ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2019/154–161/$2.00/©JCCA 2019

Use of the Mulligan concept in the treatment of lateral ankle sprains in the active population: an exploratory prospective case series

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Introduction: *Patients classified with ankle sprains are commonly treated with a multimode intervention approach. Currently, protection and tissue healing are the most accepted forms of care for these patients.*

Introduction: *Les patientes classées comme présentant une entorse à la cheville sont généralement traitées avec une approche d'intervention multimodale. À l'heure actuelle, la protection et la guérison des tissus représentent les formes de soins les plus largement acceptées pour ces patientes.*

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List of Abbreviations
FMWM – Fibula Mobilization-with-Movement
MFMWM – Modified Fibula Mobilization-with-Movement
LAS – Lateral Ankle Sprain
NRS – Numeric Rating of Pain Scale
PSFS – Patient-Specific Function Scale
FAAM – Foot and Ankle Ability Measure
GRoC – Global Rating of Change
DPAS – Disablement of Physically Active Scale
WBLT – Weight-Bearing Lunge Test
YBT – Y-Balance Test

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.
The involved patients provided consent for case publication.

Case presentation: *Six patients (4 male, 2 female) 20.2 ± 1.3 years of age were classified with acute grade I lateral ankle sprains (LAS). Each patient was treated with either the Fibular Mobilization with Movement (FMWM) or Modified Fibular Mobilization with Movement (MFMWM).*

Management and outcome: *The clinical outcomes for the patients treated with both fibula MWM improved and patients returned to activity levels at about three days after three treatments.*

Discussion: *As medicine continues to advance and explore new theories for rehabilitative clinical practice it is necessary to assess interventions on patients. This prospective exploratory case series was written to share a clinical intervention, Mulligan Concept, and the outcomes that occurred in the patients with a lateral ankle sprain.*

(JCCA. 2019;63(3):154-161)

KEY WORDS: athletic training, manual therapy, mobilizations with movement, Mulligan, sports medicine

Exposé de cas : *Six patients (4 hommes et 2 femmes) âgés de 20,2 ± 1,3 ans présentaient une entorse latérale de la cheville aiguë de grade I. Chaque patient a été traité soit avec la mobilisation fibulaire avec mouvement (FMWM) ou la mobilisation fibulaire modifiée avec mouvement (MFMWM).*

Gestion et résultats : *Les résultats cliniques pour les patients traités avec les deux mobilisations fibulaires avec mouvement se sont améliorés et les patients retournent à leurs niveaux d'activité environ trois jours après trois traitements.*

Discussion : *Au fur et à mesure que la médecine avance et explore de nouvelles théories pour la pratique clinique de réadaptation, il est nécessaire d'évaluer les interventions sur les patients. Cette série de cas exploratoires prospectifs a été rédigée dans le but de partager une intervention clinique, le concept Mulligan, ainsi que les résultats obtenus chez les patients présentant une entorse latérale de la cheville.*

(JCCA. 2019;63(3):154-161)

MOTS CLÉS : entraînement sportif, thérapie manuelle, mobilisations avec mouvement, Mulligan, médecine sportive

Introduction

Many therapeutic interventions are indicated when providing care to patients diagnosed with a Lateral Ankle Sprain (LAS). Current health care standards are often based on protocols for pain management, which focus on protection and tissue healing. Protection, Rest, Ice, Compression, and, Elevation, along with stretching, therapeutic modalities, therapeutic exercise, and medication, are often prescribed for LAS injuries.[1-3] However, these best practices for LAS injuries may be limited in effectiveness due to a primary model of focus on apparent tissue-healing.[3-5]

The Mulligan Concept (MC) includes a treatment technique termed "mobilization-with-movement" (MWM) to correct a hypothesized anterior positional fault of the distal fibula for patients classified with a LAS injury.[6] Kaminski *et al*. recommends joint mobilizations to create arthrokinematic changes to help restore function but, states that MWM need further research.[7] The MC approach can be used to address the positional fault that may be indirectly responsible for the symptoms and functional limitations reported by the patient.[1, 3-6]

Improved patient-oriented evidence and disease-oriented evidence has been highlighted in patients treated with the MC, and improvement occurred in shorter time frames than would be expected for tissue healing to occur.[8,9] However, further investigation is necessary in order to clarify and validate the potential benefits.[7] Research on outcomes of clinically applicable patient care to introduce clinicians to the MC for LAS are needed. Accordingly, the purpose of this study was to examine the effects of two different MC MWM in the non-weight bearing position on active patients classified with a grade I LAS.

Table 1.
Patient demographics, injury history, and Mulligan concept techniques applied.
(FMWM: Fibula Mobilization with Movement; MFMWM: Modified Fibula Mobilization with Movement)

Patient	Age	Sex	Onset	Time to Tx	Mechanism	Treatment
1	19	Male	Acute	<24 Hours	Noncontact	FMWM
2	21	Male	Acute	<24 hours	Noncontact	FMWM
3	22	Female	Acute	<24 hours	Contact	MFMWM
4	19	Male	Acute	48-72 hours	Noncontact	FMWM
5	19	Male	Acute	<24 hours	Contact	MFMWM
6	21	Male	Acute	<24 hours	Noncontact	MFMWM

Table 2.
Ankle sprain grading system[10]

Clinical grade	Description of grade level
Grade I (Mild)	Minimal swelling (edema) and tenderness; minimal or no function loss; no mechanical joint instability
Grade II (Moderate)	Moderate pain, swelling, and tenderness over involved structures; Yes some loss of joint motion; joint stability is mild to moderately impaired
Grade III (Severe)	Complete ligament rupture with evident swelling, hemorrhage, and tenderness over involved structures, function lost; joint motion and instability evident as abnormal

Table 3.
Study inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
18-40 years of age	Acute fracture to lower extremity
150 minutes a week of physical activity	Syndesmotic or medial ankle sprains
Evaluation and classification in ≤3 days	Lower extremity surgery over past 12 months
Grade I LAS Classification	Gross laxity in the lateral ankle ligaments

Case presentation

A total of six patients met inclusion criteria for the current study (Table 1). The convenience sample of participants, who were seeking evaluation and treatment of ankle pathology, were informed of the study guidelines and consent was obtained prior to being included in the study. A detailed history, observation, palpation, and orthopedic tests were completed during evaluation to determine the severity of their LAS injury, with an ankle sprain grading system being used to classify each patient (Table 2).[10] Further study criteria was met before patients were accepted into the study (Table 3).

After each patient met inclusion criteria and consented to participate in the study, each was instructed to complete an intake packet (i.e. NRS, PSFS, FAAM, GRoC and DPAS) and the weight bearing lunge test (WBLT)

was then conducted (Figure 1).[11-16] The protocol used to assess the WBLT was based on previous research modeled by Vicenzino *et al*.[9,10,17-20] The WBLT was used due to high reliability reported in various literature examining the WBLT test.[8, 16]

Next, patients completed bilateral lower extremity Y-Balance testing (YBT). The protocol for YBT assessment in this study was based on work by Plisky et al; interrater reliability ranged from 0.99 to 1.00.[21] After the completion of the WBLT and YBT, a modified PSFS score was used to assess the patient's perception of function during each test.[21]

Prior to data collection, Institutional Review Board approval was granted at the work site of the treating clinician (TC). The Institutional Review Board accepted this a priori study design based on the details that all care provided was considered to be part of an appropriate treatment plan. The TC had completed the Mulligan Concept Lower Extremity Course and had been signed off on the MWM to the ankle joint by a Certified Mulligan Practitioner and Instructor. The TC later went on to be Certified as a Mulligan Practitioner.

Figure 1.
Weight-bearing lunge test start and stop positions.

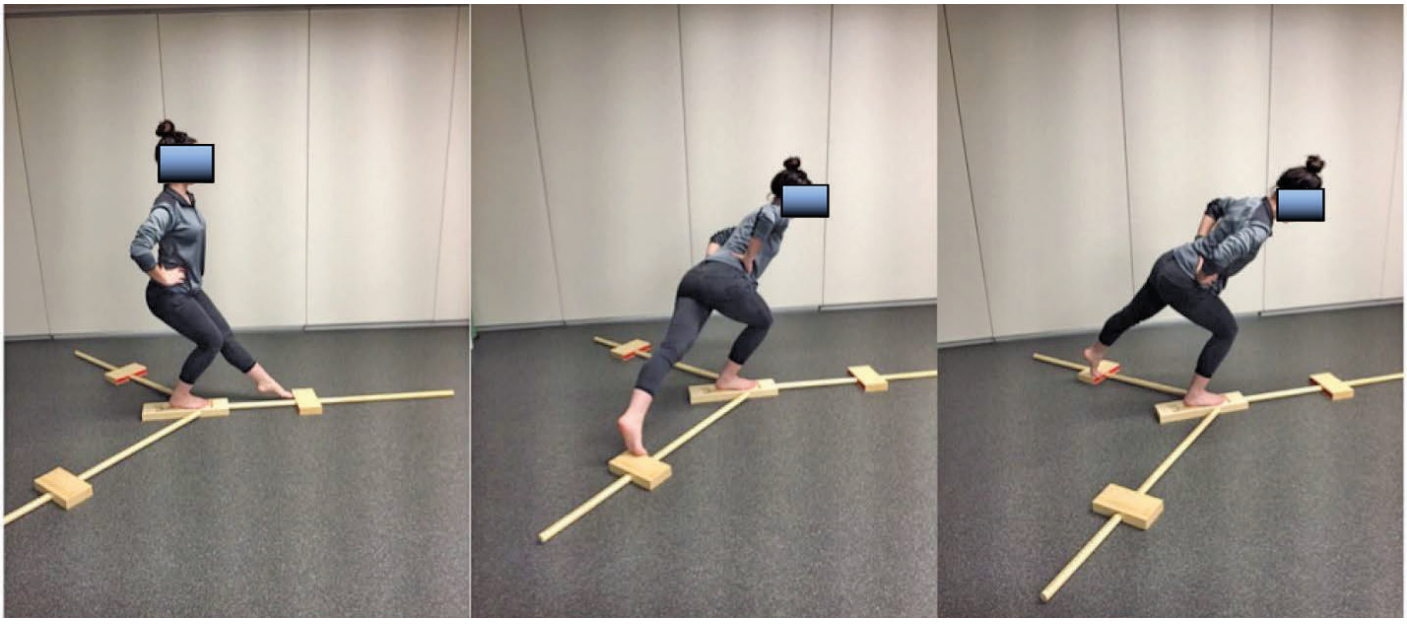

Figure 2.
Y-balance anterior, posteromedial, and posterolateral testing directions.

Figure 3.
FMWM treatment application.

Figure 4.
MFMWM treatment application.

Management and outcome

All patients were initially treated with the FMWM technique to glide the distal fibula anterior-cranially to posterior to correct the hypothesized positional fault (Figure 3). If a Pain-free Immediate Long-Lasting (P.I.L.L.) effect occurred within three attempts, the FMWM treatment was continued; however, if the P.I.L.L. effect was not achieved after three attempts, the TC attempted the MFMWM technique, with a more proximal contact to achieve the anterior-cranial to posterior glide of the fibula to correct a positional fault (Figure 4), to best meet P.I.L.L. standards.[6]

Application

While receiving treatment, patients were restricted from sports-related activities but were allowed to continue with activities of daily living. From the initial treatment session until discharge criteria was met, each patient was treated with the MC. During immediate care (first 48 hours) compression, elevation, and ice was used. At the time of the data collection, the use of Protection, Rest, Ice, Compression, and, Elevation was considered the accepted standard of care. The authors believe it is worth stating that these patients were not treated with ice as a patient preference, cryotherapy was not administered or withheld from any patients. At the time this manuscript was submitted, to the best of their knowledge, PRICE was still considered a standard method of treatment; however, there have been several papers published, related to appropriate treatment using PRICE, that information has now shown different findings regarding the use of PRICE in acute injuries. There is evidence in the literature that supports this decision.[22-24] Three of the patients (2,3, and 6) were then treated with ice, compression, and elevation for about five minutes, one time on the first day following the mechanism of injury, for pain relief. Patients were then returned to activity and discharged based on the TC evaluation and previously established norms for the collected outcome measures. Discharge criteria included, NRS score of 2 or less, and a DPA score of 23 or less.[11-13] In regards to the FAAM a score of 90 or above for daily activities and a score of 80 or above for sports activities were required prior to discharge.[15] With the YBT participants had to be within 4 cm compared bilaterally.[21] The WBLT had to be within 1.5 cm compared bilaterally.[16, 17]

Comparative outcomes

Results are reported to illustrate the initial effects of MC, effects following the complete treatment protocol, and follow-up measures in the six patients of this case series. Three patients reported a P.I.L.L. effect with the FMWM and the other three patients exhibited a P.I.L.L. effect with

Table 4.
Outcomes from initial to discharge to one month follow-ups (has met established MCID or MCD**)*

	Intake	Post-Treatment		Discharge		One-Week Follow-Up		One-Month Follow-Up	
	Mean	Mean	Mean Difference	Mean	Mean Difference	Mean	Mean Difference	Mean	Mean Difference
NRS	3.33 ± 1.03	.83 ± 1.33	2.5*	0 ± 0.0	3.33*	0 ± 0	0	0 ± 0.37	0
PSFS WBLT	6.5 ± 0.84	8 ± 1.26	1.5	9.67 ± 0.82	3.17*	9.83 ± 0.37	0.17	10 ± 0	0
PSFS YBT	6.33 ± 0.82	7.5 ± 1	1.2	9.67 ± 0.83	3.33*	9.83 ± 0.37	0.17	10 ± 0	0
WBLT	7 ± 3.1 cm	8.9 ± 3.35 cm	1.9 cm	10.42 ± 3.06 cm	3.42**	10 ± 2.78	0.42	10 ± 2.80 cm	0.42
YBC	81.78 ± 11.15 cm	85.3 ± 6.9 cm	3.5	88 ± 9.53 cm	6.25	87.7 ± 8.2	0.33	89.2 ± 6.3 cm	1.21
DPA	22.67 ± 9.7	N/A	N/A	5.33 ± 9.5 cm	17.33*	3.8 ± 5.4	1.5	1.5 ± 3.4	3.83
GRoC	1.33 ± 2.34	N/A	N/A	6 ± 0	4.67*	6.2 ± 0.4	0.17	7 ± 0	1
FAAM ADL	82.5 ± 14.27	N/A	N/A	99.5 ± 0.8	17*	98.2 ± 3.7	1.7	100 ± 0	3.5
FAAM Sport	65 ± 23	N/A	N/A	88.67 ± 14.14	23.67*	95 ± 5	0.83	99.83 ± 0.37	4

the MFMWM. Initial change in NRS met MCID standards and positive trends were reported with PSFS, WBLT, and YBT with the initial pre-treatment assessment to the initial post-treatment assessment (Table 4). Each patient returned to unrestricted activity after meeting discharge criteria within an average of 2.33 treatments completed over an average of 2.83 days (Table 5). At the follow-up dates of one-month and three-month, the patients retained the improvements that were present at discharge to unrestricted activities.

Table 5.
Patient discharge information.

Patient #	# of Treatments	Days to Discharge
1	2	3
2	2	2
3	2	2
4	2	2
5	3	5
6	3	3

Discussion

The results of this prospective exploratory study are similar to those seen in existing literature that have suggested the use of the FMWM and MFMWM to improve reported pain, function, and disability in patients classified with acute grade I LAS injuries as in this case series.[18-20] For the current study being presented, immediate improvement in clinical outcomes were present as well as at discharge, and follow-up time points. As indicated in Table 4, MCID were achieved for the NRS, the DPA scale, the GRoC, both subsections of the FAAM, and on both modified PSFS. A MDC improvement occurred for the WBLT and YBT over the course of treatment.[16, 21] For all measures, these changes were maintained for one-week and one-month follow ups, suggesting that both FMWM and MFMWM are potentially viable options to treat patients classified with grade I LAS.[21,25-29]

The MCID for the NRS is considered ≥ 1.7 points on the ten-point scale.[11] In patients with acute injury, the MCID for the DPA scale has been reported at nine points.[12] For the PSFS the MCID is considered two points of change for the average of three activities.[13] The MCID for the FAAM-ADL and FAAM-Sport has been established as eight and nine respectively.[15] Lastly, MCID has been established for the GRoC of two points.[14] Each measurement was taken pre-intervention, post-intervention, at discharge, and at a 1-month follow-up. This return

to unrestricted activity occurred at a quicker timeframe than is traditionally expected with grade I LAS.

Currently, several studies highlight the benefit of immediate and meaningful changes in pain and function in patients classified with LAS.[3-5, 7-10, 17-19] Through MWM, the patients benefited from both a joint mobilization and an emphasis on pain-free early motion. This case series supports earlier studies that have utilized the early intervention and joint mobilizations with movement in the management of ankle sprains.[17-19] Within the MC, several techniques, not only the FMWM technique has been used to treat patients classified with LAS.[25-27] Overall, the findings for this study were consistent with other established literature on the FMWM and MFMWM at reducing pain and increasing function.[17-19]

The clinical outcomes for the patients treated with both fibula MWMs improved and patients return to activity levels at about three days after three treatments. Current recovery standards for acute grade I LAS injuries are 11.86 to 20 days from onset to return to play, while some patients continue to report symptoms such as pain, instability, etc. after returning to activity.[30,31] About 30% of patients with previous ankle sprain develop chronic ankle instability (CAI) and 78% of the patients with CAI develop osteoarthritis.[5] No long term outcomes were recorded but, at the one-month follow-up all patients maintained their improved outcome scores. The treatment was guided through the use patient-oriented outcomes instead of solely objective functional testing and/or tissue healing biomarkers or diagnostic tests (MRI, ultrasound, Anterior Draw Test, Inversion Stress Test, etc.). Therefore, when the immediate changes in initial pain and function lasted over time the patient continues functional progressions toward unrestricted activities and the TC continues the treatment plan. Based on the theory of the MC, it is possible that the improvements may be based on modulated neurophysiological pathways versus apparent tissue disruption.[32,33] The limitations of this study include sample size, the multimodal intervention approach, and patients being physically active individuals.

Summary

The clinical importance of this prospective exploratory study is the immediate and follow-up outcomes observed during the assessments at specific time points. This study will add to other research studies on the use of MC in clinical practice, specifically for the treatment of grade I LAS injuries.

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