

Bridgewater College

BC Digital Commons

Honors Projects

Fall 2019

The Value and Effectiveness of the Selective Functional Movement Assessment (SFMA): A Literature Review

Melanie Hux

Follow this and additional works at: https://digitalcommons.bridgewater.edu/honors_projects



Part of the **Exercise Science Commons**

The Value and Effectiveness of the Selective Functional Movement Assessment (SFMA):

A Literature Review

ES 499 Honors Project-Fall 2019

Melanie Hux, ATS

Bridgewater College

Abstract

The Selective Functional Movement Assessment (SFMA) is an evaluation tool used by healthcare providers in the physically active patient population that is designed to aid clinicians in diagnosing and treating movement-based pathologies. The purpose of this literature review is not only to evaluate the value and effectiveness of the SFMA, but also to raise awareness in the rehabilitative community. This literature review is specifically geared towards athletic trainers but can also be useful for other healthcare providers. This review revealed a total of 16 articles based on the eligibility criteria in three key databases. Three primary themes found in the literature are foundational expansion, clinical usage, and quality analysis. This research is limited in the chosen eligibility criteria, the type and number of databases utilized, and the low-grade evidence discovered. In conclusion, this literature review found some degree of low-grade evidence that supports the usage of and gives value to the effectiveness of the SFMA as a musculoskeletal evaluation and treatment tool.

Keywords: Selective Functional Movement Assessment, SFMA, Gray Cook, value

Introduction

While many healthcare and related professionals may be familiar with the Functional Movement Screen (FMS), its counterpart is less widely known. The Selective Functional Movement Assessment (SFMA) is designed “to help the healthcare professional in musculoskeletal evaluation, diagnosis and treatment geared toward choosing the best possible rehabilitative and therapeutic exercises.”¹ Since it is “specifically designed to address pain,” the SFMA should be utilized by clinicians as a tool to assist in the diagnosis of musculoskeletal injuries.¹ Healthcare professionals that may benefit from the usage of the SFMA include athletic trainers, physical therapists, chiropractic physicians, and medical physicians, whereas the FMS can be utilized by sports and conditioning coaches, health and safety instructors, physical educators, personal trainers, and other related professionals.¹ The purpose of this literature review is to collect and synthesize previous research about the diagnostic value of the SFMA. This review contributes to the literature because it expands and integrates the limited amounts of discussion on the SFMA. This review is exploratory in nature and is intended to report on the current standings in SFMA research because it could be a useful assessment tool. It is important for the healthcare community to understand its worth to both patients and clinicians.

For one to better understand the SFMA itself, it is useful to also understand its history. Founder, Gray Cook, is a physical therapist (PT), orthopedic clinical specialist (OCS), and a certified strength and conditioning specialist (CSCS).¹ He began by studying proprioceptive neuromuscular facilitation (PNF) patterns and linking them to neurological principles and movement.¹ Thus, Cook and his colleagues initially created the FMS, which was first introduced in formal print in 2001.¹ Upon further speculation, Cook and his team decided to differentiate painful movements from those non-painful movements in healthy, active individuals.¹ This is

when the SFMA was established. Cook's Functional Movement System is a two-pronged approach that incorporates the FMS to screen movements in healthy individuals and the SFMA to assess painful and dysfunctional movements in patients. His book *Movement: Functional Movement Systems: Screening, Assessment, and Corrective Strategies* was published in 2010 and it properly outlines the differences and proper usages of the two tools.

This literature review will focus on the lesser known SFMA to increase awareness in the medical and rehabilitative community. The SFMA operates on the theory of regional interdependence and consists of seven top-tier assessments, including cervical spine, upper extremity, multi-segmental flexion, multi-segmental extension, multi-segmental rotation, single-leg stance, and overhead deep squat (Appendix A).¹ These movements then split into multiple breakouts when dysfunction or pain is found. These breakouts literally break down the overarching top tier movements into sub-movements in order to isolate the root cause of the dysfunction (Appendix B). These movements are primarily scored into four categories: functional and non-painful (FN), functional and painful (FP), dysfunctional and non-painful (DN), and dysfunctional and painful (DP) (Appendix C).¹ Additionally, the movements can also be scored based on the specific criteria for each pattern (Appendix D).¹ The clinician should be assessing limitations and asymmetries within the specific movement patterns.¹

Methods

Literature Eligibility Criteria

Research articles were included if they studied, gave background information, or noted the use of the SFMA, and were published after the year 2010. This yearly limit is significant because Gray Cook's Functional Movement Systems were released in his book that year, which

caused the FMS and SFMA to gain traction amongst the rehabilitative community. Therefore, any article published beforehand is extraneous to this literature review. Articles were also included if they met the previously stated criteria and also cited Gray Cook's *Movement*.

Articles were excluded if they simply mentioned the existence of the SFMA, or if the SFMA or functional movement was not used, alluded to, or mentioned in the title of the article or the abstract. Furthermore, articles were also excluded if they were not written in the English language or were not a published study in the format of a journal article.

Search Strategy

Sports Discus, Medline by PubMed, and Google Scholar were the three databases/search engines utilized in this literature review. Science Direct, CINAHL, and Cochrane Library were also considered but did not produce any relevant results. The primary search term used for each database/search engine was "selective functional movement assessment." In Sports Discus, this search term produced 12 results, of which 10 were selected to be included in this literature review. Medline by PubMed term produced 10 results, many of which were similar to the Sports Discus results, and therefore 2 additional articles were selected to be included. Google Scholar provided much broader search results. Initially, 207 results were produced. Limiting the search to the year 2010 produced 160 results. A new search method was utilized in order to find relevant articles according to the eligibility criteria with a narrower scope. By searching the articles that cited Gray Cook's book *Movement*, 439 results were produced. Then, using the original search term "selective functional movement assessment" within these 439 results produced 48 results. Many of these results were similar to those articles found previously, so 4 new articles were selected to be included. This search method was found to be the most useful in finding articles that fit the eligibility criteria. Overall, 16 total articles were selected based on these criteria.

Review of Literature

Foundational Expansion

The first theme in the literature consists of sources that simply provide background knowledge of the SFMA itself; this includes Gray Cook's original resources along with articles that discuss risk assessment and management.

The primary resource for information on the SFMA is Gray Cook and his literature. As aforementioned, his book discussing the Functional Movement Systems, including the FMS and SFMA, is titled *Movement: Functional Movement Systems: Screening, Assessment, and Corrective Strategies* and was published in 2010.¹ Additionally, Gray Cook has other books, articles, and DVDs that provide information about functional movement, which can be found on his website at <http://graycook.com/>. All other relevant sources in this literature review should cite or directly mention Gray Cook and his work.

Risk Assessment and Management

Gerbarg's article "Movement Screening to Increase Assessment Efficiency" was published in 2015. This article is not a research study. When referring to the SFMA, he notes that "the tool provides structure to assessment" and requires "observational skills and critical thinking."² In his out-patient physical therapy clinic, he regularly uses the SFMA to "identify movement dysfunction in athletes."² He then uses his assessment findings to create proper interventions.² Gerbarg talks about the increase in movement dysfunctions and advises that early identification is key to rehabilitation success.² Further, he goes more in-depth as to how the SFMA can lead to using the findings for intervention with a functional approach.² Overall, this article shows the importance of using the SFMA for risk assessment and management in athletes.

Clinical Usage

Another important theme in the literature is how the SFMA is being used in research studies. The SFMA has been used in studies of back pain and dysfunction, shoulder pain and dysfunction, knee pain and dysfunction, running mechanics, fitness and health, and movement in rehabilitation.

Back Pain and Dysfunction

Krzyzanowicz et al's article "Patient Outcomes Utilizing the Selective Functional Movement Assessment and Mulligan Mobilizations With Movement on Recreational Dancers With Sacroiliac Joint Pain: A Case Series" was published in 2015. This research study found that SFMA interventions along with Mulligan mobilization techniques quickly decreased pain and improved function, and produced clinically significant changes in patient-reported outcome measures.³ To better comprehend the technique used by this study, the Mulligan Concept Mobilizations with Movement (MWM) is defined by the article as "a manual therapy intervention developed by Brian Mulligan and couples accessory mobilizations with physiological motion to treat positional faults of joints."³ The authors also noted that the SFMA could still identify movement dysfunctions in dancers despite their level of hypermobility.³ Interestingly, the study also found that the participants all demonstrated the same movement dysfunctions in the SFMA.³ While this study was limited by having only three participants, it did support the success of the treatment intervention in dancers with sacroiliac joint pain.³

Goshtigian and Swanson's article "Using the Selective Functional Movement Assessment and Regional Interdependence Theory to Guide Treatment of an Athlete with Back Pain: A Case Report" was published in 2016. This research study found clinically significant increased

function and decreased pain, increased soft tissue extensibility, increased joint mobility, and improved motor control in an athlete with non-specific low back pain.⁴ The athlete originally had DN movements in cervical rotation, upper extremity medial rotation/extension, multi-segmental flexion, multi-segmental extension, multi-segmental rotation, and deep squat patterns.⁴ At discharge, the athlete only had DN movements in upper extremity medial rotation/extension.⁴ His pain also decreased on the numeric pain rating scale at discharge.⁴ This study stated that “the SFMA helped to guide therapists away from the tendency to treat one pathological structure in a region ... and instead identify non-painful impairments in regions adjacent to the site of pain that required intervention.”⁴ The authors believe that using the SFMA is an appropriate approach because it identifies the “cause of pain rather than dealing with local symptoms.”⁴ While this study was limited in being a case report, it still effectively used the SFMA for evaluation and treatment. The article also noted that a drawback to the SFMA is that interventions “can vary greatly between therapists, as there is no definitive treatment prescription related to specific findings” and therefore “intervention choices are dependent upon practitioner judgement, experience, and personal equipoise.”⁴

These two articles studying back pain and dysfunction with the SFMA both concluded that the SFMA is an effective tool to guide evaluations and treatment interventions.^{3,4} The researchers found improved outcome measures such as decreased pain and increased function in their patients by utilizing the SFMA in these studies.^{3,4} While this information is notable, it is also influential that these studies both have a very small number of participants.^{3,4}

Shoulder Pain and Dysfunction

Busch et al’s article “Relationship of Preseason Movement Screens with Overuse Symptoms in Collegiate Baseball Players” was published in 2017. This research study found that

“poor SFMA performance was associated with an increased likelihood of experiencing at least one overuse symptom during the preseason and during the competitive season.”⁵ The researchers used the SFMA upper extremity patterns and categorized the scores as “good” or “poor,” with a good score being FN and poor scores being DP, DN, and FP.⁵ This study also reported that the SFMA could “quickly and accurately identify individuals who have limited or painful mobility.”⁵ The study notes that the upper extremity pattern of the SFMA is flawed in that one only has to touch the specific landmark to be considered functional, whereas not being able to touch this landmark by a half inch or six inches distance is still considered dysfunctional.⁵ While this study was limited in that the 60 total participants were a convenience sample, and that overuse symptoms were self-reported by the participants and therefore could be underreported, it showed that utilizing the SFMA in pre-participation screens could help identify athletes who are at-risk for overuse symptoms.⁵

Busch et al’s article “Relationship of Movement Screens with Past Shoulder or Elbow Surgeries in Collegiate Baseball Players” was published in 2018. This research study found that previous shoulder and elbow surgeries were unrelated to upper extremity pattern SFMA performance.⁶ While this study did not measure rehabilitation outcomes, the researchers report that “the lack of significant findings could be due to improved rehabilitation strategies among practitioners.”⁶ Other explanations of findings include differences in surgery dates at testing time, sport-specific anatomical adaptations of the upper extremity, and the scoring criteria of the SFMA upper extremity pattern.⁶ This study was limited in that the 176 total participants were a convenience sample and that the surgery dates were not collected in the 30 participants that reported a previous shoulder or elbow surgery.⁶ This article still notes that the SFMA can “help identify individualized movement dysfunctions” and “quickly and accurately assess quantity and

quality of movement,” and therefore is still beneficial to use in the pre-participation examination.⁶

Cramer and Nasypany’s article “Efficacy of Reflexive Neuromuscular Stabilization During Treatment of Scapular Dyskinesia in an Overhead Athlete: A Case Report” was published in 2018. This research study found that combining traditional conservative treatments and reflexive neuromuscular stabilization was an effective treatment for an athlete with scapular dyskinesia. By utilizing the SFMA to find the cause and determine the treatment for scapular dyskinesia, the athlete had improved perceived limitations, eliminated pain, decreased disability, and increased function.⁷ The researchers reported that “incorporating a functional movement assessment into the evaluation process enables proper location and identification of sources of dysfunction.”⁷ The researchers also felt that the SFMA was key in creating an individualized treatment plan, which allowed for positive clinical results.⁷ Furthermore, they noted that “there are many ways to evaluate and treat the shoulder complex but a treatment-based classification system should be considered especially when a specific mechanism is unknown.”⁷ Limitations to this study include that it is a case report with one participant and that it would be difficult to compare to future studies.⁷

These three articles studying shoulder pain and dysfunction with the SFMA all agreed that the SFMA should be utilized in evaluations,^{5,6,7} while two of the three articles supported its usefulness.^{5,7} Two of these studies also reported that the SFMA is a beneficial tool to use in the preparticipation assessment to gain insight on movement dysfunctions and athletes who are at-risk for overuse symptoms.^{5,6} It is also significant that two of these studies had a larger number of participants,^{5,6} but the third study had only one participant.⁷

Knee Pain and Dysfunction

Kim and Yim's article "Selective Functional Movement Assessment (SFMA)-Based Therapeutic Corrective Exercises Reduces Knee Joint Pain in a Patient with Patellofemoral Pain Syndrome after Pregnancy (Case study)" was published in 2017. This research study found that, overall, "SFMA-based therapeutic corrective exercise was effective for chronic PFPS after pregnancy in this patient."⁸ After completing the SFMA corrective exercises for eight weeks, the participant in this study showed improvements from dysfunctional to FN in multi-segmental flexion, multi-segmental extension, single leg stance, and overhead deep squat; she did not show improvements from DN in multi-segmental rotation.⁸ Other improvement measures were taken into consideration, including the straight leg raise test and the visual analog scale.⁸ The researchers report that pain is the most significant contributor to dynamic imbalances and that bad posture persists even after pain has been resolved; therefore, eliminating these dynamic imbalances is important for decreasing pain, improving posture and function, and also for therapeutic implications.⁸ They also mentioned the very high levels of inter-rater reliability of the SFMA.⁸ This study is limited in that it had only one participant.⁸ This article studying knee pain and dysfunction with the SFMA shows the overall effectiveness of corrective exercises.

Running Mechanics

Mokha et al's article "Functional Movement Pattern Training Improves Mechanics in a Female Runner with External Snapping Hip Syndrome" was published in 2015. This research study found that using treatment interventions from the SFMA decreased pain, increased function, improved running mechanics and relieved symptoms of external snapping hip syndrome in a runner.⁹ The athlete initially showed DN movements in multi-segmental flexion, extension, and rotation due to decreased motor control that were all improved to FN movements

post-intervention.⁹ She also reported no pain or other symptoms and felt that she was running more naturally post-intervention.⁹ The researchers note that “this approach was unique in that the focus was on improving foundational, basic movement patterns rather than targeting the running technique itself or strengthening specific muscles.”⁹ This study demonstrated that correcting underlying movement patterns can improve running mechanics.⁹ This study was limited in that it is a case report with one participant and that the researchers did not follow-up to check for the persistence of the biomechanical changes.⁹ This article studying running mechanics with the SFMA agreed that the SFMA should be utilized to guide therapeutic exercise interventions.

Fitness and Health

Spector et al’s article “A Pilot Study of a Home-Based Motivational Exercise Program for African American Breast Cancer Survivors: Clinical and Quality-of-Life Outcomes” was published in 2014. This research study found that increasing physical activity levels in breast cancer survivors lead to improvements on several fitness and health parameters, including SFMA measures.¹⁰ The importance of this study is that African American breast cancer survivors have decreased levels of physical activity and higher rates of advanced disease, mortality rates, recurrence rates, incidence of comorbidities, and long-term physical effects.¹⁰ Exercise training has been proven to improve outcomes in cancer survivors in general.¹⁰ The researchers reported that “functional movement changed with SFMA scores revealing significant improvements in functional movement patterns and a decrease in dysfunctional movement patterns.”¹⁰ This study did not specifically identify which SFMA patterns were used, but rather dichotomized results into functional and dysfunctional, but it did include the SFMA as being an objective assessment.¹⁰ While this study is limited in that it did not specifically research the SFMA itself, it is unique in the way that it used the SFMA in breast cancer survivors.

Kim et al's article "Effects of Corrective Exercises on Selective Functional Movement Assessment and Health Risk Appraisal in Middle-Aged Women" was published in 2016. This research study found that functional corrective exercises have a positive, longer-term effect on SFMA scores of healthy women in comparison to basic fitness exercises in a control group.¹¹ Individualized functional corrective exercises were given to each woman in the experimental group based on her SFMA results while the control group performed squats, dead lifts, and bench presses.¹¹ These exercises were performed for one hour, twice a week, for four weeks total.¹¹ Measurements were taken pre-intervention, post-intervention, and four weeks post-intervention in a total of 30 participants.¹¹ The researchers found that the experimental group had statistically significant improvements in SFMA score at four weeks and eight weeks after baseline testing while the control group only had statistically significant improvements at four weeks after baseline.¹¹ It is important to note that this study also found that general exercises improved SFMA scores as well as specific functional corrective exercises.¹¹ This study is limited in the smaller number of participants and the shorter length of an intervention period.¹¹ In spite of this, this study is high quality research because it is a randomized-controlled trial.¹¹

These two articles studying fitness and health show that the SFMA can be useful in presently healthy individuals.^{10, 11} These studies both found increased function in the SFMA after exercise training.^{10, 11} While these studies both have a moderate number of participants, the population type differed in that one population was healthy while the other specifically had the pre-existing condition of breast cancer.^{10, 11}

Movement in Rehabilitation

Hetzler and Mahaffey's article "Melior Via: A Better Way to Integrate and Restore Movement into Orthopedic Rehabilitation" was published in 2016. These clinicians aim to

standardize the language and clinical understanding of movement in the medical field.¹² They surmise that “movement is complex but not complicated” and should therefore should be a shared viewpoint amongst professionals.¹² The authors point out that movement is universal and predictable in all normal infants; they believe that these principles should be used to guide orthopedic rehabilitation after injury, trauma, or surgery because it is the instinctual methodology to learning movement in the first place.¹² They report that “we build every movement from a series of postures and patterns that are the root of all movements.”¹² The “postures” are supine, prone, quadruped, sitting, kneeling, and standing while the “patterns” are breathing, head control, pushing down, weight shifting, reaching, and rolling; these postures and patterns ultimately lead to gait and further functional movements.¹² The authors state that the “building blocks for all movement are unlimited mobility, diaphragmatic breathing and a nervous system that is incomplete.”¹² They call their method the Movement Integration Theory and have conducted previous studies that have shown increased quality of care, improved short and long term outcomes, and lowered costs to patients, health care insurance, and rehabilitation venues.¹² These clinicians utilize the SFMA at patient intake to align their Movement Integration Theory postures and patterns with the SFMA diagnosis to formulate an individualized treatment plan and again at discharge to ensure positive patient outcomes.¹² The authors used this treatment plan with an athlete who had symptoms for almost a year; his pain was unresolved by all other traditional treatments and was considering surgery.¹² Within three weeks of treatment, the athlete had no pain and returned to full activity.¹² The researchers name the SFMA as pivotal in directing the clinicians toward effective treatment for the athlete.¹² This article studying movement in rehabilitation applied the SFMA in order to pave the way for restoring primal movement principles in treatment.

Quality Analysis

The last important theme in the literature is evaluating the SFMA from a quality analysis perspective. The SFMA has been examined in terms of reliability, validity, and critical appraisal.

Reliability

Glaws et al's article "Intra- and Inter-Rater Reliability of the Selective Functional Movement Assessment (SFMA)" was published in 2014. This research study found "substantial to almost perfect intra-rater reliability of the SFMA" and "slight to substantial" inter-rater reliability in regards to the categorical scoring tool.¹³ This study ultimately concluded that raters with greater experience showed higher reliability rates.¹³ The study used three raters of various experience levels to score previously recorded videos of 35 healthy participants in the SFMA top-tier movement patterns; the raters re-scored the same videos between one to two weeks later.¹³ The raters used the categorical scoring tool (FN, FP, DN, and DP) and the criterion checklist scoring tool, which is a list of 34 specific requirements to be met for good technique.¹³ The researchers note that "screening and assessment tools that incorporate whole body functional movements may uncover important underlying impairments that allow for the development and implementation of targeted interventions to both maximize recovery after primary injury and prevent secondary injury" in reference to the SFMA.¹³ It is also important that this study adds that this reliability data is comparable to that of other similar movement-based tools.¹³ In addition, the researchers also report that "use of the SFMA may provide a more comprehensive understanding of the mobility and stability impairments throughout the body than the traditional medical model, and subsequently may aid the development of targeted interventions to maximize recovery after primary injury."¹³ This study is limited in that it uses video recordings, which may

not give the same experience as in-person scoring, and that the participants are all healthy, whereas the SFMA is intended to be used in injured participants.¹³

Dolbeer et al's article "Inter-Rater Reliability of the Selective Functional Movement Assessment (SFMA) by SFMA Certified Physical Therapists with Similar Clinical and Rating Experience" was published in 2017. This research study found that "the SFMA categorical and criterion scoring methods, when assessed in real-time in a clinical population, demonstrated moderate to good reliability with experienced, certified raters."¹⁴ Three experienced raters scored 49 clinically unhealthy participants on the SFMA top-tier movement patterns with two of the raters scoring in real time and one of the raters scoring the previously recorded videos.¹⁴ The largest proportion of subjects reported a leg, ankle, or foot injury and 17 of the 49 participants reported pain with the top-tier movement patterns.¹⁴ The study also demonstrated that "comparisons of live rating to video rating yielded the least reliable scoring for the criterion scoring checklist method."¹⁴ Interestingly, the study also found that "all levels of agreement improved when accounting for prevalence of dysfunction."¹⁴ This study is limited because it used video analysis while the SFMA is intended to be used for live scoring.¹⁴

Stanek et al's article "Intra- and Inter-Rater Reliability of the Selective Functional Movement Assessment (SFMA) in Healthy Participants" was published in 2019. This research study found that "certified SFMA raters with greater amounts of experience can demonstrate adequate intra- and interrater reliability using the categorical scoring method."¹⁵ This study consisted of 25 participants that were all physically active, college-aged, and healthy.¹⁵ The researchers intentionally used healthy participants in this study in order to minimize the effect of pain and/or dysfunction on the reliability of the test.¹⁵ Three raters of varying experience levels scored each of the participants two separate times between 2 to 7 days apart on the top-tier

movement patterns.¹⁵ All three raters were present for the scoring of each participant but were not allowed to discuss scoring amongst each other.¹⁵ The researchers pointed out that “the methodology of this study combines aspects of previous SFMA reliability studies and further supports their findings,” in reference to Glaws et al and Dolbeer et al.¹⁵ This study was limited in that all participants were healthy and that the researchers chose to only assess the categorical scoring tool and not include the criterion checklist scoring tool.¹⁵

These three articles studying the reliability of the SFMA all agree that the SFMA shows statistically significant levels of inter- and intra- rater reliability.^{13, 14, 15} This information is important because it means that the SFMA can be consistently scored amongst raters. These studies specifically found increased reliability with raters of greater experience levels.^{13, 14, 15} Also, two of these studies incorporated video recording.^{13, 14} It is interesting that the third study based its methodology off of a combination of the first two studies because the researchers ensured that they took past studies into account.¹⁵ In addition, it is valuable that all of these studies had a moderate number of participants.^{13, 14, 15} On the other hand, these studies also had a low number of raters to assess for scoring reliability.^{13, 14, 15}

Validity

Riebel et al’s article “Correlation of Self-Reported Outcome Measures and the Selective Functional Movement Assessment (SFMA): An Exploration of Validity” was published in 2017. This research study found that “improvements in self-reported outcome measures were associated with fewer painful movement patterns of the SFMA” and also that “improvements in self-reported function were not related to changes in movement quality, except for subjects presenting with lumbopelvic complaints.”¹⁶ The researchers surmised that “if a movement-based assessment is a valid means of evaluating a patient’s musculoskeletal pain or dysfunction, it

could reasonably be expected that a change in a patient's self-reported functional status would result in some level of change in the patient's movement patterns."¹⁶ At intake, 85 clinical subjects were instructed to complete several self-reported outcome measures, including the Patient-Specific Functional Scale (PSFS) and then a region-specific outcome measure depending on their location of primary pain (Neck Disability Index, Quick Disabilities of the Arm, Shoulder, and Hand, Oswestry Disability Index, and the Lower Extremity Functional Scale); additionally, the subjects completed the Numeric Pain Rating Scale (NPRS).¹⁶ Next, experienced and certified raters scored each participant using both the categorical scale and criterion scale on the SFMA.¹⁶ Afterwards, the subjects were independently assessed and treated for their pain for at least six weeks or until treatment completion.¹⁶ The subjects then completed the PSFS and their region-specific outcome measure again after their treatment and were re-scored on the SFMA by the same initial assessor.¹⁶ Comparison of intake to final assessments showed statistically significant improvements in self-reported outcome measures and a decrease in the number of painful patterns; no significant improvements were found in the number of dysfunctional patterns or criterion scores.¹⁶ The researchers report that "as a patient's perception of function improved, he or she was likely to experience a decrease in the number of painful patterns performed," however, "an improvement in self-reported function was not related to a change in movement quality as defined by the SFMA."¹⁶ They also make a good point in stating that "it may be useful to consider instead the concept that there is some range of movement quality (a "standard deviation" of movement) that is acceptable for activity and function rather than just one ideal way for all patients to move."¹⁶ This study also noted many possible explanations as to how these results could have occurred, such as differences in perception of pain and the types of treatments each individual received.¹⁶ In addition, the researchers discuss

the possibility that there may not have been enough subjects in each region category for statistical measurements to be accurate even though the consolidated dataset had enough subjects.¹⁶ This study was limited in that the participants were all generally young and physically fit military academy members.¹⁶ The researchers also note that “movement quality as evaluated by the SFMA may be an independent attribute of patient presentation that is not strongly influenced by changes in patient self-reported function alone.”¹⁶ This article studying the validity of the SFMA showed some statistically significant levels of validity.

Critical Appraisal

Fauntroy et al’s article “Using the Selective Functional Movement Assessment for the Evaluation of Dancers' Functional Limitations and Dysfunctions: A Critically Appraised Topic” was published in 2019. This literature review found that “low-quality evidence... exist[s] that supports improvement of overall evaluations when utilizing the SFMA.”¹⁷ Notably, this article also took into consideration the levels of evidence, as defined by the Oxford Centre for Evidence-Based Medicine, and examined the studies found based on this method.¹⁷ Although the studies discovered in this critical appraisal were considered low-quality evidence, each included study displayed an effective use of the SFMA as an overall evaluation that correctly identified dysfunctional movement patterns.”¹⁷ This study reviewed 4 relevant articles that met the inclusion and exclusion criteria (Goshtigian and Swanson, Kryzyzanowicz et al, Mokha et al, and Glaws et al) that showed improvement in patients’ dysfunctions.¹⁷ Authors from these studies reported that the SFMA is a valuable tool for clinicians because it provides “a more holistic view of the patient.”¹⁷ Furthermore, this study itself is high quality research because it is a critical appraisal. This study is essential because it expands upon a multitude of previous studies that give value to the SFMA.

Discussion

As an overall impression of this tool, it is useful to clinicians by providing insight diagnostically and providing targeted treatment options. In summary based on the literature, this tool may be helpful in specific populations, including those with back,^{3,4} shoulder,^{5,6,7} and knee pain and dysfunction,⁸ runners,⁹ and in general for fitness and health,^{10,11} and rehabilitation.¹² The literature also noted that the SFMA has some level of validity,¹⁶ reliability which improves with SFMA-certified clinician experience,^{13,14,15} and that it has a general low-grade evidence to support its usage clinically.¹⁷ Therefore, the SFMA does have some level of clinical usefulness and significance.

This literature review found a total of 16 articles of varying levels of evidence-based medicine. Specifically, this literature review found two anecdotal evidence articles, four case studies, one case series, seven cohort studies, one randomized controlled trial, and one systematic review. In his book *Principles of Athletic Training: A Guide to Evidence-Based Clinical Practice*, Prentice notes the five levels of evidence based on the type of study from the Oxford Centre for Evidence-Based Medicine (Appendix E).¹⁸ The levels are as follows: 1-randomized controlled trials; 2-cohort studies; 3-case-control studies; 4-case reports/studies; and 5-anecdotal evidence, expert opinions without critical appraisal.¹⁸ Based on this system, a majority of the articles in this literature review could be levels 2-4. These levels of evidence are then graded based on the quality of evidence, or Grading of Recommendations Assessment, Development and Evaluation (GRADE), with code A being high; B being moderate; C being low; and D being very low.¹⁸ Based on this system, the SFMA could be graded as code B because this literature review found at least one high quality study: Kim et al and Fauntroy et al.^{11,17} Interestingly, both of these studies found that the SFMA had positive effects on

participants.^{11, 17} Furthermore, research can also be categorized on the Strength of Recommendation Taxonomy (SORT), which includes A as “consistent, good-quality, patient-oriented evidence”; B as “inconsistent or limited-quality patient-oriented evidence”; and C as “consensus, disease-oriented evidence, usual practice, expert opinion, or case series for studies of diagnosis, treatment, prevention, or screening.”¹⁸ Based on this system, the SFMA could be a strength B due to the patient-oriented evidence. These three systems cumulatively give some degree of moderate quality to the SFMA.

One must also consider the limitations of the research articles found during this literature review. As aforementioned, many of these articles consist of case studies and cohort studies. Due to the nature of these types of studies, there was no control group to reduce the risk of placebo effects. Also, two articles (Gerbarg, and Hetzler and Mahaffey) appear to be magazine articles rather than peer-reviewed journal articles, which may decrease their credibility, even though they were found by scholarly databases.^{2, 12} Furthermore, certain articles (specifically Kim and Yim, and Kim et al) seemed to be unprofessional and contained many mistakes within the article itself, grammatical and otherwise.^{8, 11} Additionally, there are holes in the literature itself. For example, many studies address specific body regions rather than addressing the body as a whole, and no studies address the sensitivity and specificity of the SFMA. The sensitivity and specificity of assessment tools, such as clinical and diagnostic tests, are important for clinicians to know because it provides further statistical value to a test and offers quantitative evidence to assist in the decision of whether or not to use a particular test. It is also interesting to report that half of the articles found come from the same journal (The International Journal of Sports Physical Therapy) and a majority of articles found come from international journals. In brief, there is a need for more high-quality research on the SFMA to confirm its worth.

The usefulness of the SFMA can be analyzed by utilizing the three pillars of Evidence-Based Practice (EBP): “best available evidence in literature,” “clinical experience,” and “patient values and experiences” (Appendix F).¹⁸ This literature review has already discussed the most recent research available on the SFMA. In regard to clinical experience, the clinician may or may not decide to utilize the SFMA. Some athletic trainers (AT) may choose to use the SFMA based on which employment setting they practice within. For example, a secondary school AT may not be able to use this tool simply due to the limited amount of time they have with each patient. AT’s in this setting have a demanding work schedule, a vast patient population, and countless duties. On the other hand, an AT who works in a clinic or health and fitness club may have the opportunity to use this assessment with more patients as they deem necessary because they may have an opportunity to spend more individualized and focused time with each patient. In regard to patient values, some may have higher levels of motivation and be willing to spend more time focused on improving their functional limitations. Others may have a lack of motivation which can impact their commitment and compliance. All clinicians should use the three pillars of EBP to determine the usefulness of any tool, including the SFMA, in his or her clinical practice.

Some benefits to the SFMA include that it is noninvasive, low risk, low cost, requires little time, and does not require any equipment to administer. Some disadvantages to the SFMA include its practicality in daily clinical usage based on the clinician’s work setting, the high cost and time that it takes to obtain the SFMA certification, and the time it takes to implement the treatment plan. It is important for clinicians to note that the research has shown that the level of training and experience with the SFMA increases reliability, which further increases the accuracy of this tool. Moreover, while the SFMA is valuable for AT’s, it is also particularly useful for physical therapists (PT) and other relevant healthcare professionals.

Limitations

This literature review is no exception to limitations. Primarily, while this literature review is intended to be exhaustive, there may have been studies that were not included in the three main database searches or were excluded based on the eligibility criteria. As aforementioned, there are some concerns about the limitations within the research found by this literature review. Therefore, it can be difficult to determine the true effectiveness of the SFMA itself. Additionally, this literature review is limited in that the author is not a certified SFMA clinician.

Conclusion

There is a need to study and further research the value of the SFMA as an assessment tool. Nevertheless, based on the findings of this literature review, one could extrapolate that it is effective diagnostically due to its success in treatment found in a majority of studies. Moreover, no studies reported any negative responses to using this tool. Many researchers, such as Cramer et al, agree that the SFMA should be implemented as part of a traditional orthopedic examination.⁷ Furthermore, Busch et al reports that rehabilitation is moving in the direction of not simply focusing on single pathological structures of injury sites, but expanding to note the influence of surrounding areas.⁵ Furthermore, the information gained in this literature review is particularly useful for athletic trainers because they are musculoskeletal and rehabilitative experts who could benefit from utilizing this tool to treat the patient population in a more efficient manner. This literature review concludes that the SFMA could be utilized by clinicians and that it does possess some degree of low-grade evidence value as an assessment tool in a clinician's toolbox.

Appendix A

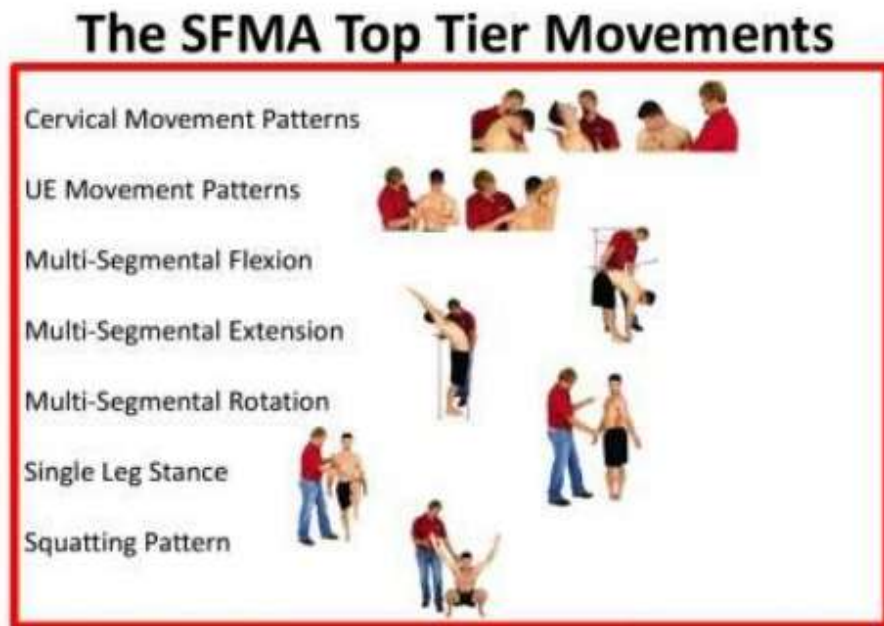


Figure 1. A depiction of the seven top-tier movements.¹⁹

Appendix B

OVERHEAD DEEP SQUATING PATTERN BREAKOUTS

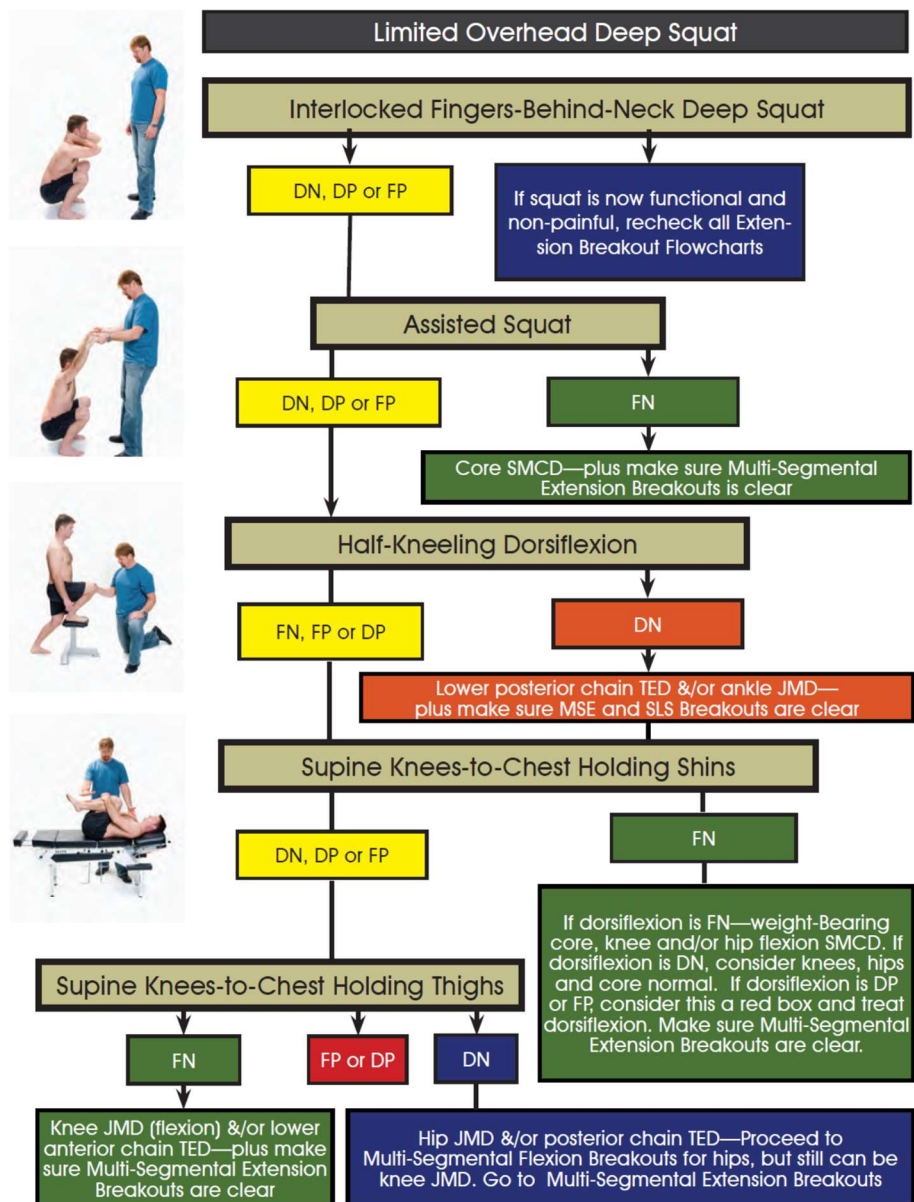


Figure 2. An example of a breakout pattern for one of the top-tier movements.¹

Appendix C

THE SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT						
SFMA SCORING		FN	FP	DP	DN	
Active Cervical Flexion						
Active Cervical Extension						
Cervical Rotation-Lateral Bend		L				
		R				
Upper Extremity Pattern 1 (MRE)		L				
		R				
Upper Extremity Pattern 2 (LRF)		L				
		R				
Multi-Segmental Flexion						
Multi-Segmental Extension						
Multi-Segmental Rotation		L				
		R				
Single-Leg Stance		L				
		R				
Overhead Deep Squat						

Figure 3. The categorical scoring sheet for the top-tier movements.¹

Appendix D

THE SELECTIVE FUNCTIONAL MOVEMENT ASSESSMENT		
Name	Date	Total Score
Cervical Flexion	<input type="checkbox"/> Primary <input type="checkbox"/> Secondary	
<input type="checkbox"/> Can't Touch Sternum_____		
Cervical Extension		
<input type="checkbox"/> Greater than 10 Degrees of Parallel_____		
Cervical Rotation		
<input type="checkbox"/> RIGHT – Can't Touch Chin to Mid-Clavicle_____		
<input type="checkbox"/> LEFT - Can't Touch Chin to Mid-Clavicle_____		
Upper Extremity	<input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT	
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Can't Touch Inferior Angle of the Contralateral Scapula		
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Can't Touch Spine of the Contralateral Scapula		
Multi-Segmental Flexion	<input type="checkbox"/> Primary <input type="checkbox"/> Secondary	
<input type="checkbox"/> Can't Touch Toes and Return to Standing Position_____		
<input type="checkbox"/> < 70 Degrees Sacral Angle_____		
<input type="checkbox"/> No Posterior Weight Shift (T-L Junction over foot) _____		
<input type="checkbox"/> Non-Uniform Spinal Curves_____		
Multi-Segmental Extension	<input type="checkbox"/> Primary <input type="checkbox"/> Secondary	
<input type="checkbox"/> ASIS Doesn't Clear the Toes_____		
<input type="checkbox"/> Can't Maintain Normal (≥ 170 degrees) Shoulder Flexion_____		
<input type="checkbox"/> Spine of Scapula Doesn't Clear the Heels_____		
<input type="checkbox"/> Non-Uniform Spinal Curves_____		
Multi-Segmental Rotation	<input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT	
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Pelvis Rotation < 50 degrees_____		
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Trunk/shoulder < 50 degrees more than pelvis_____		
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Spinal/Pelvic Deviation_____		
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Excessive Knee Flexion_____		
Single Leg Stance	<input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT	
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Eyes Open Standing < 10 seconds_____		
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Eyes Closed Standing < 10 seconds_____		
<input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT Loss of Height_____		
Overhead Squating	<input type="checkbox"/> Primary <input type="checkbox"/> Secondary	
<input type="checkbox"/> Loss of Shoulder Flexion_____		
<input type="checkbox"/> Thoracic Flexes_____		
<input type="checkbox"/> Hips Don't Break Parallel_____		
<input type="checkbox"/> Sagittal Plane Deviation of Lower Extremity Rt. _____ Lt, _____		

Figure 4. The criterion checklist scoring sheet for the top-tier movements.²⁰

Appendix E

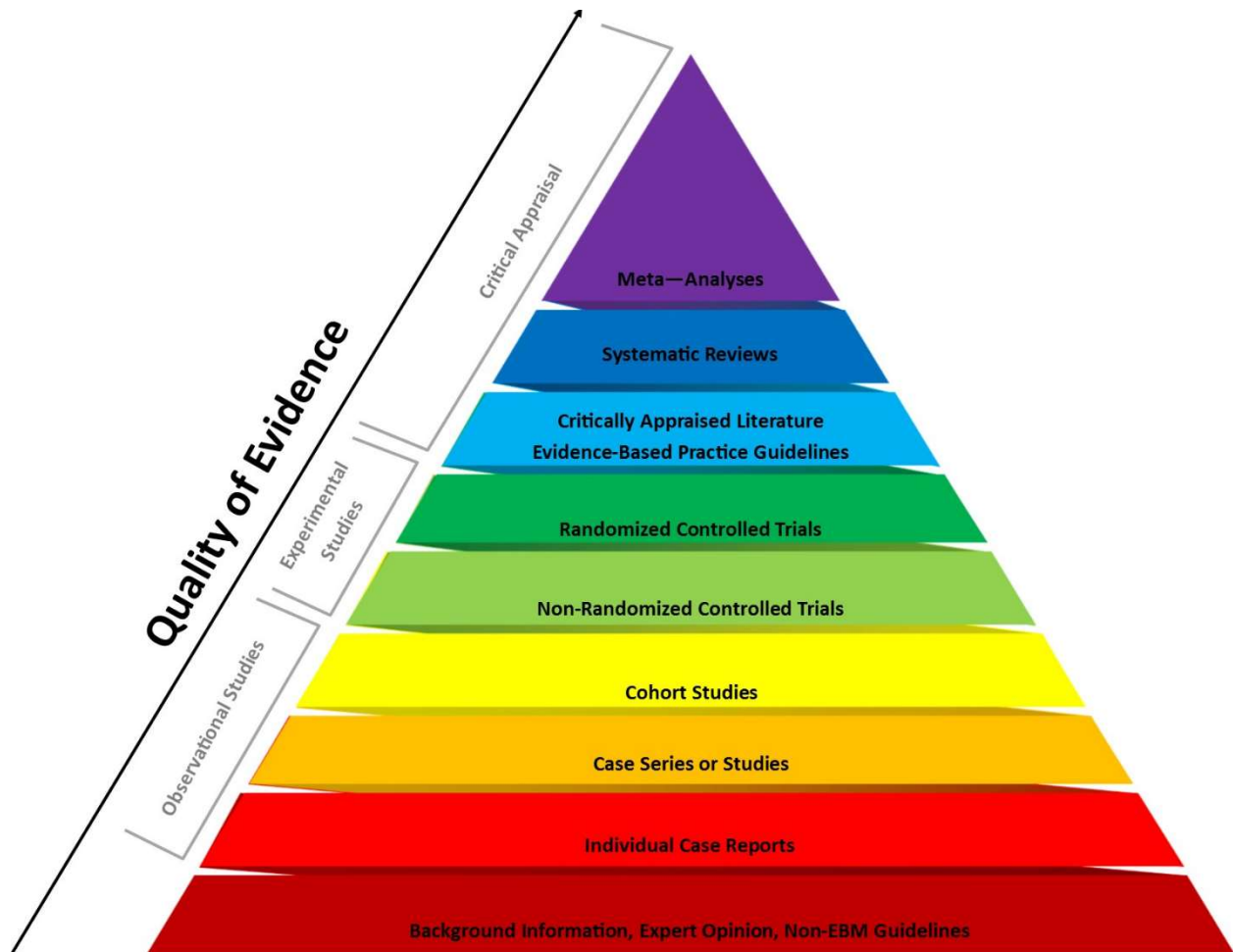
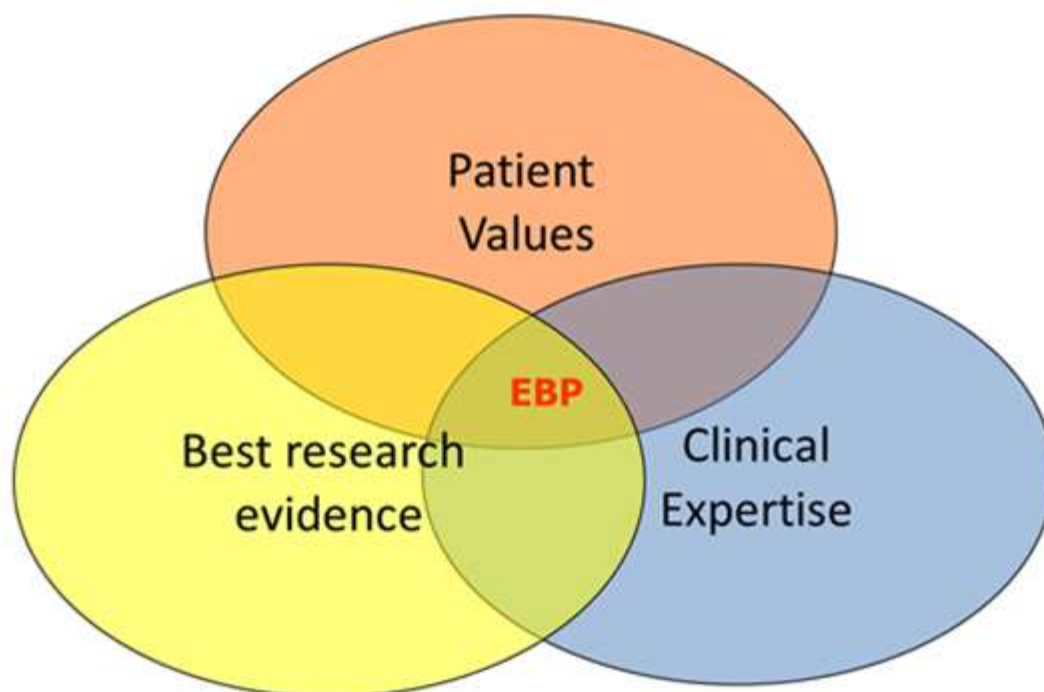


Figure 5. A depiction of the levels of Evidence-Based Practice.²¹

Appendix F



Sackett D et al (2000): Evidence-Based Medicine. Churchill Livingstone

Figure 6. A depiction of the three pillars of Evidence-Based Practice (EBP).²²

Acknowledgements

I would like to express my great appreciation to the many people who were vital in the creation of this literature review. First of all, I am particularly grateful for the multitude of advice and assistance given by Dr. Charles W. Hale IV, who served in the role of my project advisor. I also wish to acknowledge the aid provided by Dr. Kyle Kellerman and Dr. Moshe Khurgel, who fulfilled the roles of my project committee members. Assistance provided by Mrs. Cori Biddle, Learning Services Librarian, was very valuable due to her help with formatting and citations. Professor Nicole Yurcaba, English Department, provided me her support, not only with the review process, but also with raising my confidence. Furthermore, I must recognize Professor Garrett Bullock, who helped me establish the foundation of this work by acting as my tutor while I studied abroad at Oxford University; without his knowledge and efforts, this work would have been impossible. Lastly, I would like to offer special thanks to my parents, David and Teresa Hux, along with the rest of my family for always supporting me and inspiring me to reach higher degrees of achievement; my family will forever remain crucial to my accomplishments. In short, this project would not have been possible without the unending service and expertise of these mentors.

References

1. Cook G, Burton L, Kiesel K, Rose G, Bryant M. *Movement: Functional Movement Systems: Screening, Assessment, and Corrective Strategies*. Santa Cruz, CA: On Target Publications; 2010.
2. Gerbarg D. Movement screening to increase assessment efficiency. *Phys Ther Prod*. 2015;26(5):30-34.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=109526475&site=ehost-live>. Accessed September 23, 2019.
3. Krzyzanowicz R, Baker R, Nasypany A, Gargano F, Seegmiller J. Patient outcomes utilizing the selective functional movement assessment and mulligan mobilizations with movement on recreational dancers with sacroiliac joint pain: A case series. *Int J Athl Ther Train*. 2015;20(3):31-37. doi:10.1123/ijatt.2014-0066
4. Goshtigian GR, Swanson BT. Using the selective functional movement assessment and regional interdependence theory to guide treatment of an athlete with back pain: A case report. *Int J Sports Phys Ther*. 2016;11(4):575-595.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4970848/>. Accessed September 23, 2019.
5. Busch AM, Clifton DR, Onate JA, Ramsey VK, Cromartie F. Relationship of preseason movement screens with overuse symptoms in collegiate baseball players. *Int J Sports Phys Ther*. 2017;12(6):960-966.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=126498906&site=ehost-live>. Accessed September 23, 2019.
6. Busch AM, Clifton DR, Onate JA. Relationship of movement screens with past shoulder or elbow surgeries in collegiate baseball players. *Int J Sports Phys Ther*. 2018;13(6):1008-1014.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=134932262&site=ehost-live>. Accessed September 23, 2019.
7. Cramer JD, Nasypany A. Efficacy of reflexive neuromuscular stabilization during treatment of scapular dyskinesia in an overhead athlete: A case report. *Int J Sports Phys Ther*. 2018;13(6):1073-1082.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=134932268&site=ehost-live>. Accessed September 23, 2019.
8. Kim J, Yim J. Selective functional movement assessment (SFMA)-based therapeutic corrective exercises reduces knee joint pain in a patient with patellofemoral pain syndrome after pregnancy (case study). *IJBSBT*. 2017;8(6):83-92. doi:10.14257/ijbsbt.2016.8.6.09
9. Mokha GMB, Sprague PA, Rodriguez R, Gatens DR. Functional movement pattern training improves mechanics in a female runner with external snapping hip syndrome. *Int J Athl Ther Train*. 2015;20(1):25-33. doi:10.1123/ijatt.2014-0095
10. Spector D, Deal AM, Amos KD, Yang H, Battaglini CL. A pilot study of a home-based motivational exercise program for African American breast cancer survivors: Clinical and quality-of-life outcomes. *Integr Cancer Ther*. 2014;13(2):121-132. doi:10.1177/1534735413503546

11. Kim JE, Kim C, Kim S. Effects of corrective exercises on selective functional movement assessment and health risk appraisal in middle-aged women. *Phys Ther Rehabil Sci*. 2016;5(4):185-192. doi:10.14474/ptrs.2016.5.4.185
12. Hetzler B, Mahaffey B. Melior via: A better way to integrate and restore movement into orthopedic rehabilitation. *Mo Med*. 2016;113(3):191-195.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6140062/>. Accessed September 27, 2019.
13. Glaws KR, Juneau CM, Becker LC, Di Stasi SL, Hewett TE. Intra- and inter-rater reliability of the selective functional movement assessment (SFMA). *Int J Sports Phys Ther*. 2014;9(2):195-207.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=98281258&site=ehost-live>. Accessed September 23, 2019.
14. Dolbeer J, Mason J, Morris J, Crowell M, Goss D. Inter-rater reliability of the selective functional movement assessment (SFMA) by SFMA Certified Physical Therapists with similar clinical and rating experience. *Int J Sports Phys Ther*. 2017;12(5):752-763.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=126498886&site=ehost-live>. Accessed September 23, 2019.
15. Stanek JM, Smith J, Petrie J. Intra- and inter-rater reliability of the selective functional movement assessment (SFMA) in healthy participants. *Int J Sports Phys Ther*. 2019;14(1):107-116.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=134454290&site=ehost-live>. Accessed September 23, 2019.
16. Riebel M, Crowell M, Dolbeer J, Szymanek E, Goss D. Correlation of self-reported outcome measures and the selective functional movement assessment (SFMA): An exploration of validity. *Int J Sports Phys Ther* 2017;12(6):931-947.
<http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=126498904&site=ehost-live>. Accessed September 23, 2019.
17. Fauntroy V, Fyock M, Hansen-Honeycutt J, Nolton E, Ambegaonkar JP. Using the selective functional movement assessment for the evaluation of dancers' functional limitations and dysfunctions: A critically appraised topic [published online ahead of print February 2019]. *J Sport Rehabil*. doi:10.1123/jsr.2018-0054
18. Prentice WE. *Principles of Athletic Training: A Guide to Evidence-Based Clinical Practice*. 16th ed. New York, NY: McGraw-Hill Education; 2017.
19. McCormack C. The sfma top tier movements. SlideShare.
<https://www.slideshare.net/CampbellMcCormackIV/sfma-aug-2015>. Published December 22, 2015. Accessed November 15, 2019.
20. Hoogenboom BJ, Voight ML, Cook G, Rose G. Functional movement assessment. Access Physiotherapy.
<https://accessphysiotherapy.mhmedical.com/content.aspx?bookid=960§ionid=53549685>. Accessed November 15, 2019.
21. Central Michigan University Library. Evidence-based medicine: Resources by levels of evidence. Library Guides. <https://libguides.cmich.edu/cmed/ebm/pyramid>. Updated November 7, 2019. Accessed November 15, 2019.
22. Vargese SS. Evidence-based medicine. Pushpagiri.
<http://prc.pushpagiri.in/2014/01/01/centre-for-evidence-based-practice-ageing-research-unit/>. Published January 1, 2014. Accessed November 15, 2019.