what I stood for prior to the start of the DAT. I followed a pathoanatomic model of injury with tissue irritability, symptom management, and tissue healing in my evaluations and a movement heavy therapeutic excise rehabilitation approach focused on muscular strengthening. I did not actively track patient outcomes (PO) in a reliable way, although, through clinical experience, I had a good idea of what the outcomes of most patients would look like as

I made clinical decisions. I term this philosophy as "Sports Medicine 101". The philosophy of Sports Medicine 101 is basically, to honor the injured tissue healing processes and progressively strengthen and increase activity in a functional way with a return to sporting activity in mind. I also believed I was an above average clinician with this philosophy and approach, and I have been able to maintain the confidence of orthopedic surgeons I have work with over the years with this philosophy as my diagnosis and treatment plan was usually in line with the thoughts of the orthopedic surgeons.

Embracing Change

Changing our fundamental clinical behaviors is a challenging prospect and a major component to the DAT. Looking to understand facilitating changes in behavior; I studied the Transtheoretical Model of behavior change (Prochaska & Velicer, 1997). The stages of change that occur, when change processes are emphasized are pre-contemplation, contemplation, preparation, action, and maintenance (Prochaska & Velicer, 1997). "Pre-contemplation" and "contemplation" represent my ability to understand myself personally and professionally going into the DAT as I was being exposed to new clinical paradigms creating a comparison of my clinical thought processes prior to the DAT. After thorough "contemplation", I would prepare for change through supplemental readings, online training, or even conference attendance, and then practice until I felt clinically competent or ready. Sometimes, I practiced on colleagues, or most commonly, I would explain concepts to the athletic training students I was working with and then demonstrate techniques with them. This "prepared" me to continue the cycle of change by applying new clinical interventions

when indicated into "action". Creating a method and mentality of measuring patient outcomes reinforced or provided a mechanism of justification to "maintain" changes and continued refinement of application. Importantly, this concept and stages of change should be considered cyclical, which represents actions of both an action researcher and AP.

To emphasize my ability to foster this clinical, professional, and personal growth, the following is a list of intervention strategies I applied for the first time in my clinical practice during Fall-1. Also included are my time-sensitive reflective thoughts on each. This list is intended to confirm my open and critical approach as well as my providing a sample of my associated clinical thoughts as a first year DAT student discovering and exploring new clinical thought processes along with novice voice.

Mulligan (Mulligan, 2010; Vicenzino, Hing, Rivett, & Hall, 2011)

- *Cervical NAGS - I did not have great success with the NAGS I performed, but will be prepared to treat headaches with "headache NAGS" when the clinical opportunity presents itself. Patients do not know I have this skill set, so I will need to make my skill set available when appropriate.*
- *Cervical SNAGS - I'm becoming more comfortable and confident with treating cervical mobility dysfunction and pain. This is becoming a valuable tool.*
- *Cervical/Thoracic Reverse NAGS – I like this concept, but I have found more success with movement (MWM) while trying to address cervical and thoracic extension.*
- *Lumbar SNAGS – I like this technique and want to continue to improve my competence. I focused mostly on flexion SNAGS with success but would like to be better with rotation SNAGS*
- *Innominate SI MWM (Posterior) – Surprised by how much this has helped two of my patients. I feel like I have found the correct line of drive for this technique as well.*
- *DIP 4th finger MWM – What seems to be a straightforward concept, I like simplicity of the MWM strategies for hinge joints.*
- *Hip ABD MWM – I only treated two patents using this technique and both reflected positive results but not long lasting. I quickly learned this is quite the workout for the clinician.*
- *Hamstring SL MWM – Same as above*
- *Knee open and closed chain IR Flexion and Extension MWM – This technique presented itself as a nice option for two postoperative patients. Breath of fresh air in working/pushing PROM in a pain-free fashion.*
- *Distal Fibular posterior MWM – I used this as a treatment for acute ankles and chronic ankle instability with associated strapping technique. I can apply strap and mobilize*

effectively, but I need to be better at using this technique as a therapy. I don't feel comfortable with the MWM and overpressure for some reason. Continue to take advantage of my opportunities with patients.

- *Ankle closed chain tibial PA MWM – I like this technique and seem to like the weight bearing option more than the distal fibular repositioning technique, but I'm still absolutely open to evolving. I still need to be better at identifying when each technique is more clinically prudent. The research is heavy on the closed weight bearing technique*
- *Great toe IP MWM – Same comment as DIP 4th finger MWM*

SFMA (Cook, 2010)

- *Performed top tier and corresponding breakouts on several patients*
- *Neuromuscular pattern development based on the 4X4 matrix – I did not use this clinically until the second half of the semester, but I am quickly becoming a big believer in this system.*

PRT (D'Ambrogio & Roth, 1997; Jones, Kusunose, & Goering, 1995)

- *Achilles tendon – I've had positive results with all techniques described. I need to better trust my ability to apply PRT. Being able to immediately decrease pain is valuable skill that will complement my intervention strategies.*
- *Gastrocnemius*
- *Low Back*
- *Sacroiliac*
- *Scapular stabilizers*
- *Anterior shoulder*

TMR (Dalonzo-Baker, 2008; Moseley, 2007)

- *I've used this technique three times with patients that I am treating in the clinic. I have mixed feeling on this technique, and I'm still trying to identify the patients that will benefit from this intervention. I feel like perhaps I'm trying too many different techniques. I may put this intervention on the shelf until I'm ready and able to pursue this technique as a viable option for the future.*

Data Analysis, Results, & Thoughts

Fall I – Progression of Clinical Findings

Collecting PO's is much easier said than done. One must first understand what PO's are intended to look like and then the clinician can work to apply this process in their clinical practice. As I first worked to find my path in collecting PO's in the Fall of 2012, I was not sure what patients I should track for DAT outcomes and which ones I should not. What I did know was that I could not track everyone. I made a decision not to track most of my long-term postoperative rehabilitations because this was not what I really wanted to "hang my hat on" as a clinician. This would not reflect a true athletic

training clinic and more resemble a physical therapy clinic. Therefore, after a short period of clinical exploration, I decided to track patients that needed more extensive care and treatment but less than 2 months. I would loosely define "more extensive" as greater than three days. I selected this path because of the time commitment from the patient and myself as it pertains to the requirements of data collection. I did not believe I had the time to give all my new patients a Disablement of the Physically Active (DPA) scale (Vela & Denegar, 2010a, 2010b), upper or lower quarter screen, SFMA, and my normal evaluation. This leaves the data collection process with a focus on patients with more significant injury or dysfunction and not the typical day to day management of pain or injury (achilles tendon pain, hip flexor pain/slight weakness, or low back tightness), which may be more reflective of what many athletic training clinicians spend most of their time performing.

This first semester of collecting PO's felt like a steep learning curve with many paradigm pursuits which was heavy on "contemplation", "preparation", and "action". In total, I collected PO's on 28 patients with 7 being incomplete at the end of Fall-1 (Table 5). Although I had many important moments of perceived clarity during my first semester, I will describe my most powerful outcome as my first "authentic" PO. Interestingly, this patient was not a student athlete, but rather a 66-year-old male faculty member from my college. Nonetheless, this patient requested my help regarding his painful knee. He had medial and lateral meniscal arthroscopic debridement surgery approximately 14.5 weeks earlier and was also diagnosed with associated medial femoral condyle osteoarthritis. He had been seeing a therapist in town 2-3 times per week for approximately 13 weeks. Based on his explanation, many

of his therapy sessions consisted of the therapist pushing through pain working to find terminal knee extension. On initial evaluation, the patient completed the DPA scale as a 41 and a 3 on the Pain Intensity Numeric Rating Scale (PI-NRS). Important to note, psychometric properties of the DPA scale describe a meaningful clinical important difference (MCID) as a change of 9 points with acute injuries and 6 points with chronic (Vela & Denegar, 2010a, 2010b) and the PI-NRS has an MCID of 2 or 30% (Farrar, Young, LaMoraux, Werth, & Poole, 2001). He was tender to palpation along both the medial and lateral joint lines, complained of pain with both weight bearing (WB) and non-weight bearing (NWB) knee extension, and was limited to minus 7° of knee extension. At the time, I was working through the Mulligan Concept (MC) of Mobilization With Movement (MWM) on the North East Seminars (NES) courses and I thought that clinically the patient may respond better to an indirect or pain free treatment due to the high DPA scale and irritability. Although, this was the first time I had applied the MC MWM with internal rotation at the knee for knee extension in either WB or NWB, I followed the PILL (**P**ain-free, **I**mmediate results, and **L**ong **L**asting) concept and progressed accordingly. I treated this patient 2 times per week with knee massage, traction, MC tibiofemoral internal rotation MWM, NWB, and WB for 3 sets of 8 each in the clinic while he performed a home exercise program. Over three weeks this patient went from a 41 on the DPA scale to a 3, which included MCID's on the first 2 follow-ups, a 3 to a 0 on the PI-NRS, and plus 7° to a plus 1° with NWB knee extension.

While I would not consider this a perfect way to collect this PO, this was a big step in the right direction for my clinical practice and as a student in the DAT. I had

worked hard to gain an understanding of the MC, watched the videos, read Brian Mulligan's corresponding techniques book (Mulligan, 2010), and practiced many techniques on a colleague. Honestly, I did not want to experiment with intervention strategies, but the only other options I had clinically at the time were direct, and I did not want to continue a seemingly unsuccessful path of continuing to cause more pain to the patient. The patient responded well and my clinical confidence with the MC began. I was able to document positive changes with a PO, and I now had evidence that suggested perhaps my old clinical philosophy needed to evolve.

Two specific PO's highlight my continued focus on the MC and my growth within this intervention. Patient 1 had an acute grade-I lateral ankle sprain (LAS), which was my eventual specific area of research. Patient 1 was the first LAS I had treated with the distal tibiofibular anterior to posterior MWM and corresponding MC taping technique. Retrospectively, my handling skills had plenty of room for improvement, but the patient reported all positive changes with the DPA scale and MCID's in 2 of the 3 follow-up intervals, and the patient spoke very highly of the corresponding taping technique (Table 5, Pt. # 7). I treated patient #28 (Table 5.), who complained of cervical pain and restricted painful ROM for greater than 2 months with cervical MC sustained natural apophyseal glides (SNAGS) with rotation and extension. Selective Functional Movement Assessment (SFMA), a movement-based diagnostic system with a series of seven full-body movement tests designed to assess fundamental movement patterns in those with known musculoskeletal pain (Cook, 2010) indicated cervical top tier breakouts were dysfunctional and painful with rotation and initial ROM measurements were: Unloaded PROM rotation on right side of

72°, left side 73° and occiput-atlas right and left side 30°, while loaded cervical AROM right side rotation 40°, left 50°, and cervical loaded AROM in extension 55°. The first day I followed the MC rules of 1 set of 3 repetitions with cervical (C) 2 rotation SNAG to right and C6 extension SNAG's. The patient reported a pre pain intensity numeric rating scale (PI-NRS) of 5 and post reported a 1 and now had AROM in right rotation of 55° and left of 65° while cervical extension improved to 75° following this initial treatment. I treated on 3 more intervals on the same cervical segments but with full treatments of 3 sets of 8 repetitions and overpressure with progressive improvements throughout. Nine days after examination and treatment began, the patient was very close to passing the cervical top tier SFMA's, reported no pain at rest or running with the last cervical loaded pre treatment measurements of: right cervical rotation of 62° and left 63°, and extension of 65°. Unfortunately, I did not perform final post treatment or long-term follow up measurements for documentation purposes, but the patient was happy with results and did need to modify sports activity training during treatments.

Continuing to highlight positive changes I experienced during Fall-1, I also pursued the clinical understanding and application of Positional Release Therapy (PRT) or Strain Counterstrain (SCS) (D'Ambrogio & Roth, 1997; Jones et al., 1995). For the purposes of this paper I will use term PRT for simplicity and as a personal preference, but I should acknowledge both terms represent almost synonymous terms for neuromuscular "resetting" strategies to treat musculoskeletal nociceptive dysfunction. Again, this was a new concept to me and based on class discussions and presentations, I felt like this technique would be a valuable tool in my clinical "tool

box". The first patient I treated with PRT was a faculty member from my institution who was in their mid 30's and participated regularly in pick-up basketball games amongst other faculty and staff members during lunch break commonly referred to as noon hoops (Table 5, Pt. #9). This person sought my help and guidance after noon hoops with a chief complaint of achilles tendon pain at rest and with activity. The patient was tender to palpation (TTP) on achilles tendon approximately 1 inch above calcaneal insertion, increased pain with passive and resistive ROM with dorsiflexion, and reported having similar pain for several months. I would suspect many health care professionals would have diagnosed this person with achilles tendonitis and treated symptomatically (including myself prior to the DAT). Rather than treating this person similar to how I would have in the past, I decided to scan for tender points and treat within the PRT philosophy. I located a tender point at the proximal medial gastrocnemius muscle proximal PAN, (D'Ambrogio & Roth, 1997), moved the lower leg and ankle into a position of comfort, which reduced the tender point discomfort to a zero, and held that specific position of comfort for 90 seconds or more. After this first treatment the patient reported feeling better at the achilles, and I treated two more tender points in the same fashion. After the third treatment, I was unable locate any further tender points within the posterior lower leg, and the patient reported being a PI-NRS of 3 after reporting an 8 prior to treatment.

The second patient I treated with PRT I wanted to discuss was a patient who competed in pole vault on the intercollegiate track and field team (Table 5, Pt. #12). This patient complained of pain with all movements associated with the glenohumeral and scapulothoracic joints and was TTP specific to soft tissue medial to scapula. The

patient could not identify any specific mechanism and did not have a history of rotator cuff pathology. Again, I considered treating the symptoms traditionally, which would have been labeled a middle trapezius or rhomboid muscle spasm, and subsequently treated with electrical modalities, or I could look outside the box and try something new. I decided to scan for tender points, found the most painful point at PR2, which is posterior second rib (D'Ambrogio & Roth, 1997) and again treated accordingly to the PRT philosophy. The patient reported the chief complaint going from a 5 to a 2 after treating with PRT on the PI-NRS and had immediate improvements in both glenohumeral and scapulothoracic movements. Overall, the patient was able to continue activity, we continued to treat in the AT clinic with scapulothoracic movements, and the DPA scale went progressively down from 30 to a 4 and a 5 to a 0 with PI-NRS over a two week period. Interestingly, I was surprised by the results from both cases, as I was not accustomed to experiencing such immediate changes.

One of the more profound changes in clinical thought processes that occurred in my clinical practice during Fall-1 was through the Selective Functional Movement Assessment (SFMA) (Cook, 2010; Cook, Rose, Kiesel, Voight, & Plisky, 2012). Greg Rose, one of the developers and presenters of the SFMA, suggests the clinician must get the diagnosis correct to provide the correct clinical care. Although this sounds simple and straightforward, if you are not diagnosing correctly, the clinician is not identifying the cause of the symptoms or pain. The SFMA provides a systematic and repeatable method of assessing movement and dysfunction, which can identify the underlying dysfunction(s) causing the symptoms.

I found the SFMA to be challenging and time intensive working to become

clinically competent. This being said, I continued to work and find competence, and I was able to discover a new way of looking at my clinical practice. The first example of discovering a new way of looking at my clinical practice was from treating a cross-country patient. This patient was a national level runner who from all appearances, looked very fit and strong, but complained of increased pain in the left calf with running expecially up hills. This patient had been treated in our clinic the previous year for the same chief complaint, treatments focused on the soft tissue at the calf were not successful, and the patient was forced to discontinue training and competition. When I was asked to assist with this patient, the athletic trainers were again treating the triceps surae complex soft tissue, as this was the location of pain with running, and the patient reported pain as the clinician palpated corresponding tightness. The PI-NRS was a 2 at rest and an 8 with running with a DPA scale of 22. As I was newly able to apply the SFMA in my clinic, I decided to apply the SFMA with the thought, "if the driver of the pain were at the site of pain, we would have seen improvements in the previous interventions." The SFMA results indicated the patient was Dysfunctional Non-painful (DN) with cervical flexion and extension, multi-segmental flexion and extension, single-leg stance, and overhead squat. Based on my findings from the breakouts and the patients' inability to perform a single leg squat, I treated with the concept of addressing the patients Stability or Motor Control Dysfunction (SMCD) with the poster chain and hips. We treated with three therapeutic exercises, which included prone extensions (a la McKenzie), single leg step up's with opposite arms into forward flexion with resistance and progressive single leg squats. What I would describe as the most important exercise, the single leg step up's with arm forward flexion with arm

resistance was prescribed as a mechanism to diagonally connect the upper and lower body posterior chain sometimes referred to as posterior myofascial slings (Myers, 2008). Each time the patient steps up; the patient would simultaneously, forward flex the opposite arm forcing the posterior chain the react to the resistance. The prone extensions were prescribed as an active warm up, and the progressive single leg squat was performed as a mechanism to reinforce the pattern development. After 6 days, the patient reported a PI-NRS with rest and running of 0 and a 6 on the DPA scale. The patient did not modify sports training, and we only treated with the previously described therapeutic exercise. With respect to hindsight and subsequent clinical growth, I must acknowledge my beginner approach to the SFMA and corresponding data points with this patient. Importantly, I intentionally applied the SFMA philosophy, prescribed corresponding therapeutic exercises and the patient had a positive result. This provided evidence that suggested I should look at the whole patient in a systematic way rather than focusing exclusively on the pain.

Fall 1 Reflection and Impact

Understanding and intentionally collecting PO's was a new concept for me going into Fall-1, which created more of a discovery or "feeling out" process. I was trained to document injuries through injury computer software, which enables the clinician to collect specific data points and input corresponding Subjective, Objective, Assessment, and Plan (SOAP) notes. My rehabilitation charts are on paper, and historically I have not done a great job of providing detailed progress notes regarding my rehabilitation progressions. Understanding this was my current documentation status or proficiency, I was not sure what I was working to discover nor was I trying to find meaning in my

PO's. My goal was simple; work to figure out how to collect PO's in my clinical practice. I needed to explore and to gain experience in collecting PO's to better understand what I was searching for in my clinical practice.

At the end of Fall-1, I had successfully collected PO's, proved to myself I was able to overcome my less than ideal history of documentation, and unintentionally gained valuable insight from a reflective practice. More importantly, I was particularly attracted to indirect treatment paradigms and my clinical thought process and approach was changing; I understood I should be working to find meaning from my global PO's and the importance of clinical reflection.

Being exposed to indirect paradigms such as the MC, PRT, and Total Motion Release (TMR) in Summer-1 and Fall-1, put me on a path of providing a mechanism to offer immediate change in patients who complain of musculoskeletal pain in my clinical practice. I did not have this skill set or option in my "clinical toolbox" prior to the DAT. Interestingly, I basically accepted this lack of immediate change void in my tool box prior to the DAT as shared in one of my wordpress blogs titled: The Journey, 9/16/2013 (Excerpt of blog).

> *I can remember a conversation I had last year with an Athletic Training Student (ATS). The ATS asked me what my thoughts are on chiropractors. Part of my answer was to explain that they have somewhat of a gift. This gift is the ability to provide immediately decrease in pain and/or symptoms. People are drawn (in my opinion) to chiropractors because they make them feel better, and they typically do not have to do anything except be compliant and relax. I also explained that they typically (again, in my opinion from my anecdotal experience) do not adequately address the dysfunction. This creates a cycle of follow-up visits without a focus on resolution of the underlying dysfunction, which is a great business model. I continued to explain to the ATS's that my philosophy does not address the immediate resolution/decrease in pain, but focuses on addressing the dysfunction (again, this was prior to the DAT). I also remember thinking to myself that I did*

not like this, but it was true (I did not have the skill set to provide immediate change.).

All the changes expressed earlier and my associated affinity towards indirect paradigms also came with a mental cost. I believed I had a firm understanding of cause and effect of my treatment and therapeutic exercise interventions prior to the DAT. I had a fairly concrete method of making clinical decisions and return–to-play decisions. When I started applying many new intervention strategies and experiencing associated immediate changes, it created a feeling of clinical confusion and uncertainty. I did not always understand what to do next after a patients' pain had immediate changes. This lack of clinical certainty was particularly difficult for me to process, which affected my clinical decisions. I can still remember thinking quietly to myself, "now what do I do?" when the previously described patients scapulothoracic pain went from a 5 to a 2 with a PRT treatment. This uncomfortable byproduct of clinical exploration and change has since decreased through scholarly practice, further depth of understanding, and further clinical experience, but I suspect the process is far from over.

Although I accomplished my goal of collecting PO successfully in Fall-1, I realized my outcomes lacked meaning. Yes, I effectively fulfilled a class assignment, created a repeatable collection process, grew clinically, and worked to scholarly reflect. I had a difficult time extrapolating meaningful data from my results. I collected outcomes on patients that I felt fit into the PO collection model. As such, I discovered I lacked specific intentions, definable questions, or purpose. Although this was true, I believe collecting PO's is a learned skill, and I was moving in the correct direction. Similarly, I also discovered the power of reflective practice. Prior to the DAT, I truly believed I was already strong in the area of reflective practice. For as long as I can

remember, I have been reflecting in my mind regarding patients I had been treating in my clinic. What I discovered in Fall-1, was although reflecting in your mind may be a positive attribute, it is nowhere near as effective as applying "fingers to keyboard". I found myself particularly surprised by how certain I was when I mentally reflected, but when I attempted to document data points and information, I soon realized I had missed many points of importance. Although tedious at times, documenting my clinical thoughts has been extremely valuable.

Ending Goals for Fall-1

My Fall-1 end of semester goals were fairly simple and straight forward. I wanted to improve my documentation of the patients' history and special tests while being aware of clearly understanding the patients' goals.

Spring-1 – Progression of Clinical Findings

I included 20 patients in my outcomes analysis for Spring-1. This included 232 total treatments with an average of 11.6 treatments per patient, while 5 of the participants received more than 20 treatments and 6 participants received 5 or fewer treatments. Of the 20 documented patients, I applied the SFMA 4X4 rehabilitation matrix to 17 patients, the MC to 6, Neurodynamics (ND) to 6, and a McConnell box tape concept on 1 patient. Patient outcomes were broken down into three categories: positive, neutral, and negative. Positive was classified if the patient's DPA scale and PI-NRS decreased appropriately, and the patient was able to successfully return to activity, practice, or competition in an expected timeframe, and my subjective interpretation. Neutral was classified if the patient did not return to activity as

expected for unexpected reasons, or the patient did not return for treatment appropriately. Negative was classified as a non-successful intervention based on patient feedback, re-injury, or my subjective thoughts. Results indicate a total of 60% of the cases being positive, 20% neutral, and 20% as poor. All poor outcomes were chronic conditions while only 1 neutral outcome was acute. Furthermore, 12 of the 20 patients received an SFMA including the top tier and corresponding breakouts. Please see details in table 5, patient numbers 29-48.

The previous paragraph is a good descriptive analysis of my clinical practice for the Spring-1. The results also showed a progress of clinical competence and an ability to collect PO's. As I demonstrate my ability to collect global outcomes and complete a class assignment, I also recognized my outcomes may be missing an important component. Again, they were lacking meaning or relevance when viewed as a whole. Consequently, I worked to see the trees rather than simply looking at the forest. This concept of looking at the trees led to discovering a subset of data within my global outcomes, which provided more meaning regarding my patient population. When I examined the data, I found 9 patients from one of our intercollegiate teams, which I will refer to as "Team 1". The 9 specific injury or chief complaints for each patient from Team 1 was: L4/L5 disk herniation, low back & SI pain, patellar subluxation, infrapatellar tendon insertion pain, hip strain, 3 lateral ankle sprains, lower leg pain, and lower leg strain. Initially, this list seems to represent a normal injury report an AT would generate and little meaning, connection, or pattern would be present. I continued to examine the data further by comparing the results of the SFMA. Interestingly, I discovered 7 of the 9 patients from Team 1 were classified as having a

core SMCD for flexion dysfunction, and the remaining 2 were classified with hip SMCD for flexion and hip SMCD for rotation. Having the SFMA results focusing on each of the patients' dysfunctions rather than chief complaints or injuries provided a pattern and meaning to this specific subset. I speculate this is what Greg Rose (SFMA Instructor) was referring to when he suggested "you must get the diagnosis correct". Further discussed, I will demonstrate how I used this information in my Fall-2 summary.

Recognizing the classification of dysfunction through the SFMA was a powerful moment in my clinical practice improvement journey. In the past, I would have looked at an end of season report, and I would work to find excessive injury patterns such as hamstring or hip flexor strains, and subjectively correlate high injury rates with poor training progressions or weight room and strength deficits. After incorporating the SFMA into practice, I was able to extrapolate valuable objective information out of a systematic and repeatable system, which otherwise would have been of little meaning. At this point in my progression of collecting patient outcomes, I cannot deny the value of the SFMA, and I must continue to view treating patients in a systematic, measureable, repeatable, whole body, regional interdependence (RI) approach.

Another important component of Spring-I (third semester of six) was that I initiated my pilot data for my intended action research, which at the beginning of Spring 1 was to examine clinical outcomes of the MC on the knee and ankle in my clinical practice. As the semester progressed and eventually ended, I discovered focusing specially on lateral ankle sprains (LAS), and the MC intervention strategy should be more successfully performed as my action research. I collected two PO's specific to LAS injuries and the application of the distal fibular anterior to posterior

MWM, which I would loosely describe as pilot data. Participant 1 was a female soccer patient who reported inverting her ankle after awkwardly catching her ankle on the soccer ball during play. The injury date was 2/18/13, and she reported to the AT clinic one week after the date of injury on 2/25/13 as her ankle remained painful and was limited in function. She was diagnosed with a grade 1 LAS and table 5 highlights participant 1 DPA scale, pre and post PI-NRS, and pre and post WBDF measurements in centimeters (cm). This participant was treated with the MC distal fibula anterior to posterior MWM and associated taping technique on the first three days of treatment. Positive changes progressively occurred on the three days of treatment, and the patient was released to unrestricted activity on day seven. The most notable changes occurred on the initial examination and treatment day with the pre and post PI-NRS scores. Prior to treatment, the patient reported a PI-NRS of 3 and a 5 in WB. After the MC intervention the patient reported a PI-NRS of 0 in NWB and a 2 in WB, with both being MCID's. Details are expressed in Charts 2-4.

Participant 2, a patient on the women's soccer team, reported injuring her right ankle on 3/2/13 while landing on the outside of her foot and inverting her ankle after taking a shot. She reported to the AT clinic 19 days later seeking assistance on March 21st. Participant 2 was diagnosed with a grade 1 LAS, scored a 29 on the DPA scale, and was treated with the distal fibular anterior to posterior MWM on the first two treatment days. As both PI-NRS data points had improved and bilateral weight bearing dorsiflexion (WBDF) measurements presented the biggest clinical discrepancy (injured = 8.5 and contralateral = 15), the remainder of the following 5 treatments, WBDF MWM was the primary therapeutic intervention applied with therapeutic exercise (Chart 5-

7). Again, progressive positive changes occurred over time, which are highlighted in charts 5-7, but we were unable to increase the WBDF beyond 10.5 on the affected ankle. Both pilot data outcomes indicate I am able to translate Brian Mulligan's P.I.L.L. (Mulligan, 2010) concept into my clinical practice with associated improvement in DPA scale, PI-NRS, and WBDF. Going further into my AR, I will need to be more intentional with my data points while examining the specifics affects of the MC in my clinical practice.

Further highlighting my clinical growth as a clinician in Spring 1, the following represents a time sensitive narrative wordpress blog titled "Mulligan Theme Week" published on April 11, 2013:

> *When Jeremy (*a classmate*) and I were talking on the phone earlier this week regarding Mulligan, I made a comment similar to: "I'm a skeptic and have always stayed away from things in my life that seem too good to be true". I'm not sure if it's nature or nurture, but I believe in process, hard work, adversity, commitment, and all the rest of those verbs. So, when we were sitting in the classroom over summer, and we are talking about these interventions that caused immediate changes in pain, ROM, and function, I was thinking to myself, this is a bunch of "bull". Life doesn't work this way, and it's simply too good to be true. It's two and half semesters from that point, and I'm still a skeptic, still believe in process, but I've bought into some of those interventions, and I feel like I'm cheating the system a bit. I still think in my head, "how can these relatively simple MWM's or SNAGS have such immediate and somewhat profound results"? I still have a hard time excepting the results.*
>
> *I know this isn't PRRT on a 70 year old holding a car on his head cool, but here are two Mulligan interventions for this week. The first case was a MLAX patient that took a false step on a track and field guard rail on the inside of the track resulting in what we think was hyperextension. The first week he had a moderate effusion, increased pain with walking and extension. We could never pin point a specific area of tenderness. He has a history of contralateral discoid meniscus 4 years prior with no surgical intervention. We treated for about 3 weeks and struggled with very slow and frustrating progress eventually getting him back to activity with limited pain in WB knee extension. Over the course of those 3 weeks, I applied non weight-bearing MWM with IR on several occasions with no success and presumed tissue irritation was the cause of the pain and wasn't a case for the MC. Tuesday before practice, I switch gears a bit and applied knee WB MWM with a lateral tibial glide, and we had positive results. After three weeks of treating, we finally found a way to change his pain with knee extension. I treated again on Wednesday, and he looked at me with a smile when we were done and said, "I don't know what you're doing, but this is what I needed". I had thought about the different MC knee techniques in*

the past but I didn't believe it would work. I didn't have confidence in the intervention and chose to believe in the tissue irritation pathology.
The second case I wanted to share was a female soccer patient that had a LMT debridement with associated lateral femoral condyle contusion about 4.5 months prior. We took the postoperative therapy very conservative because this was her second knee arthroscopy (contralateral knee LMT 2.5 months prior to second surgery) in the past 6 six months and the associated bone bruise. During the therapy process we have SFMA'ed her, treated dysfunction, she has worked very hard, and we have corrected some of her dysfunctions. She has been back to full unrestricted activity but has continued to complain of a vague dullish pain over lateral joint line after activity. I have been using the history of bone bruise to the condyle as the tissue causing the pain, but yesterday I decided it's been more than long enough for that tissue to calm down, and let's see if the MC is clinically indicated. Specifically, she could reproduce the discomfort with a SL knee squat from flexion to extension. First, I applied the WB lateral tibial glide MWM with no success and then went to the WB internal rotation MWM and had success. We finished 3 sets of 8, and the pain and the funny feeling was no longer present. She looked at me with a confused look and asked me what just happened? I work to limit my emotions, but I feel special and lucky to have these experiences. Of course, I say this in a very skeptical way :)

Ending Goals for Spring-1

As stated above in "*Ending Goals for Fall-1"*, my goals from Fall-1 semester generally consisted of being better at documenting history, special tests, and better understanding of the patient's goals. I did not think that effectively described my limitations or barriers. Therefore, I believe the time sensitive semester goals below provided the necessary change, which would keep me on my clinical path to advanced practice.

1. Work to collect data from patients that reflect my clinical practice.

- *I rely too much on my longer-term patients for ease of data collection purposes.*
- *Work to track immediate changes with signs and symptoms.*
- *This may be due to my lack of confidence in my new "quicker" interventions. I feel like I have a voice in the back of my head saying, "I don't want to commit to all the paperwork and process and then the intervention doesn't work." In reality the intervention usually demonstrates the results I expect. Work to be confident.*

2. Use the SFMA as both a diagnostic tool and evaluation of progress tool.

- *I'm not using the SFMA and an evaluation of progress tool, and therefore I do not know if my selected interventions are providing the intended results.*

3. Discover what I'm working to find in my data collection process.

- *What am I really trying to find out big picture? I feel like I'm simply casting a big net, and I look for anything that fits into the DAT data collection model. I need to be more specific with my questions.*
- *I don't have any purpose to my data collection process.*
- *Work to extrapolate meaningful data because I have identified what I'm looking for.*
- *I need to find a way to make this process more streamlined and less complicated.*

4. Find a new way to categorize patient's dysfunctions if possible.

- *Classifying by body parts is contradictory to the SFMA and 4X4 regional interdependence philosophies.*
- *Look into classifying patients by dysfunction if possible.*
- *Feels like the way to go but many patients have multiple dysfunctions.*
- *Sorting through multiple dysfunctions to find the cause of the symptoms may be too difficult for the residency process.*

5. Work to find a medium to consistently record and track data.

- *This semester I bounced around more than I should have between my "cheat sheet" rehabilitation charts, paperwork, and SportsWare-online database. This hindered my reflective practice.*

Fall-2 – Progression of Clinical Findings

Fall-2 proved to be another busy semester in my clinical practice, and again, I continue in my pattern of fostering change. First, I began intentionally incorporating the concept of reactive neuromuscular training (RNT) into my evaluation, treatment, and rehabilitation process. Interestingly, RNT is a vague term that falls most cleanly into the SFMA 4X4 regional interdependence (RI) (Cook, 2010; Wainner, Whitman, Cleland, & Flynn, 2007) and Vladimir Janda's (Page, Frank, & Lardner, 2010) sensorimotor paradigms but is not well documented in the literature. I believe RNT is best described in chapter 11 of the *Musculoskeletal Interventions: Techniques for Therapeutic Exercise* book (Voight, Hoogenboom, & Prentice, 2007). Basically RNT is used to help create new neuromuscular patterns through assistance. For example, the clinician can methodically apply pressure or resistance with their hands or exercise bands with the purpose of forcing the patients neuromuscular system to react to the stimulus creating new patterns. I used on RNT 60% of the patients I treated based on my general global outcomes.

Second, after being exposed to Primal Reflex Release Technique (PRRT) my first year, I felt ready to pursue further training and clinical application of PRRT. As a result, I completed the home study course and began treating patients in my clinical practice. Applying PRRT in the clinic, whether the clinician is working to down-regulate primal reflexes or treating specific soft tissue restrictions, the act of treating visually looks much different than what is commonly seen in the AT clinic. This unusual appearance compounded with terminology such as "Karate Chopping" was a barrier for me to overcome. After creating and understanding the connections between Vladimir Janda's

three levels of sensorimotor control (spinal, subcortical, & cortical), Sherrington's law of reciprocal innervation, autogenic inhibitory reflex, and PRRT, I was able to get past the unusual appearance associated with PRRT (Iams, 2013; Page et al., 2010). Regarding my global outcomes, I incorporated PRRT on 30% of the patients and have utilized on many patients who were not included in my global outcomes.

Continuing to describe clinical change, as a mechanism to create objective measures when focusing on preventative measures, I procured a Functional Movement Screen (FMS) testing kit and completed the associated training. Described as: "a predictive system, which is a reliable, seven-step screening system with three clearing tests designed to rank movement patterns basic to the normal function of active people" (Cook, 2010). I used the FMS to establish movement baselines on one of my intercollegiate teams I work with, which will be discussed further below. Lastly, I attended Graston Instrument Assisted Soft Tissue Mobilization (IASTM) M1 training and was subsequently Graston M1 certified after the two day training course. As a result, I purchased Técnica Gavilán instruments due to affordability factors. Due to the date (end of Fall-II) of training and tool acquisition, I will not be able to share any patient outcomes related to IASTM, I anticipate applying IASTM therapeutically when clinically indicated.

Working to understand my clinical practice and meet my goals from Spring 1, I took a three-pronged approach to collecting patient outcomes during the Fall 2 semester. The three chosen areas of emphasis to meet my goals were general global outcomes, a predetermined area of focus, and proactive measures. I changed my approach to collecting patient outcomes with the intent to find more meaningful

outcomes in my clinical practice. This is important to recognize in action research and clinical practice. First, my general global outcomes, which was collected similarly to previous semesters represents my "big net" approach to treating patients in my AT-clinic. The general global outcomes create a clinical pattern regarding treatment strategies and population, which assists in my reflective practice. Results indicated my clinical practice and intervention strategies have continued to grow. The second component included my predetermined area of focus or an a priori investigation of treating lateral ankle sprains (LAS) with the MC. Focusing on one area can create PBE as it pertains to the management of LAS in my AT-clinic. The data provided evidence of change with the application of the distal fibular MC MWM when treating LAS. Finally, in the spirit of prevention and instilling an objective proactive means of correcting poor movement patterns, I provided Functional Movement Screen (FMS) outcomes. The FMS outcomes were specifically collected to address a classification pattern obtained from PO's from Spring-1.

The general global outcome measures were comprised of 10 patients, which were 8 males and 2 females. Table 4 (Pt. # 49-58) highlights each general global outcome measure. Again, my subjective self-evaluation of each outcome is detailed, which shows 60% were positive, 20% neutral, and 20% negative. Continuing to reflect on specific intervention approaches, I applied both the MC and the combination of RNT/4XX4 matrix on 60% of the patients, 30% PRRT, and 20% traditional. Important to note, patient numbers 49 and 50 (Table 5), who I reported as having negative outcomes, I speculate they fall into the biopsychosocial paradigm (Borrell-Carrio, Suchman, & AEpstein, 2004). As I make this statement, I feel like I am making an excuse

for why I could not progress these patients to a positive outcome. Although, I am becoming more and more aware of the biopsychosocial arena, I do not have a full handle on treating this population. I continue to work on my awareness in this area, but I do not know what direction I will go in the future. Part of my hesitation is based on my inability to relate to these patients while another part questions how exactly the biopsychosocial model fits into an intercollegiate AT-clinic. My plan is to remain open and work to find a role I am comfortable with as I progress forward.

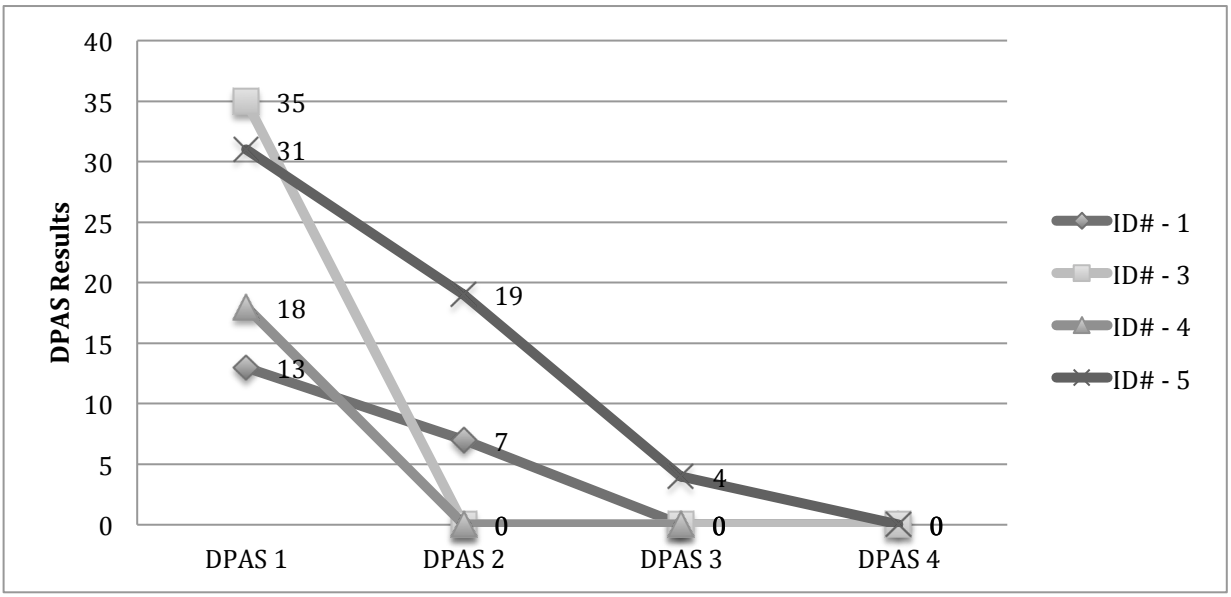
For my predetermined area of focus, I investigated the application of the MC intervention strategy to treat LAS in my clinical practice. In total, 5 patients (intercollegiate athletes) who received care in my institution's AT-clinic, volunteered to participate in my action research. After initial evaluation, 1 participant was removed as a participant due to non-compliance. Descriptive details listed below in table 2.

Table 2. LAS Descriptive Results

ID #	Contact/Non-contact	Gender	Grade	Sport	Side	Season	Total Tx's
1	Non-Contact	F	SR	WSOC	Left	In	10
2	Contact	F	JR	SB	Right	NT	N/A
3	Non-Contact	F	SO	WLAX	Left	NT/Off	4
4	Non-Contact	M	SO	MBB	Left	In	3
5	Contact	M	FR	MSOC	Right	In/Off	10
*NT = Non-Tradition Season, Tx's = treatments, F = Female, M = Male, WSOC = women's soccer, SB = softball, WLAX = women's lacrosse, MBB = Men's							

Chart 1 features the DPA scale scores for each LAS sprain participant. The final DPA scale result for each participant represents the 1-month follow-up. Notice a consistent downward trend to zero. Participant #5 was the only participant who did not have a zero when released from therapy while all other participants reported zeros on both the release day and 1-month follow-up.

Chart 1. DPAS Results for each LAS Participants



Pre and Post MC distal fibular MWM intervention weight bearing dorsiflexion (WBDF) measurements in centimeters results are highlighted in table 3. Notice the final number in each of the participant's pre WBDF column, which is the final 1-month follow-up WBDF highlight with an "*". All participants made positive changes in WBDL incrementally over the course of their therapy, and the improvements were retained.

Table 3. Pre, Post and 1 month follow-up WBDF Results expressed in cm.

#1 WBDF Pre	**#1 WBDF Post**	**#3 WBDF Pre**	**#3 WBDF Post**	**#4 WBDF Pre**	**#4 WBDF Post**	**#5 WBDF Pre**	**#5 WBDF Post**
3.5	4.5	4	4.5	10.5	11.5	3	4.5
4.5	5.5	6.5	10	11	11	8	10
5.5	6	8.5	9	12.5	14	8.5	9.5
6	6.5	*11		*13.5		8.5	9.5
6.5	7					10.5	11.5
7	7					*13.5	
6.5	8.5						
*7.5							
***-1month follow-up**							

Also important to note, many of the measurement intervals, an immediate change was recorded after the intervention.

Specific to a foot and ankle outcomes measure, the Foot and Ankle Measure (FAAM) and Sports subscale was used as a specific patient outcomes measure for the LAS predetermined outcomes. The FAAM Sport is broken up into 2 parts consisting of the FAAM for activities of daily living (ADL) and the FAAM Sport. The FAAM-ADL is a 21-question global outcome for activities of daily living (ADL's) related to the foot and ankle while the FAAM Sport is an 8-question measure of sport like activities. The test retest reliability is 0.89 for ADL and 0.87 for the Sports subscales (Martin, Irrgand, Burdett, Conti, & Swearingen, 2005). For each section, the patient self-rates their foot and ankle in a percentage of normal out of 100%, and a calculation from the likert scores is expressed as the FAAM or FAAM Sport score expressed in percentage of 100% also (Martin et al 2005). FAAM Sport scores are expressed in Table 4 with 1-month follow-up identified with an asterisk. All FAAM Sport final results are at 100% as well as the participant self-rated percentages. As such, a nice trend in improvement occurs with intervention intervals. Interestingly, many differences exist with the self-rated percentages compared to the calculated FAAM or FAAM Sport scores.

Table 4. FAAM & FAAM Sport Results, with 1 month follow-up

#1 FAAM	**#1 FAAM Sport**	**#3 FAAM**	**#3 FAAM Sport**	**#4 FAAM**	**#4 FAAM Sport**	**#5 FAAM**	**#5 FAAM Sport**
95 / 77.4	85 / 68.8	90 / 66.7	75 / 50	100 / 90.5	85 / 59.4	39.3	28.1
100 / 100	95 / 90.6	100 / 100	100 / 100	100 / 100	100 / 100	75 / 86.9	65 / 59.4
100 / 96.4	98 / 93.8	100 / 100	100 / 100	*100 / 100	*100 / 100	85 / 96.4	75 / 78.1
*100 / 100	*100 / 100	*100 / 100	*100 / 100			100 / 90	90 / 90.6
						100 / 100	95 / 93.8
						*100 / 100	*100 / 100

Self Rated % / FAAM or FAAM Sport %, *=1 month follow-up

Described previously in *Spring-1 progression of clinical finding*, I identified a pattern of movement impairments through the SFMA classification system with 7 of 9 members of Team 1 as being classified as having a core SMCD. This finding pushed me to pursue the Functional Movement Screen (FMS) as a mechanism to objectively measure the movement patterns of this team. The FMS is described as a "predictive system, which is a reliable, seven-step screening system with three clearing tests, designed to rank movement patterns basic to the normal function of active people" (Cook, 2010). I measured 24 members of Team 1 who were not injured and scored according to the FMS 4 point scale of 0 to 3 with a score of 3 of meeting the movement standard and 0 indicates pain and a failed screen. Based on indicators for each specific movement, the patient received an individual score and bilateral scores (lowest score is recorded for composite score) for bilateral movements along with a composite score with 21 being the maximum allowable score. The evaluator should note bilateral asymmetries, individual scores of 1, and a composite score of below 14, as the likelihood for future injury is increased (Kiesel, Plisky, & Voight, 2007). Team 1 results show a mean score of below 2 on the hurdle step (1.88), trunk stability push up (1.63), and rotary stability (1.17). The mean composite score was 14.38, and 37.5% of Team 1 scored below 14. Descriptive and frequency statistical results are presented in tables 7 & 8, respectfully.

In my opinion, AT seems to hang its hat on prevention. This is apparent through many ACL and throwing prevention, strengthening programs, and philosophy of taping and bracing. Generally speaking, I am not convinced AT's always understand if the preventative intervention is actually preventative. This is further compounded with a

coaching population who has little training in periodization or training adaptation. From my experience, most coaches follow the "harder and more is better" philosophy. Meaning, if it is hard, it must be good and therefore, if we do more, it is better. My FMS research was my way of working through these obstacles. I have had a desire to intervene with Team 1 for many years but have not had the motivation or sustainable mechanism. The FMS results indicate a team pattern of movement dysfunction as well as individual dysfunction. I provided corrective exercises to Team 1 and individuals, but I am unable to share results due to the time restraints associated to this dissertation. I will then be able to re-asses after a period of time to measure any changes in movement dysfunction. I will begin to work with the head coach to address the issues that can be cleared in the weight room or on the field (e.g. SMCDs) and will help him design training progressions (McGill, 2006). Working to correct movement dysfunction proactively simply makes more sense than waiting to address the dysfunction after they have been injured. Indirectly, this model has a means of improving my intercollegiate clinical practice setting.

When I began the DAT, I did not know I was going to be required to scholarly reflect or "blog" about my patient care. Being told I was required to blog brought out an immediate feeling of apprehension and anxiety. I had very strong feelings against being "forced" to blog. The weeks went by, and I worked to find my voice and purpose through my blogs, which eased my apprehension and anxiety. As a DAT blogger the following is another time-sensitive blog I will share which emphasizes my continued clinical thoughts and growth.

> *"We had a basketball patient injure their knee while slipping and falling with a non-sport activity at the beginning of September. The MOI started with abduction and IR of the hip*

(split like fall to the ground) and leg with associated valgus stress of knee and compression of anteromedial aspect of knee on the ground. The patient was initially treated for knee contusion for the first two weeks, was seen by our Ortho because little progress was made, and a MRI was obtained inside of about three weeks from the time of the injury. MRI report as follows:

Multiplanar, multisequence imaging through the left knee was performed. The lateral meniscus is intact. The medial meniscus is intact. The ACL and PCL are intact. The quadriceps tendon and patellar tendon are intact. There is proximal thickening and edema around the MCL which implies an underlying sprain. There are also irregular disorganized fibers and edema throughout the medial retinaculum which most likely relates to an underlying tear. The bones demonstrate a small amount of edema found along the lateral aspect of the medial femoral condyle probably relates to a small contusion. No significant chondromalacia. No focal osteochondral defect. IMPRESSION: 1. There are findings of a medial retinacular tear and partial tear of the medial collateral ligament. There is also a small focus of edema found within the medial femoral condyle which likely relates to a small contusion.

The patient was treated conservatively and symptomatically for contusion, slight MCL sprain, and slight medial retinaculum pathology (following MRI instructions), which is the same as prior to MRI. I use the terms slight because the evaluation was fairly benign. The clinician had to work pretty hard to find pain and laxity on exam. The patient struggled well beyond the pathoanatomic tissue-healing model of 6 to 8 weeks. The chief complaint of pain with terminal (last 10 degrees) knee extension was constant throughout as the patient and clinician struggled to get over the hump with functional activities. Anything beyond a jog would cause pain and change of direction activity was limited because of pain and reports of knee giving out.

Okay, so which way is this one going to go? Will we end up in a pain neuromatrix, tissue pathoanatomic, or neuromuscular model?

A co-worker asked me to get involved at approximately 10 weeks after the DOI with the thoughts that my Mulligan goggles would be helpful. Again, her chief complaint was painful and limited active terminal knee extension in both open and closed chain positions. As I had about 20 or 30 minutes to work with this patient, I went through a standard knee examination, which was WNL for all major bony, ligamentous, tendinous, muscular, and meniscal structures with normal bilateral passive knee extension. End feel was also normal bilateral. AROM in extension was limited to an ~7° in both open and closed chain. I then put my Mulligan goggles on and progressed through the knee MWM's for extension – IR, lateral glide, and medial glide with no improvements in active terminal extension. I scratched my head a little bit and palpated with a finer comb, which lead me to a small anteriomeidal meniscal asymmetrical and none painful bump/difference. I had recently attended the LE Mulligan course, and Frank (Instructor) had mentioned in a quick and nonchalant fashion about the "squeeze" technique for the knee but followed up with a "we don't use this too often" comment. The squeeze is described as a meniscal lesion technique for knee extension or flexion. So, I squeezed with a simple caveman technique by contacting the medial pillar of my thumb on the anteriomedial asymmetrical "lesion" and pressing it centrally while the patient went into active extension. This technique increased active terminal extension without pain. For some

> *reason I felt comfortable being aggressive with this technique, and we treated with about 4 sets of 8 or 10 repetitions with the patient actively extending while I applied overpressure. Basically, treated until my thumb got tired and wouldn't work anymore. When we were finished, she had: an ~2 ° active extension lag with no pain, body language was very good, and the patient hustled to the bus for a road trip.*
>
> *Most of the improvements lasted until the next day, which indicated we were on the right track and we could continue to be aggressive. My coworker treated in a similar fashion but in a closed chain position for the remainder of the week, and the patient seemed to be diligent with home treatments. The patient resumed conditioning and sport specific training one week later and was competing in unrestricted basketball practice (limited fitness) after 2 weeks."*
>
> *I know I described this as a MC and even though I really don't fully understand nor have had any real training in the MDT model, I feel like this case fell into the derangement MDT paradigm. So at the end of the day, I'm calling this injury pathoanatomic (mechanical) tissue pathology.*

Athletic Training Challenges

As stated in my PoAP, I have always wanted to work as an AT in the intercollegiate setting. History indicates, AT began its roots in the professional and intercollegiate settings in the mid 1900's, but it was not until later the profession began working towards being recognized and considered a viable healthcare provider within the umbrella of health care professions. As a consequence of the early development of athletic training in the intercollegiate setting, AT was developed most commonly within an athletic department model or structure. Characteristically, this model is structured with the Director of Athletics as the direct supervisor of athletic training services. As such, the Director of Athletics, who typically has no to very little medical training, may have a tendency to make supervisory decisions with a bias towards the success of athletics rather than a model of patient care (Waxenber & Satlof, 2014). Continuing to examine the intercollegiate model, I believe AT's over the years have also created a model of coverage rather than patient care that is widely accepted. Athletic administrators and university/college administrators further support this as a

business model of minimizing risk. While acknowledging this model has merit, I believe a coverage model in combination with an athletic department model, represents barriers to AT and AT's wishing to move towards becoming advanced practitioners. As the focus and structure is based on covering practices and competitions, which means reacting to acute injuries rather than a structure focused on a patient care, centered on a service model. Working to change these models should include AP's armed with outcomes, advanced clinical skills, and a viable and sustainable service model that will be interpreted as valuable by the athletic structured model.

Final Reflection and Impact of Residency

Clinical residency has been fun, exciting and especially challenging. Working to better understand and create a path towards being an advanced practice AT clinician through my clinical practice felt uncomfortable and vulnerable, but I understood rewarding accomplishments often come from diligence and persistence. I believe our AT profession needs clinicians to help create an AT identity through PBE, translational researchers and authentic patient outcomes. I practice athletic training in an intercollegiate setting similar to many others who are expected make a variety of clinical decisions regarding a specialized athletic patient population. Contrasting my clinical experience with my residency clinical outcomes, I continue to embrace and recognize my shore of ignorance. Creating and utilizing my calculated clinical toolbox combined with my PO's has created the beginning of a clinical philosophy I refer to as a rule-in-pathoanatomic approach. This approach creates a clinical mindset and starting point of utilizing a broad set of intervention strategies such as MC, TMR, PRT, PRRT, or

even RNT as a means to rule in the traditionally excepted pathoanatomic tissue involvement paradigm. When clinically indicated the clinician has the clinical skills, training, and understanding to function with and the use of multiple paradigms if necessary on individual patients. Important to this approach is focusing on decreasing or making an immediate change in one or more of the patient's complaints, which can be both subjective patient centered evidence (DPA scale, or PI-NRS) or diagnostic centered evidence (BP or ROM). As each patient is treated, the clinician should be able to manage and be aware of the patient's level of tissue irritability, nonverbal cues, and the use of traditional pathoanatomic approaches. Although progressive in nature, I believe the evidence in my PO's and AR previously described support of the rule-in-pathoanatomic approach, which the following wordpress blog highlights from Fall-1 titled "Everyone needs a little baby blue in their life".

> *"As I mentioned earlier this semester, my current clinical mindset or approach has been to "rule in" standard pathoanatomic pathologies. If a patient complains of quad pain and a traditional examination indicates a strain, I will work to treat with interventions such as PRT, TMR, PRRT, or even a little Mulligan. If these interventions are not successful, I have ruled in the quad strain, and I can treat based on tissue involvement within the pathoanatomic spectrum. Or sometimes, I can decrease pain or symptoms and treat less tissue involvement than presented initially. This process makes sense in my head, and it's an easy pitch to the patient. Also, seems like a pretty good model for an athletic trainer.*
>
> *I had a patient seek our care regarding shoulder pain with forward flexion last week on 10/8/13.*
>
> - *Traditional AT examination diagnosis = R Shoulder Biceps tendon pathology.*
> - *Track and Field thrower (weight, hammer, shot, disc)*
> - *Top Tier = DN on bilateral UE internal rotation & DOS (very close to FN). Also, presented with kyphosis in T-spine with MSF*
> - *Pain at rest = 0, Pain with active forward flexion = 5*
> - *TTP @ biceps tendon*
> - *DPAS = 15*

First day (10/8) I applied Mulligan at the shoulder, RNT at the shoulder girdle and head, and PRRT (double triceps) with no change in symptoms. Continued on with pathoanatomic treatments which consisted of:

- *Anterior chest and shoulder active and passive stretching*
- *Scapular retractions*
- *Sleeper stretches (homework as well)*
- *Eccentric loads*
- *NSAIDS X 1 week*

Day two of therapy, I took the patient through PRRT again & TMR with no change in symptoms and worked my way back through standard treatments.

Day three of therapy, I went back to RNT because I didn't believe RNT didn't work the first time and I was unable to locate a direction of improvement and was back to standard treatments.

Day four, I ruled in pathoanatomic pathology.

Day five - 10/15

- *Same top tier results*
- *DPAS 4*
- *Resumed normal in season weight room activity*
- *No TTP at biceps tendon*
- *Pain at rest = 0, Pain with active forward flexion = 1*
- *Patient is happy with progress*

My thoughts:

- *I still feel like I'm missing something when I don't get an immediate change in symptoms.*
- *Would the patient have responded well to PRRT primal's?*
- *Would have been smarter to use the belt with shoulder Mulligan because muscular hypertrophy size of patient?*
- *I didn't scan for PRT tender points in neck or shoulder girdle.*

I have come to the point where I don't want to buy into the standard pathoanatomic model, but when I get to hedge my bets while I play both sides of the field and the patients get better, I can't complain too much."

My residency findings and associated PO's also demonstrate evidence of my understanding and competence in the areas of PO's, AR, PBE, and a scholarly practice. This evidence corresponds directly to my clinical practice and improved patient care. Indirectly, as I work with and mentor athletic training students as a preceptor and

respectfully mentor and guide athletic training staff members through my title of Director of Athletic Training Services are positively affected from my progression of positive change evident in my clinical practice. Fundamental to the concept of scholarly practice, sharing my evidence to the AT profession in a scholarly fashion provides benefit to the AT profession as a product of PBE to be reviewed, critiqued, and investigated by either bench or bedside researchers.

Looking to my clinical practice in the future, I am excited and optimistic in continuing on my path towards AP. I believe in the importance of AR, PBE, translational research and the implications these concepts hold regarding the future of AT as our profession is, again, on the cusp of educational reform. Perhaps enough momentum exists for practicing clinicians to embrace PBE, participate in reflective practice and collecting PO's. I am also looking forward to remaining to be open to change and clinical exploration with my patient outcomes. It is truly exciting times to be on my current clinical and professional path.

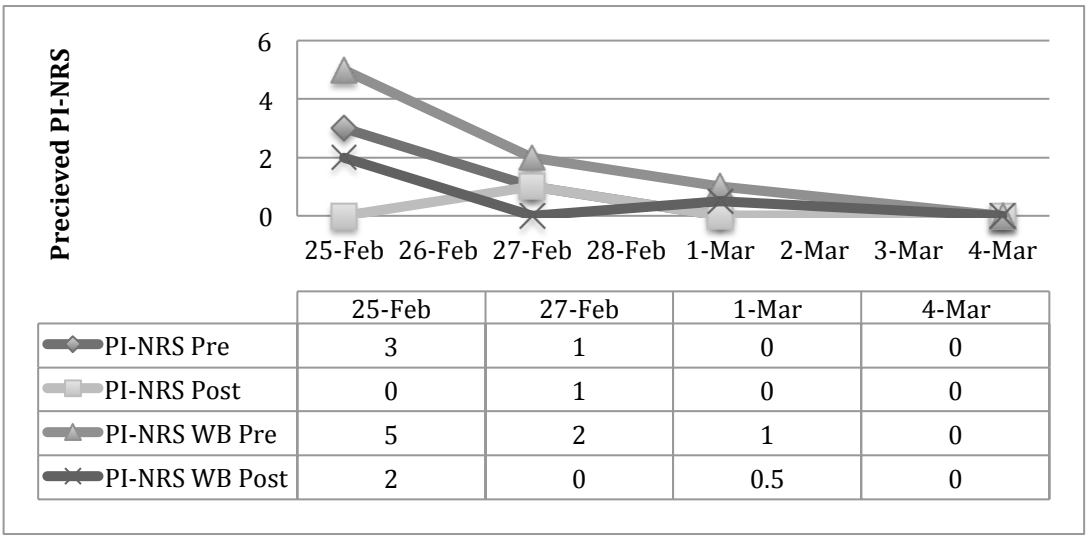
Table 5. Global Patient Outcomes (Fall-1, Spring-1, & Fall-2)

Pt. #	# Tx	Type	Sport	Intervention Focus	Outcome	Gender	Location – c/c
Fall -1							
1	6	Acute	MLAX	Therapeutic Exercise (TE)	Good	M	UE – Shoulder
2	5	Acute	WSOC	Mobilization	Good	F	LE – Foot
3	3	Chronic	WSOC	Prophylactic	Good	F	UE – Wrist
4		Chronic	WSOC		Negative	F	LE – Lower Leg
5	2	Chronic	WSOC		Neutral	F	LE – Foot
6	2	Chronic	WSOC	MC	Neutral	F	LE - Foot
7	7	Acute	MBB	MC, TE	Good	M	LE - Ankle
8	5	Acute	WSOC		Neutral	F	LE – Knee
9	4	Chronic	NS	PRT	Good	M	LE – Lower leg
10	3	Acute	WSOC	TE	Good	F	LE – Thigh
11	2	Chronic	MLAX	PRT, TE	Neutral	M	LE – Knee
12	6	Acute	MT&F	PRT, TE	Good	M	UE - Scapulothoracic
13	3	Acute	WSOC		Neutral	F	LE – Knee
14	6	Chronic	NS	MC, TE	Good	M	LE – Knee
15	4	Chronic	MXC	4X4, TE	Good	M	LE – lower leg
16	2	Acute	WSOC		Neutral	F	LE - Knee
17	1	Acute	MLAX	Prophylactic	Neutral	M	LE – Ankle
18	8	Acute	MLAX	McConnell, TE	Negative	M	LE – Thigh
19	8	Chronic	MXC	4X4, TE, MC	Positive	M	LE – Thigh
20	5	Chronic	WSOC	TE	Positive	F	LE – Knee
21	2	Acute	MLAX	TE	Neutral	M	UE – Shoulder
22	8 IC	Chronic	MLAX	4X4, MC		M	Lumbar Spine
23	10 IC	Chronic	NS	MC, 4X4, TE		M	Cervical Spine
24	8 IC	Acute	WSOC	MC, 4X4, TE		W	Lumbar Spine
25	4 IC	Chronic	WXC	4X4		W	LE – Bilateral Knee
26	4 IC	Chronic	MLAX	4X4, TE		M	LE – Bilateral Knee
27	4 IC	Chronic	NS	MC, 4X4		M	Lumbar Spine
28	7 IC	Chronic	WXC	MC, 4X4	Positive	F	Cervical Spine
Spring 1							
29	11	Chronic	W XC	Mulligan, 4X4	Positive	F	LE - Lower leg
30	8	Acute	M T/F	4X4,ND's	Positive	M	LE - Thigh
31	9	Chronic	WT/F	4X4	Positive	F	LE - Knee
32	4	Chronic	WSOC	4X4, ND's	Positive	F	Spine/SI - Low back
33	4	Chronic	WXC	4X4	Neutral	F	LE - Knee

34	21	Chronic	WSOC	Mulligan, 4X4	Negative	F	Spine/SI - SI
35	7	Chronic	WSOC	4X4	Positive	F	LE - Knee
36	8	Chronic	WSOC	4X4	Neutral	F	LE - Hip
37	8	Chronic	WXC	4X4	Negative	F	LE - Knee
38	4	Chronic	MLAX	Mulligan, Rehab	Positive	M	LE - Knee
39	5	Acute	MT/F	4X4, ND's, McConnell	Positive	M	LE - Thigh
40	6	Acute	MLAX	Rehab	Neutral	M	LE - Ankle
41	16	Chronic	WSOC	4X4, Mulligan, ND's	Negative	F	LE - Ankle
42	5	Chronic	WSOC	4X4	Neutral	F	LE - Knee
43	5	Chronic	MLAX	4X4	Positive	M	LE - Foot
44	5	Acute	WSOC	Mulligan	Positive	F	LE - Ankle
45	10	Chronic	WSOC	4X4, ND's	Negative	F	LE - Lower leg
46	6	Chronic	WSOC	4X4, ND's	Positive	F	LE - Lower leg
47	10	Acute	MXC	4X4	Positive	M	LE - Hip
48	8	Acute	WSOC	Mulligan, 4X4	Positive	F	LE - Ankle
Fall 2							
49	17	Chronic	MLAX	Mulligan, 4X4, RNT, PRRT	Negative	M	LE – Knee, Foot
50	7	Chronic	NS	4X4, RNT	Negative	M	Upper arm, Pelvis, Lower Leg
51	2	Acute	MLAX	Mulligan, RNT	Positive	M	LE – Upper Leg
52	2	Acute	MLAX	PRT	Positive	M	C-Spine, Torso
53	2	Acute	MSOC	Mulligan, RNT	Neutral	M	LE – Ankle
54	12	Post-Opp	WSOC	Trad, 4X4	Positive	F	LE – Lower Leg
55	10	Acute	MLAX	Trad, 4X4, RNT	Positive	M	LE-Ankle
56	1	Chronic	WXC	PRRT, Mulligan	Neutral	F	C-Spine
57	8	Chronic	MLAX	Mulligan, 4X4, RNT, PRRT	Positive	M	Torso
58	2	Acute	MLAX	Mulligan	Positive	M	LE - Ankle

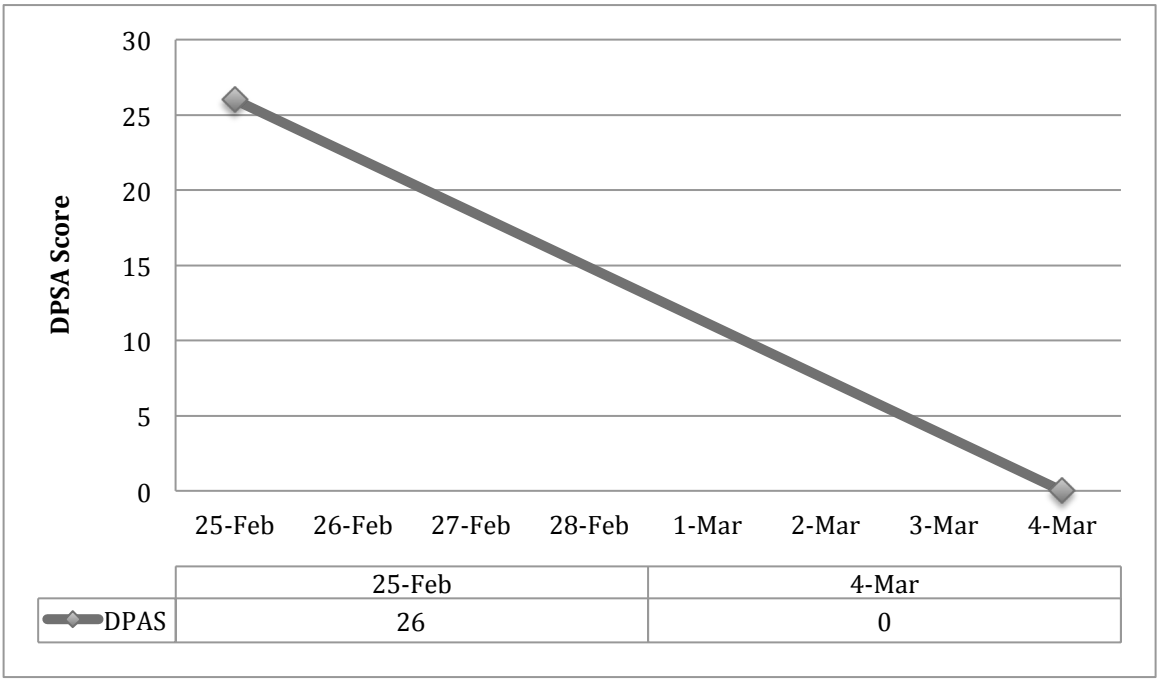
[IC]=Incomplete resolution at time of review

Chart 2. Pilot Data, Pre and Post PI-NRS – Participant 1



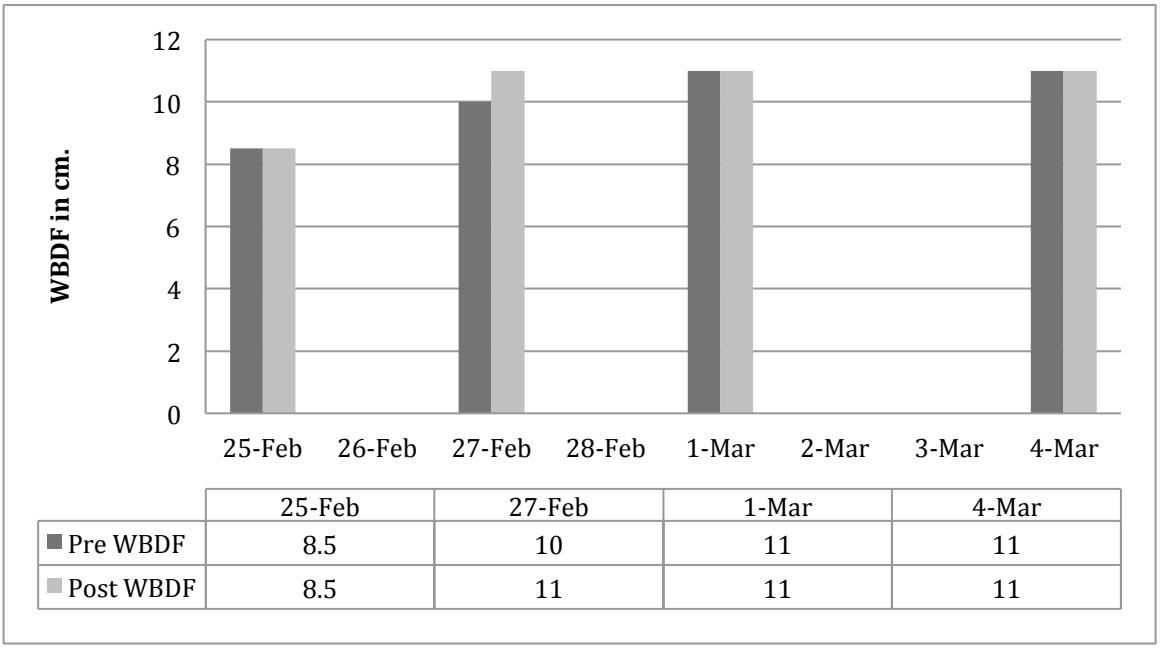
	25-Feb	27-Feb	1-Mar	4-Mar
PI-NRS Pre	3	1	0	0
PI-NRS Post	0	1	0	0
PI-NRS WB Pre	5	2	1	0
PI-NRS WB Post	2	0	0.5	0

Chart 3. Pilot Data, DPAS Results – Participant 1



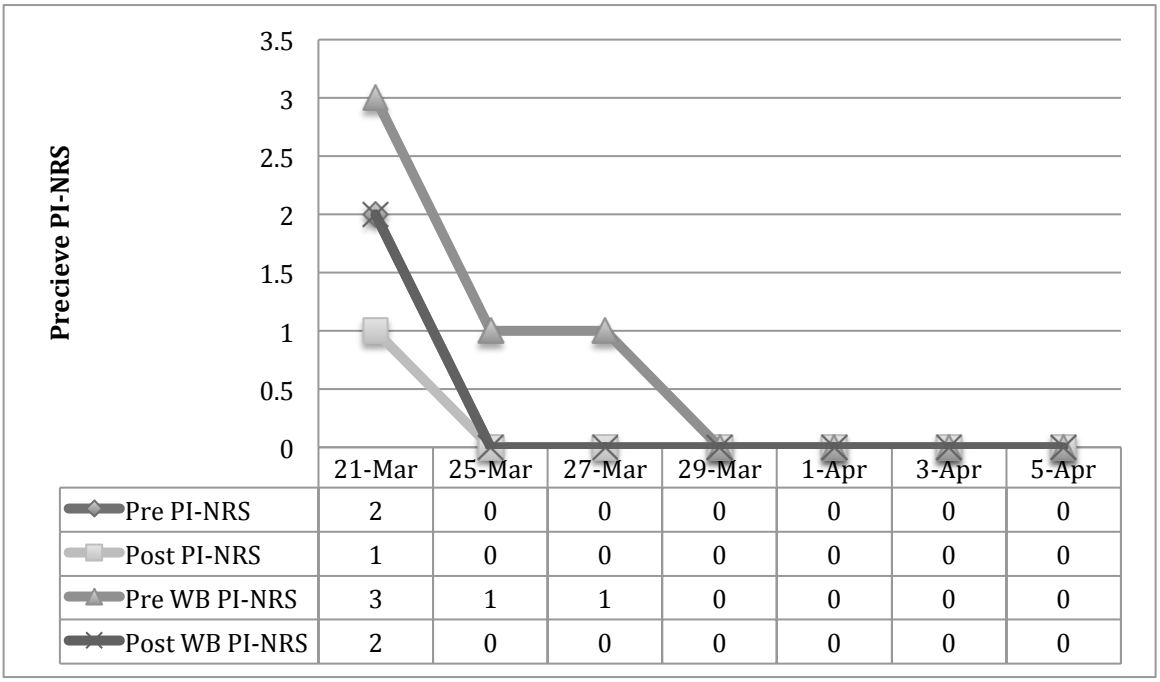
	25-Feb	4-Mar
DPAS	26	0

Chart 4. Pilot Data, Pre and Post WBDF – Participant 1



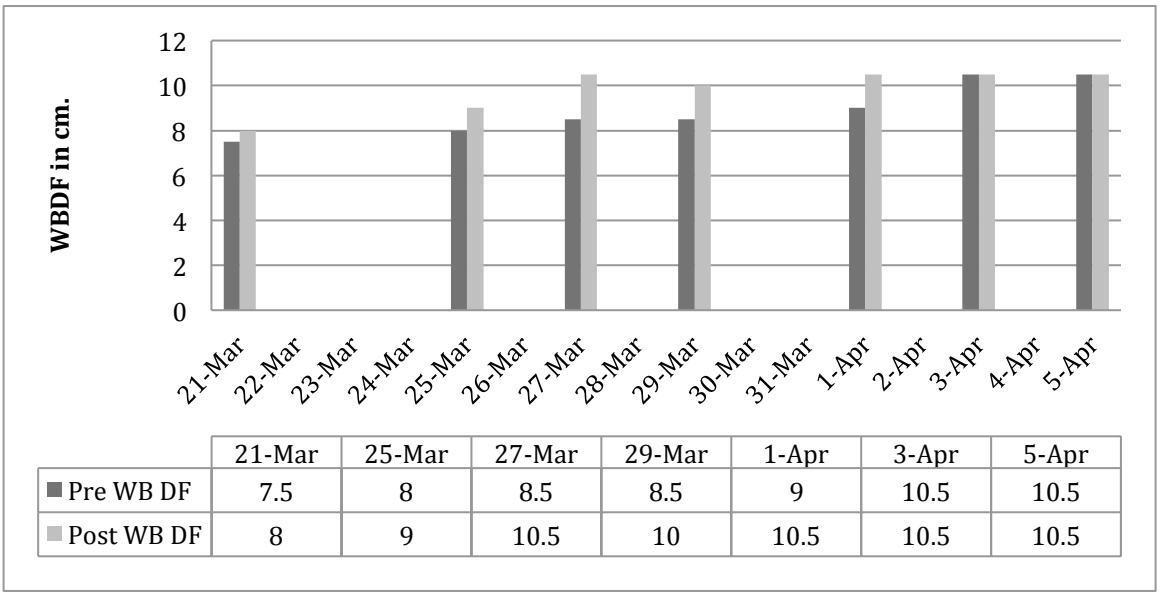
	25-Feb	27-Feb	1-Mar	4-Mar
Pre WBDF	8.5	10	11	11
Post WBDF	8.5	11	11	11

Chart 5. Pilot Data, Pre and Post PI-NRS – Participant 2



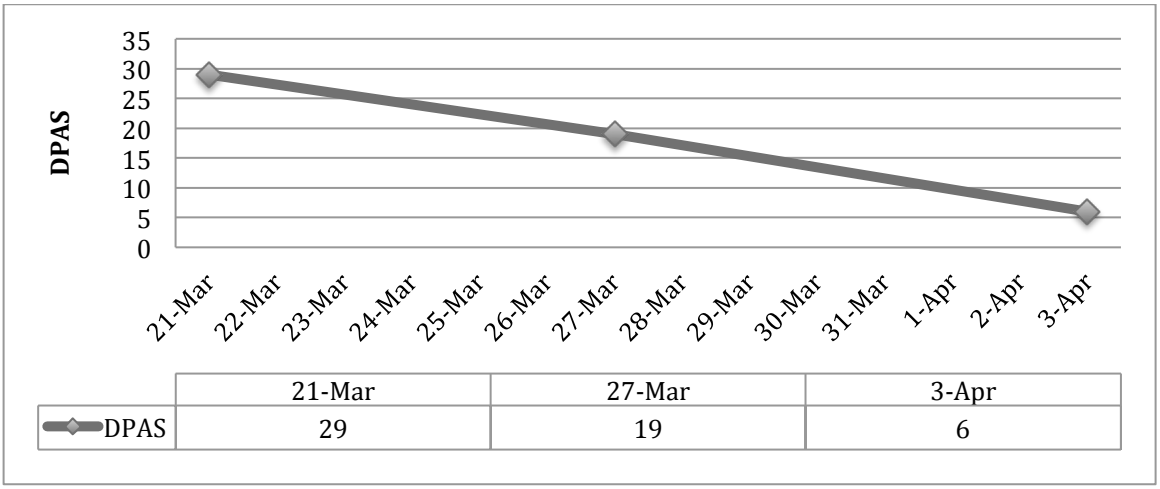
	21-Mar	25-Mar	27-Mar	29-Mar	1-Apr	3-Apr	5-Apr
Pre PI-NRS	2	0	0	0	0	0	0
Post PI-NRS	1	0	0	0	0	0	0
Pre WB PI-NRS	3	1	1	0	0	0	0
Post WB PI-NRS	2	0	0	0	0	0	0

Chart 6. Pilot Data, Pre and Post WBDF, Participant 2



	21-Mar	25-Mar	27-Mar	29-Mar	1-Apr	3-Apr	5-Apr
Pre WB DF	7.5	8	8.5	8.5	9	10.5	10.5
Post WB DF	8	9	10.5	10	10.5	10.5	10.5

Chart 7. Pilot Data, DPAS Results – Participant 2



	21-Mar	27-Mar	3-Apr
DPAS	29	19	6

Table 7. Team 1, FMS Descriptive Results

	Deep Squat	Hurdle Step	In-Line Lunge	Should Mob	ASLR	Trunk Stability Push-up	Rot Stability	Total
Mean	2.08	1.88	2.5	2.92	2.21	1.63	1.17	**14.38**
Median	2	2	3	3	2	1	1	**14**
Mode	2	2	3	3	2	1	1	**13**

Table 8. Team 1, FMS Frequency Results

Total Score	N	%
11	1	4.2
12	2	8.3
13	6	25
14	5	20.8
15	4	16.7
16	1	4.2
17	4	16.7
18	1	4.2

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Chapter 4

Literature Review

Lateral Ankle Sprain

Lateral ankle sprains (LAS) are among the most common injuries within American sports and the physically active population (Beynnon, Renstrom, Alosa, Baumhauer, & Vacek, 2001; Fong, Hong, Chan, Yung, & Chan, 2007). The most common predisposing factor to experiencing a LAS is a previous history of ankle sprain (Bahr & Bahr, 1997). Specifically, the ankle is the most common injured body part in basketball, cheerleading, soccer, and volleyball and the second most common injured body part in American football and lacrosse (Fong et al., 2007). In volleyball, it has been shown that during the first 6-12 months following an ankle sprain you are anywhere from 6 to 10 times more likely to have another episode of LAS (Bahr & Bahr, 1997). It has been reported that 40% of the LAS's lead to lateral ankle instability which is defined as: "the existence of an unstable ankle due to lateral ligamentous damage" (Hertel, 2002). Chronic ankle instability (CAI) "denotes the occurrence of repetitive bouts of lateral ankle instability, resulting in numerous ankle sprains" (Hertel, 2002). Recognition and understanding of both LAS and CAI is fundamental in providing appropriate rehabilitation techniques in an effort to limit subsequent ankle injuries and return the injured persons ankle to a pre-injured state (Hertel, 2002).

Most commonly, LAS occurs with the ankle forced into plantar flexion and inversion as the body's center of gravity rolls over the ankle (Chan, Ding, & Mroczek, 2011). Authors have also described the mechanism of injury as excessive supination at the rearfoot in combination with an externally rotated lower leg during the landing

phase or during rearfoot contact (Ekstrand & Tropp, 1990) or a large and abrupt inversion and internal rotation with limited or no plantar flexion (Fong, Ha, Mok, Chan, & Chan, 2012). Typically, the patient will describe an incidence of rolling over the ankle with a possible combination of inversion, plantar-flexion, and external rotation of the lower leg (Chan et al., 2011; Ekstrand & Tropp, 1990; Hertel, 2002). Based on this mechanism, ligamentous structures typically involved are the anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL), and posterior talofibular ligament (PTFL) (Chan et al., 2011; Hertel, 2002). The bony anatomy commonly referenced in ankle complex includes the talocrual joint, subtalar joint, and the distal tibiofibular syndesmosis (Hertel, 2002). The talocrual joint is comprised with articulations from the dome of the talus, medial malleolus, tibial plafond, and lateral malleolus (Hertel, 2002). As the axis of rotation passes through the medial and lateral malleoli, the talocrual joint primarily enables plantar and dorsiflexion in the sagittal-plane, but the oblique nature of the axis of rotations also provides small movements in the transverse and frontal planes (Hertel, 2002). The subtalar articulations are comprised of two joints between the talus and calcaneus. The two joints can be described as posterior talocalaneal and anterior talocalcaneonavicular providing foot pronation and supination (Hertel, 2002). The distal tibiofibular joint is comprised of the distal tibia and fibula connected with a densely structured syndesmosis preventing widening between the tibia and fibula but allowing accessory gliding and providing a roof to the ankle mortise (talocrual joint) (Hertel, 2002). While loaded, the Ligamentous and bony architecture in combination with the capsular tissue, tendons crossing the ankle mortis, and muscle activation create the stability of the ankle complex and resist

rotation (Chan et al., 2011; Hertel, 2002). Specifically, in relation to LAS, peroneal longus and brevis help prevent inversion of the rear foot usually with an eccentric contraction (Hertel, 2002). The anterior compartment also plays a vital role in preventing LAS by providing eccentric resistance when the foot is forced into plantar flexion. In healthy ankles the peroneus longus and brevis along with the anterior compartment of the lower leg work to prevent the foot being put in a compromised plantar flexed and inverted position (Hertel, 2002).

The standard for classifying LAS injury is based on three grades of sprain. The three grades are: Grade-I, ATFL stretch associated with mild swelling and tenderness with minimal difficulty with range of motion (ROM) and weight bearing (WB); Grade-II, ATFL torn ± CFL tear associated with moderate swelling, ecchymosis, anterolateral ankle tenderness, restricted ROM, increased difficulty with WB; Grade-III, ATFL, CFL torn ± capsular tear ± PTFL tear associated with diffuse swelling, ecchymosis, tenderness over anterolateral capsule, ATFL, CFL and inability to bear weight (Chan et al., 2011). Interestingly, the ATFL is usually the first ligament injured in LAS's and is also the weakest of the 3 main ligaments. The ATFL prevents anterior translation of the talus from the ankle mortise and helps to prevent excessive inversion and external rotation of the distal tibiofibular complex on the talus. Increasing strain on the ATFL as the foot goes from dorsiflexion to plantar flexion is also a characteristic of the ATFL (Chan et al., 2011; Hertel, 2002). Designed to prevent against excessive inversion at the talocrual and subtalar joints, the CFL is the only extra-articular ligament in lateral ankle complex, is the second strongest ligament, and forms the floor of the peroneal tendon (Chan et al., 2011). The PTFL is designed to prevent posterior translation of the

talus, inversion, rotation of the loaded talocrual joint, and is the strongest and least commonly injured ligament during LAS (Chan et al., 2011; Hertel, 2002; Wheeless, 2012).

Traditional Treatment and Rehabilitation of LAS

After the LAS and resulting tissue disruption, treatment should begin in an effort to manage the acute inflammatory process. It is important to understand the normal tissue response after injury, ensuring appropriate clinical decisions (Kannus, Parkkari, Jarvinen, Jarvinen, & Jarvinen, 2003). The body initially responds to injury with the coagulation and haemostasis phase (Velnar, Bailey, & Smrkolj, 2009). This includes an immediate neuronal reflex mechanism that causes vessel constriction for a short period of time (a few minutes) (Velnar et al., 2009). Next, a coagulation cascading event of chemically rich blood flow is sent to the injured area, which induces platelet aggregation and clot formation. These trapped platelets will provide a provisional matrix for cell migration (Velnar et al., 2009). A healthcare provider should examine the injured ankle, rule out fractures and initiate treatment to the acute LAS. "Immediately post injury, ice should be applied and ankle elevated in an effort to reduce tissue metabolism which may limit secondary hypoxic injury (Beynnon et al., 2001; Bleakley, McDonough, & MacAuley, 2004; Hageman, 2006). Ice should continue intermittently throughout the Inflammatory process which typically activated moments after the onset of injury through approximately 72 hours (Hageman, 2006; Velnar et al., 2009). It is also recommended that compression be applied and the ankle immobilized through the inflammatory phase (Hageman, 2006; Velnar et al., 2009). Compression is applied during the inflammatory phase to assist in counteracting the

increased osmotic pressure at the injury site, which limits fluid loss from the vascular system as to decrease the formation of edema and limit secondary cellular death (Hageman, 2006). The intended affect of immobilizing the ankle is to limit stress to the damaged tissue, decrease pain, allow the inflammatory process to conclude, and prepare for the proliferative phase on approximately day three (Hageman, 2006; Mattacola & Dwyer, 2002; Velnar et al., 2009).

Optimally on day three, the injured ankle shows no signs of the acute inflammatory process which indicates haemostasis has been accomplished and the immune response was successfully set in place. The acutely injured tissue involved in the LAS shifts towards tissue repair (Velnar et al., 2009). At this point the clinician should understand the implications of an acute LAS and the associated impairments. These impairments could include: tissue disruption (ligament, capsule, muscle, tendon, bone); decreased ROM; arthrokinematic impairments; impaired proprioception and sensation; impaired neuromuscular-firing patterns; and impaired postural control (Chan et al., 2011; Hertel, 2002). Understanding the impairments will enable a multifaceted rehabilitation progression to be developed with the goal of obtaining asymptomatic functional activities that may be preformed at the pre-injury level and beyond (Mattacola & Dwyer, 2002). As a possible complement to the rehabilitation progression, the literature supports the use of ankle braces and if financially feasible, orthotic intervention. Lace-up ankle braces have shown to provide support and increase proprioceptive abilities in injured ankles (Mattacola & Dwyer, 2002). Orthotic intervention, although costly, may provide support to the mechanically unstable rearfoot, which can limit inversion and supination (Mattacola & Dwyer, 2002).

As the patient progresses from phase 1 to phase 2 of the rehabilitation program the emphasis is to: restore normal gait patterns, restore normal active and passive ROM, and begin to initiate increases in strength or neuromuscular reeducation. Restoring normal active ROM should emphasize dorsiflexion and the achilles tendon stretch to prevent the development of arthrokinematic changes that would create increased chance of further LAS (Hertel, 2002; Mattacola & Dwyer, 2002). Addressing strength deficits should be initiated in all areas of weakness but particular attention should be focused on the peroneal muscles because of the increased likelihood of further LAS and development of CAI if weakness remains (Chan et al., 2011; Hertel, 2002; Hubbard, Kramer, Denegar, & Hertel, 2007; Mattacola & Dwyer, 2002). Based on the severity of the injury, strength progression should start with isometric exercises and progress to dynamic resistive exercises that emphasize eccentric contractions (Mattacola & Dwyer, 2002). It is recommended the exercise be performed with 3 sets of 10 or 12 repetitions twice per day (Mattacola & Dwyer, 2002). Heel walks, toe raises, and toe walks may be implemented to assist with strength and coordination (Mattacola & Dwyer, 2002). All exercises should be performed bilaterally (Evans, Hertel, & Sabastianelli, 2004; Mattacola & Dwyer, 2002).

As we continue to limit undue stress placed on the disrupted tissue, the proliferative phase enables the continued collagen repair (Velnar et al., 2009). "Functional stress stimulates the incorporation of stronger replacement collagen" (Karlsson, Lundin, Lind, & Styf, 1999). Ideally, during this phase of heeling we should have regained normal gait patterns, ROM impairments and some of the strength impairments. Proprioceptive and balance training should have already begun based on

the ability to fully weight bear (Mattacola & Dwyer, 2002). The CKC proprioceptive and balance training should be the focal point of the rehabilitation process. Several studies indicate wide variety balance training can improve functional ankle balance (Hale, Hertel, & Olmsted-Kramer, 2007; Mattacola & Dwyer, 2002; McKoen et al., 2008; Rozzi, Lephart, Sterner, & Kuligowski, 1990; Wester, Jepersen, Neilsen, & Neumann, 1996). Similar to progressive strength exercises, dynamic balance training should progress from simple to dynamic, which can include combinations of: multi-directional, multi-height, and multi-surface movements. Therefore, as the patient progresses from the simple dynamic balance exercise, the clinician must plan carefully. Examples of "exercises to promote the restoration of functional proprioceptive variability within the sensorimotor system are: hop to stabilization, hop to stabilization and reach, hop to stabilization box drill, progressive single-limb stance balance activates with eyes open, and progressive single-limb stance activities with eyes closed" (McKoen et al., 2008). Running may be initiated with intervals of 50% jogging and 50% walking when the patient can walk long distances without altering gait or increased pain (Mattacola & Dwyer, 2002). The clinician should not forget to incorporate pain fee cardiovascular activity to assist the patients' preparedness to return to activity (Mattacola & Dwyer, 2002).

As the patient progresses through the proliferative phase into the remodeling phase and phase three of rehabilitation after approximately two weeks, mechanical ankle laxity should still present and may remain present for one year or longer (Hubbard & Hicks-Little, 2008). Continued focus should remain on limiting the stress to the damaged tissue, obtaining normal active ROM, regaining strength, muscular

endurance, and continuing the progression of activity specific dynamic balance drills. As the patient becomes closer to returning to activity and sport or activity specific exercise have been introduced, functional balance can be evaluated bilaterally with the SEBT. Although, standardized norms do not exist for the SEBT, bilateral comparison (injured vs. non-injured) has shown to be a predictor of dynamic stability (Olmsted, Carcia, Hertel, & Shultz, 2002). The goal should be to have bilaterally equal "reaches" on all excursions. No data was available to suggest how long rehabilitation should continue, therefore, it is recommended that rehabilitation continue until the patient is bilaterally equal on the SEBT. Interestingly, LAS, chronic ankle instability (CAI), and functional ankle instability (FAI) are highly researched and published topics in the literature; recurrence rates remain high (Kaminski et al., 2013).

Positional Fault

Further examining the mechanism of LAS, the literature supports the concept of distal fibular movement occurring as a result of the stresses placed on the talocrual joint during the moment of injury. Referred to as a positional fault, the evidence suggests the distal fibula is pulled anteriorly as the ankle is placed in excessive amounts of supination, inversion, and internal rotation from LAS. As a result the distal fibula may remain mal-aligned and result in altered arthrokinematic movements. Lateral radiographic measurements comparing the alignment of the distal anterior margins of the tibia and fibula of subjects with a self reported history of unilateral CAI showed a significant difference between CAI and uninvolved at P=0.006, and a control group match at P=0.045 (Hubbard, Hertel, & Sherbondy, 2006). Investigating the same distal anterior margins of the tibia and fibula with lateral radiographs on subacute

ankle sprains on participants with no history of contralateral LAS indicate similar evidence of anterior fibula positional faults with participants being diagnosed with subacute LAS. Hubbard and Hertel, 2008 found a significant difference with inter ankle differences at *P*=0.008 and control group match at *P*=0.045 while Fukuhara, et al. 2012 found significance with inter ankle comparison at *P*=0.007 and control group match at *P*=0.048 (Fukuhara et al., 2011; Hubbard & Hetel, 2008). Further, when comparing the alignment of the anterior margin of the talus to the anterior margin of tibia via lateral radiographs, results indicate an anterior positioned talus with individuals diagnosed as having CAI (Wikstrom & Hubbard, 2010). The use of computerized axial tomography (CAT) images and the axial malleolar index (AMI), a measurement in the transverse plane evaluating the alignment between the talus and the fibula and tibia has been presented in the research. Generally, the greater the AMI the greater the positional fault. Results indicated alignment differences and a greater AMI with individuals who had experienced acute LAS compared to individuals with no history of LAS (Eren, Kucukkaya, Kabukcuoglu, & Kuzgun, 2003). Also using the CAT images and AMI to evaluate bony alignment of individuals who were surgical candidates for reconstruction based on being diagnosed with lateral ankle instability had a greater AMI compared to controls (Berkowitz & Kim, 2004). Therefore, based on the evidence, individuals who sustain LAS or have been diagnosed with CAI are likely to have associated positional fault(s) at the ankle.

The Mulligan Concept

Brian Mulligan, FNZSP (Hon), Diploma MT, based on his training, education, and influence from Freddy Kaltenborn, PT, OMT, Geoff D. Maitland, MBE, AUA, FCSP, FACP,

SASP, and his personal clinical exploration, developed the Mulligan Concept (MC) through the 1980's into the early 90's. This mobilization concept for both spinal and peripheral joints is simply defined as "the sustained repositioning of one articular surface on its neighbor while a movement or function is undertaken"(Mulligan, 2010). This concept is based on a theory that minor positional faults occur secondarily from injury or imbalance, which lead to mal-aligning of joints, statically which may lead to mal-tracking dynamically. This mal-tracking results in symptoms that can include pain, stiffness, decreased ROM, and weakness (Mulligan, 2010). Mulligan developed several acronyms as a means to establish guidelines and explanation of the MC and theories. The repositioning of one articular surface on another to address positional faults of joints is further described with "Mobilization With Movement" (MWMS) when referring to peripheral joints and "Sustained Natural Apophsyeal Glides" (SNAGS) or Natural Apophsyeal Glide (NAGS) when referring to the spine (Mulligan, 1982, 1993, 2010; Vicenzino, Hing, Rivett, & Hall, 2011).

The MWMS, SNAGS, & NAGS are guided by two important principles of application which must be followed by the health care practitioner. First, the MC MWM should be "Pain Free immediate and Long-Lasting", which is referred to as the "PILL" concept (Mulligan, 2010). The MC is only indicated if it is pain free, immediate, and the results are long lasting. While performing a MWM if the patient reports feeling pain the practitioner must stop and re-adjust the mobilization technique so that MWM is pain free. Positive affects of the mobilization or MWM are expected immediately after the technique is completed. Generally, the patient should feel a decrease in pain, increases in active, passive, or resistive ROM as a result of the MWM or SNAG. The clinician

should evaluate clinical effectiveness through a comparable sign or a client specific impairment measure (CSIM) (Mulligan, 2010, 2013; Vicenzino et al., 2011). Being client specific, the CSIM "is a physical task or functional activity that the practitioner is able to evaluate and that is comparable to the patient's presenting problem" (Vicenzino et al., 2011). Long lasting results are to be expected. Improvements in discomfort and joint restrictions should retain progress over time and not regress back to the original baseline from treatment to treatment (Mulligan, 2010, 2013; Vicenzino et al., 2011). If improvement from baseline is noted but one of the above is has not been met, the technique may still be indicated but the clinician must use clinical judgments to assess how to improve the outcomes. This may occur through changing the force applied or adjusting the mobilization angle of drive (Mulligan, 2010, 2013; Vicenzino et al., 2011).

Second, the health care practitioner should be guided by the acronym "CROCKS", which identifies: Contraindications, Repetitions, Overpressure, Communication, Knowledge, and S = Sustain, Sense, Skill, Slow, Success (Mulligan, 2010). One should always be aware of contraindications associated with mobilization and MWM when treating patients and the movements should be accompanied by repetitions and overpressure to assist in long lasting mobilization affects. Although the patient may find decrease in pain and joint restrictions one would expect the results not to be long lasting without repetitions (traditionally 3 X 8 or 3 X 10 with extremities and 1 X 3 with first time spine treatments) and overpressure applied by the practitioner or preferably the patient. The treating clinician should also communicate the MWM being applied and especially the PILL concept so that the patient has a firm understanding of expectations, emphasizing the requirements of absolutely no pain

associated with the movement. A working knowledge of anatomy and arthrokinematic principles is important for the clinician because each technique will be based upon the uniqueness of each joints articular surface interaction. Finally the "S" stands for: sustain the mobilization throughout the entire movement, sense through the clinicians fingers or handling skills must be realized, the MWM must be slow and methodical, and to be successful the clinician should have excellent handling skills.(Mulligan, 2010) These handling skills are especially important as the clinician must be able to move their body in space while maintaining the desired patient joint position throughout the entire range of motion (Mulligan, 2010).

Viewed as a robust clinical mobilization philosophy for orthopedically based health care providers and patients (May & Krzyzanowicz, 2014), the MC has been investigated in the literature. Systematic review by Vicenzino et al. indicates low level of evidence in the literature but does acknowledge "trends in the data that support the clinical claim of the rapid ameliorative effects on pain and function during and initially after a single treatment application and also a course of treatment" (Vicenzino et al., 2007). Investigating the literature to specifically identify evidence to support either a biomechanical positional fault theory or the reported hypoalgesic affects cannot be substantiated or refuted (Vicenzino et al., 2007). Rather, the continued pursuits of evidence through well developed randomized clinical trials and laboratory studies are recommended. Hing et al. investigated the available literature in 2008 with the purpose of identify the clinical efficacy of the MWM techniques to treat peripheral joints (Hing, Bigelow, & Bremner, 2009). Critical review and scoring each article from the Downs and Black checklist method indicated the literature review held an overall

rating of moderate, on a scale of strong, moderate, limited, or poor level of mythological quality of research on peripheral MWM (Hing et al., 2009). Furthermore, 24 out of 25 (96%) of the studies that met the criteria for critical analysis demonstrated positive effects from MWM (Hing et al., 2009). Although limitations are present in the literature, practicing clinicians who are Certified Mulligan Practitioners (CMP) continue to apply the MC in their clinical practice and find value treating within this paradigm (May & Krzyzanowicz, 2014).

Treating LAS with the Mulligan Concept

The specific MWM indicated to treat LAS is described as: with patient in a long sitting, foot and ankle extended off the edge of treatment table, clinician places thenar eminence on the ventral distal 2-3 cm of the distal fibular and glide the fibula in a dorso-cranial direction. The patient actively inverts the foot, and the clinician may apply pain free overpressure (Mulligan, 2010, 2013). Following Brian Mulligans teachings and publication of his first book in 1995, although limited, research began to appear in regards to treating LAS with MWM. A descriptive analysis of the distal fibular anterior to posterior (AP) MWM and associated taping technique was detailed as a mechanism to challenge customary beliefs of treating LAS in 1996 (Hetherington, 1996). Unfortunately, few treatment details were listed in the case examples, but the author suggested "the highly successful and often dramatic results gained from treating patients with sprained ankles with a rationale based on a patho-anatomical diagnosis of antero-inferior subluxation of the distal fibula, warrants and justifies further study in the area" (Hetherington, 1996).

In 1998, O'Brien and Vicenzino worked to further investigate the effects of the MC MWM to treat LAS through specific outcome measures (O'Brien & Vicenzino, 1998). In a case study with 2 participants who had been diagnosed with acute LAS, a methodological approach of BABAC and ABABC (A=non intervention period, B=intervention period, & C=post-treatment return to sport phase) was applied to each respective participant in an effort to represent the natural progression of the injury. Each phase represented approximately 1 week with varying amounts of treatment sessions, and the study lasted 5 weeks (O'Brien & Vicenzino, 1998). Outcome measures used included pain via the visual analog scale (VAS), ankle inversion, weight-bearing dorsiflexion, a patient centered functional performance test (Kaikkonen Scale), and perceived function on a VAS (O'Brien & Vicenzino, 1998). Focusing on the trends of the data rather than specific changes, the results of this study indicate "the MWM treatment technique produces immediate reduction in pain, increases in range of inversion, improved outcomes and improvements in function for people with acute LAS. This improvement appears to be beyond that attributable to the natural time course for recovery for sprained ankles" (O'Brien & Vicenzino, 1998). Important to note, the investigators also applied the MC fibular repositioning tape (FRT) after MWM treatments, but did discuss further. Based on the available literature specific to LAS and the MC MWM (distal fibula AP), this is the best evidence available for the clinical effectiveness of this technique. This being said, I found the methodology contrary to a patient centered approach with a lack of meeting the individual needs of the patients.

Lastly, Kavanagh in 1999 created a mechanical jig to measure the amount of force and movement while applying the distal fibular AP MWM on two participants

with a history of "rolling over" without any reported acute ankle sprains, six participants who had been diagnosed with an acute LAS, and seventeen normal participants with no history of injuring either ankle. Results indicated 1/3 of the of the acute LAS had significantly greater amount of movement (*P*=0.01%) per unit of force (*P*=0.09%) (Kavanagh, 1999).

Mulligan Concept Fibular Repositioning Tape

Brian Mulligan also developed a taping technique referred to as fibular repositioning tape (FRT), which can be used as a mechanism to maintain or reinforce fibular postion after application of the distal fibular AP MWM or as a LAS preventative measure. The clinican applies the FRT by starting (only covering the fibula) the tape obliquely at the distal end of the fibula, and a pain free posteriolateral force is applied and maintained which enables the remaining tape to be laid down matching the glide force in a oblique superior circular direction around the lower leg (Moiler, Hall, & Robinson, 2006; Mulligan, 2010, 2013). Once the tape is secured, the clinician can release glide. Patients can wear the tape for 24-48 hours

Regarding prevention of LAS, an Australian based pilot study in 2006 worked to evaluate the effectiveness of using FRT as a LAS prevention technique. In this study, 125 male basketball players were split into two groups in which group 1 used the FRT prevention technique and group 2 had the option to use traditional ankle taping, brace, or no ankle prophylaxis. Each day of exposure was recorded independently because the groups were different on each day of basketball activity. In the end, the authors were able to say based on the injury rates of the two groups, the FRT group was 5 times less likely to have an ankle injury when compared to the control group (Moiler et

al., 2006). While this pilot study was limited by a small sample size, no true control, and no baseline uniformity, the FRT showed promise in the area of prevention of lateral ankle sprain on a young (13-23 years old) athletic population (Moiler et al., 2006).

Proximal Fibular MWM to treat LAS

Another MC MWM to treat LAS, the proximal fibula posterioanterior (PA) glide with no knee rotation is considered a secondary option when treating LAS within the MC paradigm. Members of the North American MC Teachers association (MCTA) describe the affects of the LAS mechanism of injury (varying degrees of supination, inversion, plantar flexion, and internal rotation) has the potential to create pain and dysfunction at the proximal fibula and lateral knee. Applying the proximal fibula MWM, the patient is in a standing upright, in a pre-squatting position while the clinician contacts the patient's lateral gastrocsoleus behind proximal fibula with the thenar eminence. Once appropriate contact has been made, the clinician applies a pain free posterioanterior glide and maintains glide while the patient flexes knee through a squat (Mulligan, 2010, 2013). Although a member of the North American MCTA recommends this MC technique as an option when treating LAS, no published clinical evidence is available to support or refute this techniques efficacy.

Mulligan Concept MWM to Treat Limited and Painful Dorsiflexion

As another MC technique to treat LAS, Vicenzino et al. (2006) developed a clinical trial to measure the immediate effects of two ankle dorsiflexion MWM treatment techniques on subjects with a history of lateral ankle sprain. The

interventions were weight-bearing (WB) MWM for dorsiflexion, non-weight-bearing (NWB) MWM for dorsiflexion and control. Sixteen subjects with a history of unilateral ankle sprains and a minimum of 20 mm of asymmetry on the weight-bearing lunge test for ankle dorsiflexion reported for treatment and evaluation on three different occasions to treat the participants' dorsiflexion asymmetry. On each occasion, with at least 48 hours in between interventions, the participant received one of 3 interventions (WB MWM, NWB MWM, & control) in a randomized order. The examiners compared pre and post intervention posterior talar glides and dorsiflexion lunge measurements. The results of this study showed that both WB and NWB-MWM for dorsiflexion improved posterior talar glide and dorsiflexion lunge test measurements immediately following the intervention. No difference was present between the WB-MWM and NWM-MWM techniques. This study also showed a long-term trend towards a deficit in dorsiflexion associated with previously injured ankles. No long term measurements were taken (Vicenzino, Branjerdporn, Teys, & Jordan, 2006).

Collins et al (2004) evaluated the effectiveness of the ankle MWM intervention on subacute ankle sprains on 16 subjects. "Inclusion was a grade II ankle lateral ligament sprain that was sustained on average 40 days (±24 days SD) prior to testing" (Collins, Teys, & Vicenzino, 2004). The authors did not indicate how a grade II sprain was evaluated or confirmed for inclusion. Randomized treatment conditions consisted of WB MWM for ankle dorsiflexion, placebo and control. Pre and post intervention measurements consisted of WB dorsiflexion lunge measurement, pressure pain threshold (PPT), and hot and cold thermal pain threshold (TPT). The PPT and TPT

measurements were included to test the premise that MWM will produce a mechanical but not a thermal decreased nociceptive response. The results indicated WB MWM dorsiflexion had an immediate and significant improvement compared to placebo and control in WB dorsiflexion lunge measurement but no differences found with PPT or TPT measurements. The results indicate this MWM technique provides mechanical benefits rather than direct hypoalgesic effect (Collins et al., 2004).

In a similar study, Reid et al. (2007) conducted a randomized controlled trial regarding the use of WB MWM on subjects that presented with a history of lateral ankle sprain and limited ankle dorsiflexion(Reid, Birmingham, & Alcock, 2007). Subjects that met the inclusion criteria for this study sustained a lateral ankle sprain in the last two years, had a minimum of a 2 cm deficit on WB dorsiflexion remaining after the completion and release from a rehabilitation program. Twenty-three subjects met the inclusion criteria. On the first day of data collection subjects started with a 5-minute upright cycling warm-up followed by WB lunge dorsiflexion measurement. Next, they were randomly selected to receive WB MWM treatment or sham treatment followed by post intervention WB lunge dorsiflexion measurement. Eleven subjects received WB MWM first, and 12 subjects received the sham treatment first. A seven-day washout period was used to minimize any carry over affects of the intervention, and treatments were alternated accordingly. The results of this study show a significant increase in WB lunge dorsiflexion measurement immediately following a WB MWM intervention when compared to the sham intervention. Again, no long-term measurements or treatments were performed (Reid et al., 2007).

Important Outcome Measures Associated with LAS

When treating patients who have been diagnosed with LAS, it is recommended outcome measures be utilized to track individual patients disease oriented evidence (DOE) and patient oriented evidence (POE). While performing action research on the affects of the MC MWM while treating patients with LAS, the following outcome measures will be utilized:

- Disablement in the Physically Active (DPA) Scale – The DPA scale is considered a reliable and valid generic patient report outcomes instrument for the physically active that focuses four themes that include impairment, functional limitation, disability and quality of life (Vela & Denegar, 2010). The DPA scale consists of 16 likert scale based questions, in which the patient can answer "no problem" = 1, "does not affect" = 2, "slight" = 3, "moderate" = 4, and "severe" = 5. The sum of all 16 questions is added up, and 16 is then subtracted which is the final score. Final scores can range from 0 to 64 with interval changes of 9 for acute injuries and 6 for persistent injuries meeting the minimal clinical important change (MCID) (Vela & Denegar, 2010).
- Foot and Ankle Ability Measure (FAAM) – The FAAM is a 29 question self-assessment tool specific to musculoskeletal pathologies of the leg, ankle, foot, and the associated affects of the pathology on the person's physical activity (Martin, Irrgand, Burdett, Conti, & Swearingen, 2005). The FAAM consists of two subscales, the Activities of Daily Living (ADL) and Sport, which are scored separately. Each of the 29 likert based questions are scored on a 5 point scale of "No difficulty at all" = 4, "slight difficulty" = 3, "Moderate difficulty" = 2, "extreme difficulty" = 1, and

"unable to do" = 0. If the respondent is unable to answer the question, they would respond with "N/A" (Martin et al., 2005). The sum of all questions answered in each section is then tallied and a percentage of sum total possible (4 x total questions answered in section) is calculated. The higher the percentage the greater the physical function. The respondents also rate their own perceived percentage of normal function for both the ADL and Sport subscales. MCID's for the ADL is considered a change 8 or more while the Sport is considered a change of 9 (Martin et al., 2005).

- Weight Bearing Lunge Test for Dorsiflexion – To assess weight bearing dorsiflexion (WBDF) "the patient is required to plant their foot perpendicular to a wall and to lunge their knee toward the wall. The foot is progressively moved away from the wall until the maximum range of ankle dorsiflexion is reached without the heel lifting" (Bennell, Talbot, Wajswelner, Wussane, & Kelly, 1998). The clinician then measures the distance from the great toe to the wall in centimeters (cm) as the WBDF measure. Inter-rater reliability ICC is 0.99, and the standard error of measurement is 0.4 cm (Bennell et al., 1998).
- Y-Balance Test – The Y-Balance provides measurement of dynamic function in a single leg position. The test kit "consists of a stance plat- form to which three pieces of PVC pipe are attached in the anterior, posteromedial (PM), and posterolateral (PL) reach directions. The posterior pipes are positioned 135 degrees from the anterior pipe with 45 degrees between the posterior pipes. Each pipe is marked in 5-millimeter increments for measurement. The subject pushes a target (reach indicator) along the pipe which standardizes the reach height (i.e. how far off the

ground the reach foot is)" (Plisky et al., 2009). The Y-balance shows good to excellent reliability and an ICC rate of 0.89 (Plisky et al., 2009).

Summary and Future Research

Based on this literature review and the large quantity of research focused on ankle sprains, both osteokinematic and arthrokinematic changes are likely byproducts of LAS. It is hypothesized these changes in combination of the painful response to acute injury, are correlated to the continued motor and movement dysfunction often presented in patients with a history of ankle injury (Vicenzino et al., 2011). It is also hypothesized, "by manual guidance of joint position, movement and muscle contraction, MWM is likely to provide a potent stimulus that provides novel sensory input, novel muscle activation strategies, and exposes the nervous system to new movement solutions" (Vicenzino et al., 2011). Although, advanced practice clinicians are aware of the associated mechanical changes and the corresponding hypothesized neuromuscular changes from the insult of LAS, very little research exists regarding what most skilled clinicians routinely do in their clinical practice (Hertel, 2013). Currently, "best practice for management of ankle sprains includes exercises and mobilization techniques to restore ROM and strength to the periarticular musculature and balance training to restore function and reduce the risk of re-injury" (Kaminski et al., 2013). Developing research parameters around clinical treatment patterns that include a comprehensive approach to treating LAS is needed in the future. Specifically, investigating the effects of applying the MC of MWM while treating patients complaining of LAS in authentic clinical practice is needed. Developing an a priori action research plan to investigate associated changes in pain, movement, and function

with MWM is needed. Especially valuable, providing evidence to the nature of expected retention of the MC MWM is warranted. This action research would provide evidence to the affects of treating real patients in real clinical practice. As such, this action research may create further research questions and recommendations for both "bench" and "bedside" focused researchers. This research construct has the potential to benefit patients, practicing clinicians, and educators.

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Chapter 5

Applied Clinical Research

Title

Analysis of an individual clinician's patient outcomes when applying the Mulligan Concept intervention strategy to treat lateral ankle sprains in an intercollegiate athletic training clinic

Lateral ankle sprains (LASs) are among the most common injuries within American sports and the physically active population.[1,2] The most common predisposing factor for suffering a LAS is a previous history of ankle sprain.[3] Injury surveillance conducted over a 15-year period reported 15% of injures recorded across all levels of the National Collegiate Athletic Association (NCAA) were related to the ankle.[4] Moreover, ankle injuries were the most prevalent injury in men and women's (MW) basketball, MW lacrosse, MW soccer, softball, and women's volleyball and the second most prevalent injury in baseball, field hockey and football.[5-15]

Brian Mulligan, founder and creator of the Mulligan Concept (MC), believes many chronic and acute painful and/or limited joint restrictions are due to subtle positional faults.[16,17] Specific to the ankle, Mulligan theorized the mechanism of LASs creates a positional fault of the distal fibula. When LAS occurs through varying degrees of inversion, plantar flexion, and internal rotation, the distal fibula is rotated into an anterior, inferior, and medial positional fault. The positional fault then creates tissue irritation, joint pain, and joint arthrokinematic restrictions.[16,18] Used as both a

diagnostic tool and therapeutic intervention, the practitioners of the MC would recommend the clinician mobilize the distal fibula with movement in a posterior, superior, and lateral direction with the intentions of decreasing pain, painful joint restrictions, and the positional fault. Vicenzino,[17] further hypothesizes this MC mobilization with movement (MWM) "is likely to provide a potent stimulus that provides novel sensory input, novel muscle activation strategies, and exposes the nervous system to new movement solutions."[17(p.96)] Moreover, if the MWM improves the symptoms, further interventions using the MC techniques are warranted based on the positional fault theory.[17]

The National Athletic Trainers' Association Position Statement: Conservative Management and Prevention of Ankle Sprains in Athletes recommends the use of early mobilization techniques to treat LAS.[19] Recent evidence indicates positional faults at the tibiofibular joint are associated with LAS[20-24] and randomized controlled trials demonstrate positive immediate affects of the MC at the ankle;[25] however, data is not available regarding application of the MC with evaluation and treatment of LAS through authentic patient outcomes in an intercollegiate athletic training clinic.[19,25] Further, regarding ankle research, Hertel[18] suggests "very little research that assesses what most skilled clinicians routinely do in clinical practice" exists.[18] As such, this study is designed to further investigate the current literature and recommendations while utilizing action research. Therefore, the purpose of this study was to examine the clinical use of the MC while treating LAS through the perspective of an individual clinician in an intercollegiate athletic training clinic.

Research Questions

Described as mechanism to provide practice-based evidence (PBE)[26], action research "involves healthcare practitioners conducting systematic enquiries in order to help them improve their own practices, which in turn can enhance their working environment and the working environments of those who are part of it – clients, patients, and users".[27(p.1)] Based on clinical experience, improved clinical outcomes, and the available literature, the following research questions were posed regarding the clinical effectiveness of the MC philosophy while treating LAS through the perspective of an individual clinician in an intercollegiate athletic training clinic:

1. Do patients diagnosed with a grade I or II LAS report change in patient oriented evidence (POE) measures while being treated with the MC philosophy?
    a. Pain Intensity Numeric Rating Scale (PI-NRS)
        i. Non Weight Bearing (NRS-NWB)
        ii. Weight Bearing (NRS-WB)
    b. Disablement of the Physical Activity Scale (DPA-Scale)
    c. Foot and Ankle Ability Measure – Activity of Daily Living (FAAM-ADL)
    d. Foot and Ankle Ability Measure – Sport (FAAM-Sport)
    e. CSIM (NRS)

2. If patients diagnosed with a grade I or II LAS report change in POE measures while being treated with the MC philosophy, are the results retained from each treatment interval and 1-month follow-up after discharge?

3. Do patients diagnosed with a grade I or II LAS demonstrate change in disease oriented evidence (DOE) measures while being treated with the MC philosophy?
    a. Y-Balance Composite (YBC)
    b. Weight Bearing Lunge Measure for Dorsiflexion (WBDF)

4. If patients diagnosed with a grade I or II LAS demonstrate change in DOE measures while being treated with the MC philosophy, are the results retained from each treatment interval and 1-month follow-up after discharge?

Descriptor of Outcome Measures

- PI-NRS: POE to describe pain. The PI-NRS is an 11-point scale with a ceiling of 10 (worst pain) and floor of 0 (no pain), and minimal clinically important difference (MCID) is a decrease of 2 points or 30%. The PI-NRS is used in combination with NRS-NWB, NRS-WB, and CSIM.[28]
- DPA-Scale: Developed on four themes to measure disablement (impairments, functional limitations, disability, and quality of life), the global patient outcome is comprised of 16-likert questions for the physically active with a ceiling of 64 (worst) and a floor of 0 (best). A positive change of 9 for acute injuries and 6 for persistent injuries represent MCID's.[29,30]
- FAAM-ADL & Sport: Comprised of two subscales (ADL & Sport) and is a self-assessment tool specific to musculoskeletal pathologies of the leg, ankle, foot, and the associated affects of the pathology on the person's physical activity. A self perceived percentage and an extrapolated self-assessment tool percentage are produced from each subscale. The higher the percentage, the greater the physical function (ceiling of 100%). Positive change of 8 for ADL and 9 for Sport represent MCID's.[31]
- YBC: Developed as an alternate to the Star Excursion Balance Test (SEBT), the YBC provides measurement of dynamic function in a single leg position by combining the three reach distance scores (anterior, posterior lateral, and posterior medial) divided by 3 times the patients limb length and multiplied by 100. The higher the number, the greater the dynamic function in a single leg position.[32]

Methods

Participants

The study was conducted in the Athletic Training Clinic of a NCAA Division III institution. Participants were student-athletes who voluntarily reported to the institutions athletic training clinic seeking care for LAS. The primary investigator (PI), a licensed athletic trainer (LAT) and employee of the college, explained the purpose of the study, the participant's rights per Institutional Review Board (IRB) guidelines and obtained voluntary consent from the participants. All participants who, after examination were given a diagnosis of a grade I or II LAS, were included in the study. Initially, the PI tested the methods and delivery with a one participant pilot study. Thereafter, four participants consented to participate; one volunteer was excluded due to a diagnosed fracture to the lateral malleoli leaving 3 total participants, age = 19 ± 1.41 years (Table 1.)

Table 1. Participant demographics

Participant #	Age	Gender	Sport	Season	Diagnosis
#1	18	Female	Women's Lacrosse	Fall Non-traditional	Grade-I
#2	21	Male	Men's Basketball	In-season	Grade-I
#3	18	Male	Men's Soccer	Post Season	Grade-II

Examination

After consent was obtained, the PI conducted a thorough history and purposeful palpation process of the leg, ankle and foot. Immediate referral for further diagnostic imaging for possible fracture was based on the results of the history, palpation, and Ottawa Ankle Rules.[33] If referral for fracture was indicated, the participant was

referred immediately. If the participant was subsequently diagnosed with fracture, the participant was removed from the study and was cared for accordingly. If fracture was not suspected, the PI continued the examination with range of motion (ROM) and manual muscle testing (MMT) assessment. Passive ankle ROM was assessed for painful limitations. Active range of motion (AROM) goniometer measurements were recorded for ankle dorsiflexion, plantarflexion, inversion, and eversion were taken to the nearest 1°. [34] The PI graded the MMT using the Modified Medical Research Council Scale with plantarflexion, dorsiflexion, inversion, and eversion (e.g., 0-5) (Appendix).[35]

Following ROM, the PI continued the examination with orthopedic special tests. The orthopedic special tests were as follows:

- Squeeze Test: The patient is positioned lying supine with the knee fully extended. The clinician stands next to the leg being tested and places one hand on each side of the leg being tested. The clinician then squeezes the tibia and fibula together at the mid-calf region. A positive test would result when the test produces pain in the distal leg and is indicative of a distal syndesmotic injury.[36,37]
- Anterior Drawer: With the patient sitting upright on the edge of treatment table with both knees flexed. The examiner cups the calcaneus with one hand and stabilizes the distal lower leg just proximal the talocrual joint, and the examiner translates the calcaneus and talus in a posterior to anterior direction. Increased laxity compared bilaterally and/or associated pain may indicate pathology of the anterior talofibular ligament (ATFL) and associated capsule.[37,38]
- Talar Tilt for Inversion: With the patient sitting upright on the edge of treatment table with both knees flexed. The examiner cups the calcaneus with one hand and

stabilizes the distal lower leg just proximal the talocrual joint, while applying inversion to the ankle mortise placing stress on the lateral ankle. Increased laxity compared bilaterally and or associated pain may indicate pathology primarily of the calcaneofibular ligament (CFL).[37,38]

- Talar Tilt for Eversion: With the patient sitting upright on the edge of treatment table with both knees flexed. The examiner cups the calcaneus with one hand and stabilizes the distal lower leg just proximal the talocrual joint, while applying eversion to the ankle mortise placing stress on the medial ankle. Increased laxity compared bilaterally and/or associated pain may indicate pathology primarily of the deltoid ligament.[37,38]
- External Rotation Test for Syndesmosis: With the patient sitting upright on the edge of treatment table with both knees flexed. The examiner grasps medial foot in dorsiflexion with one hand while the other hand stabilizes the lower leg without compressing distal tibiofibular syndesmosis. Next, the examiner applies an external rotational force to the foot. Increased anterior lateral ankle joint pain indicates pathology to the syndesmosis.[37,38]

Based on the examination, a LAS was defined as:

- Grade I, ATFL stretch (little to no tearing) associated with mild swelling and tenderness with minimal difficulty with range of motion (ROM) and weight bearing (WB).[39]
- Grade-II, ATFL torn ± CFL tear associated with moderate swelling, ecchymosis, anterolateral ankle tenderness, restricted ROM, increased difficulty with WB[39]

- Grade-III, ATFL, CFL torn ± capsular tear ± PTFL tear associated with diffuse swelling, ecchymosis, tenderness over anterolateral capsule, ATFL, CFL and inability to bear weight.[39]

Diagnosed grade-III LAS, syndesmotic injury, and or suspected fractures were referred to a physician for further diagnostic testing.

When the participant was able to weight-bear on the affected ankle, the PI evaluated dorsiflexion with the weight-bearing lunge test (WBDF) bilaterally. This method of measuring dorsiflexion was used to emphasis the functional nature of evaluating osteokinematic and arthrokinematic changes in a weight bearing position.[40,41] The distance from great toe to the wall while the heel remained flat on the ground and the knee was touching the wall was recorded to the nearest half centimeter for the WBDF test.[40,42]

After the standardized evaluation was performed and recorded, the PI used a non-therapeutic dose of one or more of the MC MWMs. First, the PI identified a client specific impairment measure (CSIM), which is a patient specific measure related to function and/or pain (e.g., painful AROM, weight bearing pain, pain with squatting, single leg squatting or painful joint restrictions). As the CSIM is a patient perceived measure, the PI used the CSIM to evaluate the clinical effectiveness of the MWM.[17] Importantly, the CSIM is used in conjunction with Brian Mulligans P.I.L.L. concept, which creates general expectations that when applying the MC, the clinician should expect the MWM to be, Pain-free, one should expect Immediate results, that is Long-Lasting.[16,43] A clinician should not apply a MWM without a CSIM to compare and/or measure clinical effectiveness.[17] After the CSIM was identified, the PI applied a distal

tibiofibular posterior, lateral, and superior mobilization (dist-fib A-P) to the affected ankle. The technique was applied as follows:

- Dist-fib A-P MWM: With the participant supine with affected ankle off treatment table. The clinician's thenar eminence is placed on the anterior surface of the distal fibula and mobilized in a posterior, superior, and lateral direction while stabilizing the leg with opposite hand.[16]

If the participant reported a decrease in the CSIM when the dist-fib A-P was performed diagnostically, the mobilization technique was considered clinically indicated. The PI continued to make clinical decisions by selecting to apply therapeutic MWM, over-pressure (OP) with the MWM, or FRT. To apply the MWM through repetitions, the PI applied the dist-fib A-P mobilization and instructed participant to actively invert ankle to end range while maintaining mobilized position through repetition. The PI applied OP with his abdomen or anterior hip to force the patent into end-range inversion at the completion of each repetition. Specifically, utilizing repetitions and OP with the dist-fib A-P MWM is recommended when applying therapeutically.[16,43] When the MWM was clinically indicated by a decreasing CSIM, the PI applied corresponding fibular repositioning tape (FRT) to maintain the mobilization.[16,44,45] The FRT was applied in the dist-fib A-P mobilized position by first preparing the area with adhesive spray and a base layer of two inch hypoallergenic Cover-Roll® stretch adhesive to prevent skin irritation. The base layer and tape are applied starting from the anterior distal fibula in an oblique direction around the lower leg in an anterolateral to lateral to posterior to medial to anteromedial direction. The PI then used two pieces of 1-1/2" BSN-JOBST Leukotape® adhesive tape to maintain

mobilization position. Pictured in appendix. Participants were instructed to leave the tape on for up to 48 hours. Generally, the Mulligan tape was utilized when the PI continued to apply distal fibular MWM's to improve the patient's CSIM to assist in reinforcing pain-free movement patterns along with the perceived needs of the participant. Mulligan taping was discontinued when the participant reported being pain-free with activity, stable and comfortable without the FRT.

Due to the nature of treating authentic patients in an athletic training clinic, the PI followed the general progression described above but made individual clinical decisions while treating each participant. Details described in each participant results.

The proposed methodology of this action research study included clinical options if the dist-fib A-P was not clinically indicated. This would have occurred when the dist-fib A-P did not improve CSIM or was painful, even after the PI reapplied the mobilization technique working to locate a better hand position and/or angle of drive for the mobilization that produced the P.I.L.L. Concept.[16,43] If the CSIM continued to not improve or the patient reported discomfort with mobilization, the PI would have evaluated the CSIM with a proximal tibiofibular anterior to posterior MWM technique next and the MWM for dorsiflexion (DF) as a third option.[16] Although, the PI planned for the eventuality that a different glide might be needed, in the three patient cases, the PI only needed to apply the dist-fib A-P. Description of each alternate glide is in appendix A.

After evaluating and treating with the MC, the PI continued to treat symptoms. During the acute inflammatory phase (48-72 hours post injury) and when signs of inflammation persisted, the participants were treated with rest, ice, compression, and

elevation.[19,46,47] Based on the clinical evaluation, daily activities were modified to limit pain and discomfort from walking. When pain and injury caused antalgic gait, participants were instructed to modify walking activity with crutches. Inflammation and edema were managed through compression with the application of a four-inch compression wrap.[19,46,47] Participants were instructed to elevate injured ankle as able while elevating, and participants were encouraged to perform pain-free ankle pumps. Cryotherpy and compression was applied in an elevated position on 20-minute intervals 2-4 times per day.[19,46,47]

Reinforcement of MWM and Reactive Neuromuscular Training

Neuromuscular re-patterning, a therapeutic approach of reinforcing the MWM, was applied with all participants. Generally, based on each participant's symptoms and quality of movement when bearing weight, the PI prescribed movements to reinforce the dist-fib A-P MWM.[16,43,48] The movements prescribed in a progressive fashion were: double leg squat (DLS), single leg squat (SLS), lateral slides (LS), and lunge with tri-extension (LTE). Constant communication with each participant was maintained to ensure pain-free and quality of movement. When minimal (below 3 on the WB-NRS) pain was present with DLS, the PI, applied Reactive Neuromuscular Training (RNT)[48,49] The purpose of applying RNT was to assist participants' neuromuscular system in reestablishing movement patterns and strategies without pain.[48,49] First, the participant communicated symptoms via WB-NRS with movement (e.g., DLS). Quantifying the painful movement enabled the PI and participant to understand when pain improved or diminished. While the participant performed a movement (e.g., DLS), the PI applied light pressure to specific locations of the participant's body (e.g., anterior

tibial tuberosity, lateral knee, or lateral hip) to assist in facilitating more appropriate pain-free movement strategies.[48-50] In general, the clinician observed the direction of the "movement error" and applied a force to exaggerate that error (e.g. if the patient was leaning too far to the right during DLS, then the clinician would place a left to right force on the patient in effort to teach the patient how to correct the fault on a reflexive level without verbal coaching). When the PI identified a position and amount of pressure, which reduced pain, the participant and PI continued to apply the pressure and movement to reinforce the neuromuscular patterning.

Results

Participant #1 reported inverting her ankle after she took a "weird" step on the grass while changing direction. She reported hearing a "crack", and discontinued practice activity due to associated pain and limited function. The participant self-treated with ice and limited activity and reported to the AT clinic the next day for examination and treatment. Examination on day 1 (Table 1) post date of injury (DOI), participant 1 complained of increased pain with all weight bearing activity, presented with moderate encapsulated effusion at the anterolateral ankle, and was tender to palpate (TTP) at the ATFL, CFL, and distal anterior fibula. Anterior Drawer and talar tilt for inversion were positive for pain, and External Rotation Test for Syndesmosis was painful at the posterior medial talus. Manual muscle testing (MMT) was 4+/5 with dorsiflexion and eversion, and 5/5 with inversion and plantarflexion. After examination, the participant was treated with dist-fib A-P MWM without OP; a MCID occurred with pre to post NRS-WB and CSIM, FRT was applied, treated symptomatically with Game Ready (GR) intermittent cold compression and a 4"

compression wrap. The participant had a desire to complete the final weekend of the Fall non-traditional season and therefore successfully practiced with the FRT and a lace-up ankle brace with figure 8 straps on day two, and further participated in scrimmage on day three again with MC FRT and ankle brace. Unfortunately, the PI was unable to gather measurements on day 2 or 3. The FRT was removed on day 3 after scrimmage. On day five the participant reported back to the clinic feeling well with a MCID on NRS-WB. Examination of the ankle revealed mild effusion and ecchymosis, TTP at ATF, CFL and distal anterior fibula, with MMT a 5/5 in all directions. The PI applied dist-fib A-P MWM, post outcome measures were taken and FRT was applied again. Important to note, although the participant was unable to identify a CSIM, she

Table 2. – Participant 1, Grade-I LAS

	Day 1	Day 5	Day 7	Day 12	1 Month Follow-up
NRS-NWM	0	0	0	0	0
NRS-WB P/P	3 / 1*	0*	0	0	0
TTP	ATFL/CFL/DF	ATFL/CFL/DF	ATFL/CFL/DF	None	None
MMT	4/5 – DF & EV, 5/5 PF & IN	5/5	5/5	5/5	5/5
DPA-Scale	35	N/A	0*	0	0
FAAM-ADL (%)	90/67.7		100/100*	100/100	100/00
FAAM-Sport (%)	75/50		100/100*	100/100	100/000
CSIM P/P	3/1*	0/0	0/0		
R-YBC		97.96		96.67	98.15
L-YBC-§ P/P		94.07/98.52		96.85	101.11
WBDF (cm) ⌘=13, P/P	4 / 5.5	6.5/10	8.5/9	10	11
MC MWM	dist-fib A-P, 1X10	dist-fib A-P, OP, 3X8	dist-fib A-P, OP, 3X8		
Tape	MC FRT	MC FRT	MC FRT	None	None
Reinforce	None	DLS, SLS	DLS, SLS, LS, LTE		
Activity	Therapy	Therapy	Activity as tolerated	Activity as tolerated	

Key: *=MCID, P/P = Pre/Post MWM, FAAM ADL & Sport (Self %/Outcome measure %), § = Involved side, ⌘ = Uninvolved side, DLS=Double leg squats, SLS=Single leg squats, LS=Lateral slides, LTE=Lunge with tri-extensions

reported the pressure being relieved at her ankle after the second set of dist-fib A-P MWM with OP and subsequently, WBDF improvement from 6.5cm pre MWM to 10cm post MWM. Therapeutic exercises consisting of DLSs, SLSs, LSs, and LTEs were prescribed for reinforcement of the MWM. Day 7 a MCID was achieved with the FAAM-ADL and Sport and the same treatment and therapeutic exercises were prescribed except over-pressure was used with the dist-fib A-P MWM as day 5. The participant reported feeling well while running on day six and took off MC FRT as she did not believe she needed the tape any longer and respectfully requested to be released from therapy. Because the participant remained TTP at the ATFL and CFL, the PI did not accommodate the request. Day 12 was the last day of therapy when TTP subsided and the final treatment outcomes were collected. Detailed results described in table 2.

Participant 2 (Table 3) reported inverting left ankle while changing direction during practice. He was removed from practice and treated symptomatically with GR and compression wrap by a LAT on the DOI. Day 1 post injury, examination by the PI indicated a mildly painful ankle with WB and mild effusion to the anterolateral ankle. History indicated approximately two LASs on each ankle. Reported TTP at the ATFL and CFL, only anterior drawer was positive for pain and laxity (bilateral comparison), and MMT was 5/5 in all directions. Pre measures were recorded; dist-fib A-P MWM with OP for 3X8 was applied. Post measures were recorded including a MCID with the CSIM. The FRT and a traditional AT ankle tape was applied, and participant practiced as tolerated. Day 2 the participant reported being sore from practice the previous day, mild effusion persisted, and was TTP at ATFL and CFL, but had an MCID with NRS-WB. The dist-fib A-P MWM was prescribed, corresponding FRT was applied with traditional

tape and the participant successfully competed in a contest that evening. On day 4 four the participant felt well, all outcome measures had improved with MCID's with NRS-WB, FAAM-ADL, and Sport. The PI treated one last time with dist-fib A-P MWM and FRT prior to practice, and the participant was discharged from therapy.

Table 3. – Participant 2, Grade-I LAS

	Day 1	Day 2	Day 4	1 Month Follow up
NRS-NWM	0	0	0	0
NRS-WB P/P	3	1*	0*	0
TTP	ATF/CFL	ATF/CFL	None	None
MMT	5/5	5/5	5/5	5/5
DPA-Scale	18	0*	0	0
FAAM-ADL (%)	100/90.5		100/100*	100/100
FAAM-Sport (%)	85/59.4		100/100*	100/100
CSIM P/P	3/1*	1/0*	0/0	
R-YBC	105.7		105.97	**Not able to test
L-YBC-§ P/P	97.1/101.49		107.30/108.45	111.27
WBDF (cm) ⌘=13, P/P	10.5/11.5	11/11	12.5/14	13.5
MC MWM	dist-fib A-P OP, 3X8	dist-fib A-P OP, 3X8	dist-fib A-P OP, 3X8	N/A
Tape	FRT & Trad	FRT & Trad	FRT	N/A
Reinforce	None	DLS, SLS		
Activity	Practice	Game	Practice	

Key: *=MCID, P/P = Pre/Post MWM, FAAM ADL & Sport (Self %/Outcome measure %), § = Involved side, ⌘ = Uninvolved side, DLS=Double leg squats, SLS=Single leg squats

Participant 3 (Tables 4 and 5), who denied a history of any LAS's reported "rolling" right ankle into inversion after getting tangled up with the soccer ball and an opponent during soccer practice. Acute (~10 minutes post injury) examination included a large encapsulated effusion at anterolateral ankle, TTP at ATF and CFL, anterior drawer was positive for pain and laxity, MMT was 5/5 in all directions, and was diagnosed with a grade-II LAS. Acute treatment consisted of MC dist-fib A-P MWM, FRT, GR, compression wrap, and the use of crutches because of increased pain with WB ambulation. After acute treatment, including MC, MCID's occurred with NRS-NWB,

NRS-WB, and the CSIM. On day 1, two symptomatic treatments (GR) were performed as the participant wanted to do all that he could to possibly be ready for what could be the last game of the season the next day. Examination indicated, moderate to severe ankle effusion, TTP at ATFL and CFL, and a MCID was recorded with NRS-NWB. Interestingly the FRT seemed to create a partial block as the effusion was mostly distal to the tape compared to proximal. Because of presence of distal edema, the PI removed tape, applied dist-fib A-P MWM with MCID's with NRS-WB and CSIM pre to post-treatments, re-applied FRT, treated symptomatically with GR, worked to apply compression wrap tighter to prevent the suspected vascular block from the FRT. Further inspection of ankle prior to the second treatment a similar effusion block was present, tape was removed, GR was applied again, a compression wrap was re-applied for the remainder of the day without FRT, and crutches were continued. On day 2 post DOI, the patient reported feeling better pre treatment, outcome measures had improved with a MCID on NRS-NWB, the participant could walk without altered gate and after communication with coaches, the participant, and the PI, the sports medicine team decided to make an effort to allow the participant to play in potentially the last game of the season. Moderate effusion persisted with mild ecchymosis, and the ATFL and CFL remained TTP. The PI applied dist-fib A-P MWM with OP at 3X8, MCID with NRS-WB was recorded; FRT was applied followed with traditional tape and Elastikon tape support. The participant was able to perform pregame warm-ups but was not able to perform well enough to be competitive in the contest. All tape was removed, and the participant was treated with ice and compression wrap after warm-ups. Although there was moderate effusion, ecchymosis, and TTP at ATF and CFL, participant

reported feeling well on day 3 with a MCID with NRS-NWB. As his team won the game, the next goal was to be ready to play on day 6 which again, could be the last game of the season. Treatments on day 3 consisted of dist-fib A-P MWM at 3X8 with OP, FRT and DL squats for reinforcement of MWM with associated RNT application at 3X10. Initially, participant 3 reported a NRS of 2 with DL squat, but when the PI applied RNT with continuous pressure at the tibial tuberosity on the affected side while performing the DL squat the NRS was 0. As such, the PI applied RNT the remainder of repetitions to

Table 4. – Participant 3, Grade-II LAS

	Injury Date	Day 1	Day 2	Day 3	Day 4	Day 6
NRS-NWB	6/4*	4/3	2*/0*	1*/0*	0*/0	0/0
NRS-WB P/P	7/4*	6*/4*	4/0*	1*/0*	0*/0	2/1*
TTP	ATF/CFL	ATF/CFL	ATF/CFL	ATF/CFL	ATF	ATF
MMT	5/5	5/5	5/5	5/5	5/5	5/5
DPA-Scale	31				19*	8*
FAAM-ADL (%)	39.3				75/86.9*	85/96.4
FAAM-Sport (%)	28.1				65/59.4*	75/78*
CSIM	7/4*	6/4*		1/0*		2/1*
R-YBC						
L-YBC-§ P/P						
WBDF (cm) ⌘=13, P/P		3/4.5		8/10		8.5/9.5
MC MWM	dist-fib A-P	dist-fib A-P	dist-fib A-P -OP	dist-fib A-P -OP	None	dist-fib A-P -OP
Tape	FRT	FRT	FRT & Trad	FRT	FRT & Trad	FRT & Trad
Reinforce	None	None		DLS with RNT	DLS, SLS, LS	
Activity	Therapy	Therapy	Game	Therapy	Light px	Game

Key: *=MCID, P/P = Pre/Post MWM, FAAM ADL & Sport (Self %/Outcome measure %), § = Involved side, ⌘ = Uninvolved side, DLS=Double leg squats, SLS=Single leg squats, LS=Lateral slides, LTE=Lunge with tri-extensions

assist with reestablishing pain-free movement pattern. Also, pre to post MCID's with NRS-NWB, NRS-WB, and CSIM occurred with the therapy on day 3. On Day 4, the participant reported feeling well and was able to keep FRT on for the past 24 hours as

the affects of the acute inflammatory process seemed to be subsiding. The ATF remained TTP, and the PI kept the FRT on from the day 3. Reinforcement exercise consisted of DLS, SLS, and lateral slides all without pain and no need for RNT. Traditional tape with Elastikon support was applied, and the participant participated in light jogging and ball work (dribbling and passing) at practice. The participant continued to participate in light practice on day 5 in an effort to feel ready for the teams' game on day 6. The participant reported a WB-NRS of 2 from the past two days of soccer activity, with mild effusion and the TTP at ATFL persisted. Treatment

Table 5. – Participant 3, Grade-II LAS

	Day 8	Day 10	Day 13	Day 18	1 Month Follow-up
NRS-NWM	0/0	0/0	0/0	0/0	0/0
NRS-WB P/P	1*/0	0*/0	0/0	0/0	0/0
TTP	ATF	ATF	ATF		
MMT	5/5	5/5	5/5	5/5	5/5
DPA-Scale			4	0	0
FAAM-ADL (%)			100/90	100/100	100/100
FAAM-Sport (%)			90/90.6*	95/93.8	100/100
CSIM	1/0*	0/0			
R-YBC		93.75/96.01		97.92	102.6
L-YBC-§ P/P		93.06		99.13	100
WBDF (cm) ⌘=13, P/P	8.5.9.5	10.5/11.5	12	13	13.5
MC MWM	dist-fib A-P, OP	dist-fib A-P, OP			
Tape	FRT	FRT			
Reinforce		SLS, SS, LS, LTE	SLS, SS, LS, LTE		
Activity		Activity as tolerated	Activity as tolerated		

Key: *=MCID, P/P = Pre/Post MWM, FAAM ADL & Sport (Self %/Outcome measure %), § = Involved side, ⌘ = Uninvolved side, DLS=Double leg squats, SLS=Single leg squats, LS=Lateral slides, LTE=Lunge with tri-extensions

consisted of premeasures, dist-fib A-P MWM with OP 3X8, reinforcement movements, and traditional tape with Elastikon support. The participant was able to perform well enough to be competitive in competition during pregame warm-ups but did not play in

the game. The team lost the game, and the season came to a close. Remaining detailed results included in table 4, with important to note details as: mild residual effusion progressively decreased but persisted until day 18, ATF was not TTP on day 18, participated requested to be discharged on day 13.

Discussion

This a priori action research philosophy was designed to measure the immediate and long-lasting effects of the MC, which provides evidence and context of authentic patient care to be interpreted by the reader. The results of this action research suggest a clinician can utilize the MC, follow the P.I.L.L. guidelines in an effort to increase pain-free function after LAS as quickly as possible. All three of the participants were pain-free with the MWM, had immediate changes in multiple outcome measures, and the results were retained over the course of treatment as well as the 1 month follow-up. Specifically, a global focus on all three participant results indicates a consistent trend of improvement over time as well as specific pre and post MWM measures (CSIM, NWB-NRS, WB-NRS, WBDF, & YBC). These results support laboratory research examining the effects of the MC while treating acute LAS.[51] In a 1998 study, the results indicated immediate decrease in pain, increase in ROM, and improvement in function beyond the "natural time course of recovery" from acute LAS.[51] The one exception to this global focus is in on day 6 for participant 3 (Table 4), in which he expressed feeling more sore with WB-NRS from the previous two days of practice. Based on the diagnosis, outcome measures, and symptoms, participant 3's LAS was more significant compared to Participant 1 and 2, which provided rich data expressing what commonly occurs in AT clinics. Clinical decisions were made based on

the participants desire to play a sport rather than solely on the injured ankle. Uniquely, this concept becomes a common component of a patient centered care philosophy when working with patients who are also competitive athletes.

Important to further facilitating a patient centered approach, patient-oriented evidence (POE) was measured. As such, consistent trends of improvement with the DPA-Scale, FAAM-ADL, and FAAM-Sport were presented. Participant 1 was at 100% (e.g., 0 on DPA-scale) on all three scales by day 7, Participant 2 by day 4, and while Participant 3 was discharged on day 18 with the FAAM-Sport at 93.8%, while the FAAM-ADL and DPA-Scale were at 100% and 0 respectfully. Interestingly, NRS-NWB and NRS-WB were both at 0 at the end of day 8. As this does not correspond with the other POE measures for Participant 3, this highlights the importance of utilizing specific patient measures such as the FAAM in combination with a NRS which enables measures of both function and palliative care.[19] All three participants returned for their 1-month follow-up and reported 100% on both FAAM's and 0 on the DPA-Scale.

The results of this case series support the current evidence which recommended clinicians should focus on treating osteokinematic and arthrokinematic changes associated with LAS.[18,19] As such, the disease-oriented evidence (DOE) from the WBDF and YBC indicated the best results to support treating LAS with the dist-fib A-P MWM. The osteokinematic WBDF measurement demonstrated in all three patients immediate pre to post MWM change, progressive improvements, and retention of improvements with 1-month follow-up measures. Patient 1, with an unaffected side measure of 13cm went from a WBDF pre measurement of 4cm on day 1 to a 10cm on day 12 and eventually an 11 on the 1-month follow-up, while participant 2, who had an

unaffected side measure of 13.5cm went from a 10.5 on day 1 to a 14cm on day 4 and settled back to a 13.5cm on the 1-month follow-up. The WBDF measure for participant 3 started at 3cm on day 1 and quickly improved to 10cm on day 3 while at discharge on day 18, he was at 13cm and returned on the 1-month follow-up at 13.5, which exceed his unaffected side of 11cm. The largest immediate change occurred with participant 1 on day 5 when the pre WBDF of 6.5cm improved to 10cm after the dist-fib A-P MWM with overpressure for 3 sets of 8.

Evaluating the osteokinematic and arthrokinematic affects of the dist-fib A-P MWM with the YBC functional measure also provided rich data. All three participants scored lower on the affected side with the first YBC measure compared to the uninvolved side. All three participants improved from pre to post dist-fib A-P MWM on every YBC measure, and eventually produced a higher (i.e., better) YBC score on the affected side compared to the unaffected side. Participant 1 first tested higher on the post YBC on Day 5, Participant 2 on day 4, and day 10 for Participant 3. This immediate change in functional activity appears to support Vicenzino et al. theory of a MWM creating "a potent stimulus that provides novel sensory input, novel muscle activation strategies, and exposes the nervous system to new movement solutions".[17(p.96)] This theory could explain why all three LAS's returned to normal strength, function, POE outcomes, and were pain-free without traditional strengthening and or proprioceptive exercises that are often recommended.[19,52-56] Based on the results of this case series, fostering a model in which the clinician provides MWM's as a mechanism to assist in re-patterning progressively pain-free movements followed by reinforcement through fundamental movement patterns was a successful approach to treat LAS. Interestingly,

it was only necessary to use RNT one time, which allowed Participant 3 to perform DLS reinforcement movement without pain on Day 3. In effect, further assisting this participant in grooving pain-free movement patterns.

The MC philosophical approach to treat LAS places more emphasis on the distal fibular anterior positional fault rather than disruption of the ATFL.[16] Although no radiographic pictures were taken, the pre to post dist-fib A-P MWM results and the PI's ability to apply pain-free OP into inversion with the dist-fib A-P MWM on Participant 2 on Day 1 and Participant 3 on day 2 indicate the clinician should consider other tissue involvement rather than the lateral ankle ligaments. Each treatment described was within the acute phase of the LAS, and each participant was TTP at the ATFL prior to the MWM. As such, if the ATFL was the primary tissue disrupted the direct application of OP into inversion would be expected to illicit discomfort. Therefore, other mechanisms of neuromuscular pain and tissue disruption should be considered when treating LAS.

Although the design of this action research study did not include a specific measure for the FRT, it is speculated the application of FRT played an important role in maintaining fibular position and assisting in grooving movement patterns during the initial days of therapy and as a prophylactic mechanism with continued activity. Important to note, as the FRT seemed to exacerbate the accumulation of effusion distal to the tape on the lateral aspect of Participant 3's ankle on day's 1 and 2, it is therefore recommended to exercise caution and provide patient education when applying FRT on an acute LAS.

Limitations

While action research case studies have many potential benefits, an obvious limitation of the generalizability of this study is the limited number of participants. More participants may assist in further clinical pattern recognition of expected outcomes while treating LAS with the MC. Further limiting, the PI was a novice practitioner of the MC and therefore did not have many years of clinical application of the MC to develop deep expertise. Also, baseline (i.e., pre-injury) measurements were not available which would have been helpful in interpreting changes in special tests, WBDF, and YBC. Finally, the clinician performing the study was also taking measurements (e.g., MMTs, ROM) and was not blinded to the results.

The concept of neuromuscular pattern development rather than traditional strengthening warrants further investigation through both action research and laboratory based randomized controlled trials. Further, procuring baseline functional measures, ligamentous laxity, ROM, and strength measures would assist in better understanding the effects of examining and treating LAS while utilizing the MC philosophy.

Conclusion

This action research through authentic patient care helped to illuminate the effect of incorporating the dist-fib A-P MWM to treat LAS in an intercollegiate AT clinic. Clinicians who examine and provide therapy to patients with acute LAS should expect immediate positive results that are progressively retained over time specific to patient centered outcome measures as well as functional clinician based measures. Based on the immediate and positive results described by treating LAS, the clinician should

examine associated osteokinematic and arthrokinematic changes beyond the traditional ligamentous involvement. While maintaining a comprehensive philosophy, the results also support a model more focused on neuromuscular re-patterning and reinforcement rather than traditional strengthening can be successfully utilized while treating patients with LAS.

Table 6. Modified Medical Research council Scale[35]

Grade	Description
5	Normal strength
5-	Barely detectable weakness
4+	Same as 4 but stronger
4	Muscle is weak but moves the joint against a combination of gravity and some resistance
3+	The muscle is capable of transient resistance but collapses abruptly
3	Muscle cannot move against resistance but moves the joint fully against gravity
3-	Muscle moves the joint against gravity but not through the full extent of the mechanical range of the joint
2	Muscle moves the joint when gravity is eliminated
1	A flicker of movement is seen or felt in the muscle
0	No movement

Figure 1. Fibular repositioning tape

Proximal Fibula Posterior to Anterior Mobilization With Movement (PF-PA MWM):

With the participant in a kneeling or standing squat position, PI positioned himself on the posterolateral side on the affected side and placed thenar eminence on the posterior aspect of the proximal fibular head and maintained an anterior mobilized fibular head position as the participant actively flexed and extended knee. When clinically indicated, the participant would perform a complete set of MWM's of three sets of eight repetitions.

Dorsiflexion Mobilization With Movement (DF MWM):

With the participant kneeling or standing on a treatment table in a split squat position with affected ankle at the front close to the edge of table, the PI, while facing the participant, placed a mobilization belt around his hips and the affected lower leg of the participant making sure to create a right angle at the line of the lower leg. The PI then placed hands on the dorsal side of the foot working to stabilize the talus and foot as he applied a posterior to anterior force with the belt while the participant flexes knee and moves into a dorsi-flexed position. As the participant flexed in and out of a dorsi-flexed position the PI lowered and raised himself at the same rhythm to maintain a right angle and consistent mobilization force.[16,43]

Figure 2. Data Collection Sheet

Name	ID#	Sport	Gender M / F
Date	DOI	Contact vs. Non-Contact	Side: Left / Right
MOI:			
Hx (B/L):			
Observation:			
TTP:			
DPAS - Date	FAAM-S Date	NRS / Pre/Post	WBNRS / Pre/Post

Circulation:		Neuro:		Ottawa:	
AROM	L-Pre/L-Post	R-Pre/L-Post	MMT	L-Pre/L-Post	R-Pre/R-Post
Dorsiflexion	/	/	Dorsiflexion	/	/
Plantarflexion	/	/	Plantarflexion	/	/
Inversion	/	/	Inversion	/	/
Eversion	/	/	Eversion	/	/
WB Lunge	/	/			

Special Test	Right	Left
Squeeze		
Ant. Drawer		
Talar IN		
Talar EV		
Kleigers-D		
Kleigers-SM		

Mulligan	CSIM	Sets/Reps	Pre-NRS/Post NRS	Tape-Date
D-Tib/Fib			/	
P-Tib/Fib			/	
WBDF			/	

Y-Balance	RA-	RPL-	RPM-	LA-	LPL-	LPM-
Thoughts						

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Appendix A

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Title: Mulligan Concept Usage and Clinical Profile From the Perspective of American Certified Mulligan Practitioners

Title: Mulligan Concept Usage and Clinical Profile From the Perspective of American Certified Mulligan Practitioners

Context: Although randomized controlled trials indicate the Mulligan Concept of Mobilization with Movement can improve pain free grip strength and pressure pain threshold in patients with lateral epicondylalgia of the elbow[1,2], improve ankle dorsiflexion in patients with subacute ankle sprains[3], and decrease the signs and symptoms of patients with cervicogenic headache[4,5], little is known about the clinical application, usage and profile of Certified Mulligan Practitioners (CMP) in America.

Objective: Better understand the usage and value of applying the Mulligan Concept philosophy in clinical care environments from the perspective of American Certified Mulligan Practitioners while establishing a clinical profile of a CMP.

Design: Quantitative descriptive design

Setting: Online survey instrument

Participants: American Certified Mulligan Practitioners

Data Collection and Analysis: Online survey instrument

Results: Results indicate the CMP's utilize the MC to treat a broad spectrum of spinal and peripheral clinical pathologies in primarily outpatient clinics with an active and athletic population. American CMP's also find value in the MC.

Conclusions: American CMP's continue to use and find value in the MC intervention strategy to treat a broad spectrum of spinal and peripheral conditions in their clinical practices.

Key Words: Mulligan Concept, Mobilization, Manual Therapy

Treating patients with mobilization techniques is used in healthcare settings including but not limited to athletic training, physical therapy, physician offices and chiropractic care. Traditionally, most healthcare education programs provide didactic and practical lessons in mobilization techniques specific to Maitland and/or Kaltenborn principles of mobilization. A lesser-known alternative to traditional mobilization techniques is described as the Mulligan Concept (MC). The MC was developed through the 1980's into the early 90's by Brian Mulligan, FNZSP (Hon), Diploma MT, based on his training, education, and influence from Freddy Kaltenborn, PT, OMT, Geoff D. Maitland, MBE, AUA, FCSP, FACP, SASP, and his personal clinical exploration.[6,7] This mobilization concept for both spinal and peripheral joints is simply defined as "the sustained repositioning of one articular surface on its neighbor while a movement or function is undertaken".[6] This concept is based on a theory of minor positional faults occur secondarily from injury or imbalance. These statically mal-aligned joints may lead to dynamic mal-tracking and dysfunction. Arthrokinematic mal-tracking may manifest symptoms that include pain, stiffness, and weakness.[6,7] The repositioning of one articular surface on another to address positional faults of joints is further described as "Mobilisation With Movement" (MWM) when referring to peripheral joints and "Sustained Natural Apophsyeal Glides" (SNAGS) or Natural Apophsyeal Glide (NAGS) when referring to the spine.[7] An underlying core philosophy of the MC strategy is referred to as the PILL concept. The PILL concept is to remind and guide the clinician when the MC is clinically indicated as the MWM, NAG, or SNAG should be ***P***ain-free, and the results should be ***I***mmediate and ***L***ong-***L***asting.[6-10]

Brian Mulligan first referenced NAGS in the literature in 1982,[11] followed by publishing the first edition of his book: Manual Therapy NAGS, SNAGS, MWMS etc. in 1989.[6] After the first edition of his book was published, Mulligan began to reference MWM specifically in the literature.[10,12-17] After publication of the first edition of his book and establishing the Mulligan Concept Teachers Association (MCTA) in 1996, the MC has proliferated globally through access of educational symposiums and peer reviewed journal articles. The MCTA then developed courses to facilitate structured didactic and laboratory learning environments and eventually credentials were made available as Certified Mulligan Practitioners (CMP). Specifically, Physical Therapists (PT), Medical Doctors (MD), Osteopathic physicians (DO), and Chiropractors (DC) are eligible to sit for the CMP examination after they have completed the upper quarter, lower quarter, and advanced two-day courses. Upon passing the CMP examination, clinicians may use the CMP credentials.[18]

Clinical research regarding the MC ranges from randomized controlled trials to single case-study design. Comprehensive systematic reviews by Vicenzino et al. 2011, Hing et al. 2009, and Vicenzino et al. 2007 indicate the MC literature is heavily focused on the short term positive effects of MC intervention strategies.[7,19,20] Three specific themes presented by the systematic reviews summarize the MC as shown through randomized controlled trials as: Improve pain free grip strength and pressure pain threshold in patients with lateral epicondylalgia of the elbow, improve ankle dorsiflexion in patients with recurrent ankle sprains, and decrease the signs and symptoms of patients with cervicogenic headache.[7,19,20] As the current literature supports application of the MC to decrease pain and or increase range of motion in

musculoskeletal conditions, the need for further research focusing on long term effects of MC interventions, detailed action research, more randomized controlled trials, and appropriate pre-intervention classification in the future.

A computerized bibliographical database (CINAHL, SPORTDiscus, Health Source, MEDLINE) search using key words "mobilization with movement" and "survey", "MWM" and "survey" indicated only one survey related to the use and application of the MC intervention strategy. Konstantinou et al. 2002, surveyed physiotherapists in Britain pertaining to their usage of the MC intervention strategy to treat low back pain (LBP).[21] The results of their study developed a profile regarding the usage of the MC to treat LBP and what clinical parameters guide LBP MC interventions. As this survey was specific to physiotherapists in Britain and isolated to treating LBP, further investigation regarding the use of the MC in America is needed. Therefore, the purpose of this study was to better understand the usage and value of applying the Mulligan Concept philosophy in clinical care environments from the perspective of American Certified Mulligan Practitioners while establishing a clinical profile of a CMP. Establishing a better understanding of the clinical usage from CMP's will assist clinical care strategies while providing health care.

Methods

Design

A 31-question electronic survey instrument was developed to investigate the usage and value of applying the Mulligan Concept philosophy in clinical care environments from the perspective of American Certified Mulligan Practitioners while establishing a clinical profile of a CMP. To ensure both face and content validity of the

survey instrument[22], a panel of experts progressively reviewed the development of this descriptive quantitative survey.

Participants

As practicing clinicians who have completed the same required MC education, American CMP's were the selected survey population. A complete list of American CMP's including email addresses were accessed[23], condensed and sorted into a list of de-identified email addresses. This data was uploaded to the electronic survey instrument. Upon receiving introductory email of invitation to participate, each participant was presented with the purpose of this study and their rights as willing participants per IRB guidelines.

Procedures

The 31-question survey instrument was sent to 290 American resident CMP in the Fall of 2013. A total of 36-email addresses were bounced back as invalid, thus a total CMP population of 254 were surveyed. After the first survey was sent out, two follow up requests for completion were sent to non-responders on 1 week intervals for 2 successive weeks for a total of 3 survey requests and was closed after 4 weeks. A total of 101 CMP's responded (39.7% response rate) and 5 responders were removed prior to final data analysis due to incomplete responses for a complete response rate of 37.7% (N = 96). Data was downloaded from the electronic survey instrument for further descriptive analysis using Statistical Package for the Social Sciences (SPSS, Version 21).

CMP Profile Results

Respondents were 53.1% (N = 51) male and 46.9% (N = 45) female with a mean age of 42.6 ± 9.5 years. Of the 96 respondents 3 were also members of the MCTA and 1 respondent reports no longer treating patients as a licensed health care provider. Respondents had been licensed to treat patients (maximum of 40 years) for a mean of 16.4 years ±8.9, while the mean length of time holding CMP credentials was 5.1 years ± 3.1 with a range of 1 to 17 years. Educationally, 25.3% (24) of the CMP's surveyed report the highest level of education as Bachelors, 31.6% (30) as Masters and 43.2% (41) report obtaining a terminal degree, while 93.7% held PT credentials, 5.3% held dual credentials of Certified Athletic Trainer (ATC)/PT and 1.1% reports DC as their primary credential. No respondents reported holding MD or DO credentials.

Clinically, respondents report treating on average 11.3 ± 4.7 patients per day over a mean of 4.5 ± 0.9 days per week while 96.8% report working in an outpatient clinic (private practice or clinic associated to hospital or facility) setting. When asked, "Which of the following description(s) best describe your patient population" (in the practice setting you are currently working in), results indicate the top three described settings as orthopedic, post-surgical, and athletics respectively. Details described with the top five patient populations in figure 1.

Regarding manual therapy diversity, 87.4 % (N=83) of respondents report pursuing other manual therapy techniques with Myofascial release, McKenzie Institute (MDT), and Strain-counter Strain being the top three (figure 2). Of the CMP's who have pursued further manual therapy training, 42.2% (N=35) have gained other certifications. The top three certifications obtained are McKenzie Institute (MDT), dry needling, and Myofascial release (figure 3).

Regarding other manual therapy techniques used in the clinical practices of CMP's, 82.8% report using Maitland mobilization, 55.9% Myofascial release, 54.8% manipulation, 52.7% McKenzie Institute (MDT), and 37.6% Stain-counter Strain.

Mulligan Concept Usage

Important to the clinical usage carry over, 97.9% of respondents report currently using the MC as an intervention strategy in their clinical practice while 2.1% does not. Figure 4, describes in an average month how many patient treatments incorporate the MC strategy.

Figures 5 and 6 describe spinal and peripheral MC usage specific to body part and technique respectfully. For each body part the respondent was first asked if they use a MC technique on specified body part followed by usage of specific techniques per body part represented in percentage of CMP who use each technique in an average month.

Lastly, when the CMP's were asked to rate the importance of the MC intervention strategy in their clinical practice from very important to unimportant, 91% rated either very important (60.0%) or important (30.4).

Discussion

The objective of this survey was to develop a clinical profile of American health care providers who obtained CMP status and to investigate their usage of the MC intervention strategy in their clinical practice. The results indicate CMP's are primarily physical therapists (99%) who pursued becoming certified in the MC after several years of experience treating patients as the mean licensed to treat patients was 16.4 years and the mean duration of holding CMP credentials are 5.1 years. These experienced PT's primarily treat in outpatient clinics (98.6%) regarding orthopedic

pathologies (95.8%). While treating a primarily orthopedic patient population, CMP's also report using mobilization (Maitland), Myofascial release, manipulation, and McKenzie (MDT) manual therapy most often while treating their patient population in conjunction with the MC.

The MC can be described as a treatment philosophy focused on a patient-centered approach, which enables the clinician to make clinical informed decisions while receiving immediate feedback and results.[7] Immediate feedback is predicated on a "client specific impairment measure" (CSIM), which is a measure of impairment and/or pain which is subjectively communicated between clinician and patient prior to treating with a MC intervention strategy.[7] An attractive feature of the MC, when the clinician develops a sound understanding of the MC in conjunction with an already deep foundational knowledge base of human anatomy, kinesiology, and arthrokinematic principles, the clinician can successfully apply MC to a wide variety of musculoskeletal pathologies.[6] Additionally, combining repetitive pain-free MWM's (active range of motion) with over-pressure (passive end-range pain-free pressure) appears to provide a mechanism of neuromuscular reinforcement with many of the MC techniques. This is especially true in a weight bearing or loaded position and theorized as why clinicians often experience retention of results.[6,7,10,20]

The results of this survey also indicate the MC is a robust manual therapy philosophy. CMP's use a variety of MC techniques to treat many conditions related to the spine and peripheral joints. While treating spinal pathology to the cervical, thoracic, and lumbar spines, CMP's report using a MC intervention strategy 93% of the time or more while applying SNAG's in the cervical and lumbar spines greater than

94% of the time. Many of the peripheral joints are treated with MWM at high rates with the glenohumeral, shoulder girdle, elbow, hip, tibial-femoral tibial rotation, ankle, and distal tibiofibular MWM's used more than 91% of the time.

Conclusion

Health care providers who become CMP's are well educated, have several years of clinical experience, and treat mainly orthopedic conditions in outpatient clinics. Furthermore, CMP's find value in the MC intervention strategy and continue to treat pain and restriction in most spinal and peripheral musculoskeletal joints and high occurrence rates. The CMP also report using the MC in conjunction with other manual therapy techniques. Providers of health care working with an active orthopedically based population and are licensed to treat patients with mobilization techniques may also find value in pursuing the robust MC philosophy.

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Figure 1 - Patient Population	N	%
Orthopedic	91	95.8
Post-surgical	60	63.2
Athletic (participates in sports)	58	61.1
Middle-aged	58	61.1
Weekend warrior	57	60.0

Figure 2. "Regarding manual therapy, what additional continuing education training have you pursued? (Check all that apply)" Top 5 included (N = 83)	n	%
Myofascial Release	33	39.8
McKenzie Institute (MDT)	31	37.4
Strain-counter Strain (SCS)	28	33.7
Dry Needling	25	30.1
IASTM	22	26.5

Figure 3. "Regarding manual therapy, what continuing education training have you become certified in?" Top Five included (N = 35)	n	%
McKenzie Institute (MDT)	16	45.7
Dry Needling	13	37.1
Myofascial Release	11	31.4
Manual Therapy	5	14.3
IASTM	4	11.4

Figure 4. "During an average month, how many patients do you incorporate a Mulligan Concept strategy?" (N=93)	n	%
More than 80%	17	18.3
Between 61 and 80%	23	24.7
Between 41 and 60%	21	22.6
Between 25 and 40%	24	25.8
Less than 25%	8	8.6

Figure 5. Spinal MC Usage

Question	Yes % (n)	No % (n)
"Do you currently use the MC on the cervical spine to treat patients?"	93.0% (92)	1.1% (1)
Specific cervical spine technique usage	% (n)	
SNAGS	94.6% (87)	
NAGS	84.8% (78)	
Reverse NAGS	79.4% (73)	
Traction	65.2% (60)	
SMWAMS	63.0% (58)	
Question	Yes % (n)	No % (n)
"Do you currently use the MC on the thoracic spine to treat patients?"	93.6% (87)	6.5% (6)
Specific cervical spine technique usage	% (n)	
SNAGS	89.7% (78)	
Reverse NAGS	67.8% (59)	
NAGS	54.0% (47)	
Question	Yes % (n)	No % (n)
"Do you currently use the MC on the lumbar spine to treat patients?"	95.7% (89)	4.30% (4)
Specific lumbar spine MC intervention technique	% (n)	
SNAGS	94.4% (84)	
SMWLMS	55.1% (49)	
Traction	50.6% (45)	
Question	Yes % (n)	No % (n)
"Do you currently use other spinal MC techniques"	91.4% (85)	8.6% (8)
Specific other spinal MC technique	% (n)	
SLR with Traction	91.8% (78)	
Two-leg rotation	58.8% (50)	
Bent leg raise	51.8% (44)	
SLR with compression	14.2% (12)	
Question	Yes % (n)	No % (n)
"Do you currently use a MC strategy while treating the SI?"	78.5% (73)	21.5% (20)

Figure 6. "Regarding extremity MWM, please select the Mulligan Concepts you currently use on an average month to treat your patient population (Please select either MWMs or Do not use for each body part)"

Joint	**MWM % (n)**	**Do not use % (n)**
Glenohumeral	96.8% (90)	3.23% (3)
Acromioclavicular	69.1% (56)	30.9% (25)
Shoulder Girdle (Scapulothoracic)	94.3% (83)	5.7% (5)
Elbow	90.9% (80)	9.1% (8)
Wrist	78.4% (69)	21.6% (19)
Hand and fingers	55.6% (45)	44.4% (36)
Hip	95.7% (88)	4.4% (4)
Tibial-femoral	91.0% (81)	9.0% (8)
Patellofemoral Joint	69.5%(57)	30.5% (25)
Tibial rotation	91.0% (81)	9.0% (8)
Proximal tibiofibular	80.7% (67)	19.3% (16)
Ankle	94.3% (83)	5.7% (5)
Ankle plantarflexion	81.6% (87)	18.4% (16)
Ankle Dorsiflexion	94.5% (86)	5.5% (5)
Distal tibiofibular	95.5% (85)	4.5% (4)
Foot	64.1% (50)	35.9% (28)
Toes	49.3% (36)	50.7% (37)