

Multimodal non-surgical intervention for individuals with knee osteoarthritis: a retrospective case series

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Introduction: *The purpose of this study is to review the pain and functional outcomes of a multimodal intervention in three patients with knee osteoarthritis (OA). This study explores how manual therapy can be delivered within an evidence-based framework for the management of knee OA.*

Methods: *Medical records were reviewed for three patients with knee OA who underwent a standardized multimodal intervention including education, exercise, and manual therapy. Changes in pain intensity and function from baseline to post-intervention were calculated and compared to thresholds for minimal clinically important differences.*

Results: *One participant met the threshold for clinically significant improvement in pain and two*

Introduction : *Le but de cette étude est d'examiner les résultats en matière de douleur et de fonction d'une intervention multimodale chez trois patients atteints d'arthrose du genou. Cette étude explore comment la thérapie manuelle peut être dispensée dans un cadre fondé sur des données probantes pour la prise en charge de l'arthrose du genou.*

Méthodes : *On a examiné les dossiers médicaux de trois patients atteints d'arthrose du genou qui ont subi une intervention multimodale normalisée comprenant l'éducation, l'exercice et la thérapie manuelle. Les changements concernant l'intensité de la douleur et la fonction entre le début et la fin de l'intervention ont été calculés et comparés aux seuils pour connaître les différences minimales importantes sur le plan clinique.*

Résultats : *Un participant a atteint le seuil d'amélioration significative du point de vue clinique*

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participants for function. No adverse events were reported.

Conclusion: *Combined education, exercise, and manual therapy delivered over a 6-week period improved function in two of the three patients reviewed. Higher quality research is required to explore whether this multimodal intervention may improve outcomes in individuals with knee OA.*

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KEY WORDS: chiropractic, knee, osteoarthritis, multimodal, treatment

pour ce qui est de la douleur et deux participants pour ce qui est de la fonction. Aucun effet indésirable n'a été signalé.

Conclusion : *L'éducation, l'exercice et la thérapie manuelle combinés sur une période de six semaines ont amélioré les fonctions chez deux des trois patients examinés. Des recherches de meilleure qualité sont nécessaires pour déterminer si cette intervention multimodale peut améliorer les résultats chez les personnes atteintes d'arthrose du genou.*

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MOTS CLÉS : chiropratique, genou, arthrose, multimodal, traitement.

Introduction

Osteoarthritis (OA) is the 12th leading cause of disability in the world and 10th leading cause in Canada.¹ It is estimated that 13% of Canadians² and over 300 million people worldwide have OA¹. Due to the increasing age of the population and rates of obesity³, the prevalence of OA in Canada is expected to increase to 25% by the year 2040, placing a large burden on the health care system². The 2011 report from the Arthritis Alliance of Canada² recommends the development of pain management interventions to help reduce the growing burden of knee OA.

The Canadian Chiropractic Guideline Initiative (CCGI) has adopted the National Institute for Health and Care Excellence (NICE) OA guidelines.⁴ The NICE guidelines recommend education and self-management, including exercise, should be offered as core treatments to individuals with OA.⁴ These recommendations are also supported in guidelines from the Osteoarthritis Research Society International (OARSI) and European League Against Rheumatism.^{5,6} A recent Cochrane Review found that self-management education programs may improve pain, function and symptoms for people with OA⁷, while a second Cochrane Review concluded that therapeutic exercise can reduce knee pain and improve physical function among people with knee OA⁸.

Manual therapy is not considered a core treatment for knee OA due to the lack of high quality evidence that currently exists.⁹ However, almost 50% of individuals with

knee OA use some form of complementary and alternative medicine, which includes manual therapy.¹⁰ The existing evidence base supporting the use of manual therapy for knee OA is comprised of only a small number of trials and review papers.¹¹ The most recent systematic review found short-term benefits favouring manual therapy over exercise alone.¹²

International guidelines differ on the use of manual therapy for knee OA. The CCGI-adopted NICE guidelines state that joint manipulation and stretching can be considered, but particularly for those with hip OA.⁴ The American College of Rheumatology guidelines and a review of guidelines by the U.S. Bone and Joint Initiative recommend the consideration of manual therapy only when in combination with exercise.^{13,14} These are generally weak recommendations, as little evidence is available to evaluate the efficacy of manual therapy as part of multimodal treatments for patients with knee OA.

The objective of this report is to describe the pain and functional outcomes of a multimodal, non-surgical intervention comprised of education, exercise, and manual therapy in three patients with knee OA.

Methods

Design

This was a retrospective case series aimed to describe the multimodal non-surgical management of three patients

with knee OA. The consenting patients' medical records were retrospectively reviewed to extract basic demographic information and outcome measure data from the time of assessment and upon completion of a standardized treatment program.

Protection of Human Participants

The Unity Health Toronto Research Ethics Board (18-192C) and Canadian Memorial Chiropractic College Research Ethics Board (1902X01) gave approval for this study. Medical charts were screened for eligibility by the research team. The current treating chiropractor explained the study to eligible participants and referred interested participants to the research team. The research team met with eligible participants to provide detailed information of the study and obtain informed consent. All participants in this study agreed to participate and provided informed consent.

Participants

Medical records were reviewed for three consecutive patients from the Department of Family and Community Medicine chiropractic clinic at St. Michael's Hospital presenting in November 2017. Individual records were considered eligible for review if they fulfilled the following inclusion criteria: 1) clinical examination evidence of knee osteoarthritis⁴, 2) ability to read/write English, 3) attendance to minimum five intervention sessions, and 4) ability to engage in a daily mild exercise program. Clinical examination evidence of knee osteoarthritis was determined by the treating clinician, taking into consideration the NICE guidelines for diagnosis.⁴ The guidelines recommend a diagnosis of OA if the patient is 45 years or older, has usage-related joint pain and either no morning knee stiffness or stiffness of 30 minutes or less. Individual medical records with any of the following criteria were excluded: 1) have been told by a physician that they should not engage in physical exercise, 2) previous knee arthroscopy or joint replacement, or 3) history of any condition that affects the individual's ability to exercise.

Intervention

All participants received a multimodal and self-management training program as part of their chiropractic treatment. The program consisted of one-on-one treatment sessions with one of the authors. Each session was ap-

proximately 15 minutes in duration at a frequency of one time per week for six weeks. The intervention was tailored and progressed for each individual, with an emphasis placed on self-management education. The components of the program were as follows:

Education

Patients received education based on current management guidelines^{4,6}, and were adapted from the educational component of the Good Life with osteoArthritis in Denmark (GLA:D[®]) program, which are published elsewhere.¹⁵ In brief, the main educational themes consisted of disease etiology, pain science, natural history, prognosis and management options for knee OA. Patients were informed that exercise and weight management comprise the main management program for all individuals with knee OA⁶, while manual therapy may confer additional benefit for some patients. They also received instruction on how to self-manage symptoms and maintain daily routines. Educational concepts were discussed and reinforced on an ongoing basis at each treatment session.

Exercise

Patients received a structured home exercise program adapted from the neuromuscular training program described by Ageberg *et al.*¹⁶ The purpose of the neuromuscular training program was to improve sensorimotor control of the lower limb. Specific exercises included sit-to-stand, forward and sideways lunges, quadriceps and hamstring strengthening, and hip abduction exercises. All exercises were individually tailored for each patient and progressed over the course of the intervention.

Manual Therapy

All patients received the same manual therapy protocol aimed at decreasing pain and increasing range of motion at the knee. Joint and soft tissue mobilization and manual muscle stretching was performed for all patients.¹⁷ At each session, manual therapy was directed to both the tibiofemoral and patellofemoral joints, as well as surrounding musculature. The specific manual therapy techniques used were determined based on identified functional impairments and tolerances for the specific patient. For example, if a patient was deemed to have reduced knee flexion, a flexion mobilization of the tibiofemoral joint was performed or if a patient reported increased pain in the

quadriceps muscle group, an increased focus was placed on delivering soft tissue therapy to this muscle. This method of delivering manual therapy has been used in previous studies of degenerative conditions with good results.^{18,19}

Outcomes

Patient demographics including: age, sex, and location of knee OA (left, right, or both) were extracted. Data from the Numeric Pain Rating Scale (NPRS) and Knee injury and Osteoarthritis Outcome Scale Physical Function Short Form (KOOS-PS) were collected at baseline and upon completion of the intervention at six weeks. These measures are included in the international standard set of outcome measures for individuals with knee OA.²⁰ Adverse events were tracked by asking the patient at each treatment session and recorded in the electronic medical record.

The NPRS is an 11-point numeric scale of pain intensity in individuals with chronic pain, where 0 represents “no pain” and 10 represents “worst pain”.²¹ Psychometric testing has shown the NPRS to be a valid and reliable measure of pain intensity²¹ and the minimal clinically important difference (MCID) is 2 points²².

The KOOS-PS is a 7-item measure used to quantify an individual’s difficulties with physical activity due to their knee problems.²³ All items are scored on a 5-point Likert scale.²⁴ Total scores are then transformed to an interval score of 0 (no difficulty) to 100 (extreme difficulty) using a conversion chart.²³ Psychometric testing has shown the KOOS-PS to be a valid and reliable measure of knee-related function in groups with knee OA and its use has been endorsed by OARSI and Outcome Measures in Rheumatology Clinical Trials.²⁵ The MCID for the KOOS-PS is 12 points.²⁶

Table 1.
Participant demographic characteristics.
Note. OA = Osteoarthritis

Participant	Age	Sex	Location of Knee OA
A	50	Male	Right
B	59	Female	Both
C	42	Female	Left

Data Analysis

Descriptive statistics for each patient were collected. Changes in NPRS and KOOS-PS scores from baseline to post-intervention were calculated for each patient. Comparison to established MCID was performed. No minimum sample size requirements are required as this was a descriptive report of three patients’ response to intervention. All participant data was anonymized and securely stored on the St. Michael’s Hospital investigator’s hospital computer secure server.

Results

Table 1 presents descriptive data for each participant. The average age of the participants was 50.3 years. Two participants had unilateral knee OA, while one individual had bilateral knee OA. The mean NPRS score prior to intervention was 6, while the mean KOOS-PS score prior to intervention was 57.6.

Table 2 shows the changes in NPRS and KOOS-PS scores from pre to post-intervention for each participant. Participant A reported a 1- and 37.4-point improvement in NPRS and KOOS-PS scores, respectively. Participant B showed no change in NPRS scores and a 7.0-point improvement in KOOS-PS scores. Participant C had a

Table 2.
*Change in outcome measures. Note. NPRS = Numeric Pain Rating Scale, KOOS-PS = Knee injury and Osteoarthritis Outcome Scale Physical Function Short Form, * = clinically important change*

Participant	NPRS _{pre}	NPRS _{post}	NPRS _{change}	KOOS-PS _{pre}	KOOS-PS _{post}	KOOS-PS _{change}
A	6	5	-1	77.7	40.3	-37.4*
B	5	5	0	44.0	37.0	-7.0
C	7	1	-6*	51.2	10.5	-40.7*

6- and 40.7-point improvement in NPRS and KOOS-PS scores, respectively. Only participant C met the threshold for a clinically significant change in pain, while participants A and C had clinically significant improvements in function. No adverse events were reported by any of the participants.

Discussion

This case series reviewed the clinical outcomes of three patients with knee OA undergoing a multimodal intervention consisting of self-management education, exercise, and manual therapy. One of the three participants showed clinically significant improvement in pain, while two of the three participants showed clinically significant improvement in function.

Participant B showed an improvement in function scores that did not meet clinical significance and did not show any improvement in pain scores. It is possible that this intervention was not effective, especially considering the small sample size. However, this participant showed mild pain levels and functional impairment prior to treatment, which may have limited their room for improvement. It should also be considered that some individuals may not respond to conservative treatment. Heterogeneous treatment responses to exercise for knee OA have been shown, including individuals with no improvement over a 12-week intervention.²⁷ It is possible the same applies for multimodal interventions including exercise and manual therapy, or that a 6-week intervention is not long enough for all individuals to experience benefit.

A strength of this intervention is the inclusion of manual therapy into an evidence-based treatment framework including the core treatments for knee OA; self-management education and therapeutic exercise.⁴⁻⁶ Case reports of manual therapy in conjunction with exercise for knee OA have been published.^{28,29} However, these reports describe interventions that do not meet recommendations from current guidelines. For example, neither report delivers patient education, a key component of knee OA management. Furthermore, one report includes the use of electrical stimulation and ultrasound²⁹ and the other includes platelet-rich plasma injections²⁸, both of which are not recommended for the management of knee OA. The strength of this case series is the inclusion of manual therapy as part of an evidence-based and guideline-recommended intervention framework for the management of knee OA.

The role of manual therapy as a stand-alone intervention for patients with OA is currently unclear. Knee joint mobilization may modulate central nociceptive pathways, decreasing the pain experienced by the individual³⁰ and evidence exists supporting the use of manual therapy for patients with hip OA^{9,31}. However, systematic reviews on manual therapy for knee OA differ in their findings. One review found inconclusive evidence for the use of manual therapy for patients with knee OA, as only three small randomized controlled trials were available⁹, while a more recent review concluded manual therapy offers short-term benefits compared to exercise alone¹².

The combination of manual therapy and exercise may offer better outcomes for patients, but a systematic review demonstrated significant improvements in pain outcomes only.³² Multiple trials have evaluated combined exercise and manual therapy.³³⁻³⁷ A wide range of specific exercise and manual therapy protocols have been used in these studies, but all trials report some positive effects for patients in pain and function. The findings of these trials further support our results, as there is a clear trend of improvement when compared to controls. However, a limitation of these trials is non-adherence to current management guidelines, as they lack self-management education.

Following review of the literature, two trials that have evaluated manual therapy in conjunction with education and exercise were identified.^{38,39} The first trial included education, exercise, manual therapy and taping for patients with patellofemoral OA.³⁸ When compared to education alone, the multimodal treatment had significantly greater improvements in the number of patients reporting being much improved and in pain. However, unlike this study, patients with tibiofemoral OA were excluded, likely limiting the utility of this intervention for the general public. The second trial found no difference comparing education, exercise, and manual therapy to a Tai Chi intervention.³⁹ Unfortunately, it is unclear if all participants received manual therapy or if it was at the discretion of the clinician. It is possible a more standardized manual therapy approach could confer additional benefit to patients.

Individually, both structured education and therapeutic exercise have been shown to effectively manage knee OA symptoms. Cochrane reviews of self-management education⁷ and exercise^{8,40} have found these inter-

ventions provide clinically meaningful outcomes with a low likelihood of causing harm⁷. Weight management is a key component of self-management education and a core treatment for knee OA in patients who are overweight or obese.⁴ Weight reduction through both exercise or dietary interventions has shown that a 5% reduction in body weight over a 20-week period can significantly improve disability.⁴¹ While no patients in this study were deemed to require weight loss education or intervention, weight-loss interventions should be considered for other patients with knee OA as indicated.

Structured education and exercise programs for individuals with hip or knee OA are available, including the GLA:D[®] program.¹⁵ In Denmark, GLA:D[®] has shown improvements in pain, function, quality of life, and medication use in 9825 patients.¹⁵ As such, GLA:D[®] is an effective alternative to current standards of care for knee OA.⁴² GLA:D[®] Canada began in 2015 and preliminary results suggest as good or better results than in Denmark.⁴³ It is not surprising our intervention showed positive results, as the data available from GLA:D[®] also supports the use of combined education and exercise. The inclusion of manual therapy in our multimodal intervention may result in greater short-term symptomatic relief, as this has been previously demonstrated.^{34,36} It would be of value in the future to evaluate the effectiveness of including manual therapy with the GLA:D[®] program.

Limitations

The specific treatment protocol used in this intervention, while supported by available evidence, was implemented and adapted at the discretion of the treating clinician. It is possible a more optimal combination of education, manual therapy, and exercise exists. For example, only verbal education was provided and no written education was given. There are also various manual therapy techniques and exercise protocols that may be considered and this intervention can be used as a starting point when designing other multimodal interventions.

It is possible that co-interventions may have contributed to the results observed, as participants were permitted to seek other treatments. For example, the use of medications may have influenced the results. However, no change in prescribed medication was noted in any of the medical records, nor did any participant personally report changes in medication use or use of other interventions.

Lastly, the results of this case series must also be interpreted with caution due to the small sample size and lack of control group.

Future Research

This case series should be viewed as hypothesis generating and the results should be used to inform further high-quality research designs. It may be possible that this multimodal approach can improve disability in patients with knee OA. A prospective cohort study with more participants should be performed and if positive results are found, a randomized controlled trial may be conducted, including evaluation for possible adverse events. These types of studies, at minimum, should be performed prior to the adoption of this intervention as a standardized approach in practice. We recommend that manual therapy be tested in conjunction with education and exercise, as this is in-line with current guideline recommendations for the management of knee OA.

Conclusion

A 6-week multimodal, non-surgical intervention including education, exercise, and manual therapy appears to improve function for two of the three individuals with knee OA and improve pain for one of the three patients reviewed in this case series. No adverse events were reported by any of the participants. The design of more robust studies to further examine the effectiveness of this multimodal intervention is warranted.

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