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Diversified chiropractic management in the treatment of osteoarthritis of the knee: a case report

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Objective: *To evaluate the effectiveness of a conservative protocol for the relief of pain and dysfunction in a patient with knee osteoarthritis (OA).*

Design: *Prospective interventional case report.*

Patient: *A 54-year-old female presented with a complaint of moderate knee pain in both knees with an onset of approximately 3 years. The diagnosis was symptomatic OA of the knees.*

Intervention and Outcome: *The patient was treated conservatively with active, passive, and nutritional therapy. The progress of the patient was scored by knee ranges of motion, the Lequesne index, and the WOMAC index at baseline and every four weeks there after. The total follow-up time was five months.*

Results: *Positive trends were seen in the knee flexion ROM, the Lequesne index, and the WOMAC index.*

Conclusion: *The treatment protocol in this study was effective for the treatment of knee OA. Conservative chiropractic treatment of knee OA has not been well documented in the literature. There is a need to document the effect of chiropractic care on the progression of OA. This case report may serve as a stepping-stone for prospective controlled trials concerning chiropractic management of knee osteoarthritis..*

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KEY WORDS: chiropractic, osteoarthritis, knee, exercise, glucosamine, ultrasound, pulsed interferential current.

Objectif : *Évaluer l’efficacité d’un protocole traditionnel visant à soulager la douleur et à minimiser le dysfonctionnement d’un patient souffrant d’une gonarthrose.*

Étude : *Exposé de cas interventionnel prospectif.*

Patient : *Une femme de 54 ans se plaignant d’une douleur modérée aux genoux apparaissant tous les 3 ans environ. Le diagnostic était le suivant : gonarthrose symptomatique.*

Intervention et résultat : *La patiente a été traitée de façon traditionnelle selon une thérapie active, passive et nutritionnelle. Le progrès de la patiente a été évalué en fonction des amplitudes de mouvement de genou, de l’indice Lequesne et de l’indice WOMAC au début et toutes les quatre semaines par la suite. Au total, le suivi s’est déroulé pendant cinq mois.*

Résultats : *Des tendances positives ont été perçues relativement à l’amplitude de la flexion du genou, l’indice Lequesne et l’indice WOMAC.*

Conclusion : *Le protocole thérapeutique de cette étude s’est révélé efficace pour le traitement de la gonarthrose. Les soins de chiropractie traditionnelle de la gonarthrose ne sont pas bien étayés dans cette documentation. L’effet des soins de chiropractie doit être corroboré en ce qui a trait à l’évolution de la gonarthrose. Cette observation peut constituer un point de départ pour des études prospectives contrôlées concernant le traitement de la gonarthrose par chiropractie.*

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MOTS CLÉS : chiropractie, gonarthrose, genou, exercice, glucosamine, ultrason, courant interférentiel pulsé.

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INTRODUCTION

Osteoarthritis (OA) is the most prevalent form of arthritis,[1,2] and its most common site is the knee joint.[3,4] Pathologically, OA is a condition involving synovial joints, characterized by focal areas of articular cartilage loss associated with remodeling of subchondral bone and marginal growth of bone and cartilage.[5] The continued catabolism of proteoglycans and the increased loss of glycosaminoglycans result in the abrasion of the articular cartilage and the formation of new bone within the joint.[6] This structural change ultimately leads to a functional deterioration of the joint, which may include symptoms such as pain, stiffness, joint swelling, deformity, and crepitus. The most recent definition of OA, developed at a workshop entitled "New Horizons in Osteoarthritis"[7], supports the concept that OA is not a single disease entity: "Osteoarthritis is a group of overlapping distinct diseases … The disease processes not only affect the articular cartilage, but also involve the entire joint, including the subchondral bone, ligaments, capsule, synovial membrane, and periarticular muscles."

Total joint replacement of the osteoarthritic knee provides a dramatic improvement in function and pain relief. However, the indications for joint replacement are controversial, and the intervention is reserved primarily for patients over the age of 60 years because the maximum lifetime of a replaced joint is about 15 years.[7] OA may be treatable conservatively and does not have to progress to a state of debilitation. Maquet [8] demonstrated the reversal capability of knee OA by surgically changing the biomechanical factors, such as diminishing the compressive load or by increasing the weight-bearing surfaces. This was attained by correcting any flexion contracture, by displacing the tibial tuberosity anteriorly, and/or by recentring the load.[8] The chiropractor, when treating knee OA conservatively, may improve the biomechanics of the knees and related structures. The goal is to decrease the pain intensity, to increase/maintain function, to prevent/impede deterioration, and hence, to improve the patient's quality of life.

Modes of treatment employed by the chiropractor may include chiropractic manipulation of the spine and other articulations, joint mobilizations, soft tissue techniques, physical therapeutic modalities, nutritional counseling, exercise prescription, and other modalities such as orthotics. Chiropractic treatment of knee OA has not been well documented in the literature; a search of the recent literature (1996 to September 1999) revealed only two articles that document the role of chiropractic in the treatment of OA.[9,10] It is important for the chiropractic profession to develop protocols for the treatment of OA. The following is a prospective interventional case study outlining an effective treatment program for knee osteoarthritis.

MATERIALS AND METHOD

Selecting the patient for the case report

The inclusion criteria for the study were as follows: (1) diagnosis of knee OA, (2) at least moderate pain in the knee for most days in the last month, (3) signed informed consent, and (4) aged 50 years or older. The exclusion criteria included: (1) intra-articular corticosteroid injection into the knee(s) within 4 weeks immediately preceding entry into study, and (2) severe chronic or uncontrolled concomitant illness (e.g., coronary artery disease).

Gathering of outcome measures

The total follow-up time was set at five months. The gathering of outcome measures and the execution of the plan of management were done by the same investigator. Outcome measures included: the Lequesne index questionnaire (Index of Severity for Knee OA), the Western Ontario and McMaster Universities Osteoarthritis (WOMAC) index questionnaire, range of motion (ROM) of the knee in flexion and in extension, and strength of the knee in flexion and extension. X-rays of both knees (AP, lateral, skyline, tunnel, and medial oblique) were already taken seven months prior to initial visit. Since the plain films were clinically useful, additional radiographic assessment was considered unnecessary.

The Lequesne and the WOMAC indices were completed at baseline and every four weeks there after. These indices are valid and reliable outcome measures for assessing pain and physical dysfunction of the osteoarthritic knee.[11] The WOMAC is used in this study in addition to the Lequesne Index because it emphasizes intensity of stiffness, whereas the Lequesne index emphasizes duration of stiffness.[12] In conducting the Lequesne and WOMAC indices, the patient completed the questionnaires at the clinic prior to receiving treatment. In general, there is a tendency for patients to overestimate their pain when prior pain scores were not made available.[13] Therefore, prior questionnaires were shown to the patient in

Table 1
Lequesne Index (scoring of points)[11]

	Points
Pain or Discomfort:	
▪ During nocturnal bed rest	
□ Non or insignificant	0
□ Only on movement or in certain positions	1
□ With no movement	2
▪ Morning stiffness or regressive pain after rising	
□ 1 minute or less	0
□ More than 1 but less than 15 minutes	1
□ 15 minutes or more	2
▪ After standing for 30 minutes	
• No	0
• Yes	1
▪ While ambulating	
□ None	0
□ Only after ambulating some distance	1
□ After initial ambulation and increasingly with continued ambulation	2
▪ After getting up from sitting without the help of arms	
• No	0
• Yes	1
Maximum Distance Walked (may walk with pain):	
□ Unlimited	0
□ More than 1 km (0.6 mi.), (in about 15 min)	1
□ From 500 to 900 m (1,640–2,952 feet or 0.31–0.56 mi.) (in about 8–15 min)	2
□ From 300 to 500 m (984–1,640 ft)	3
□ From 100 to 300 m (328–984 ft)	4
□ Less than 100 m (328 ft)	5
Walking Aid Used:	
□ None	0
□ With one walking stick or crutch	1
□ With two walking sticks or crutches	2
*Activities of Daily Living:**	
▪ Able to climb up a standard flight of stairs?	0 to 2
▪ Able to climb down a standard flight of stairs?	0 to 2
▪ Able to squat or bend on the knees?	0 to 2
▪ Able to walk on uneven ground?	0 to 2

* Code: Without difficulty, 0; with difficulty, 1; unable 2.

advance of her completing new ones. Significant circadian rhythm is found in patients with primary OA of the knee, such that considerable variability exists in the perceived pain at different times of day.[13] Therefore, the patient completed each of the questionnaires at a relatively constant and defined time of day (between 5:30 pm – 6:30 pm on a weekday after work).

The knee ROM and strength were assessed at baseline and every four weeks thereafter. The extent of flexion and extension of both knees was measured by a goniometer. The strengths of knee flexion and extension were evaluated subjectively by the investigator and recorded using the muscle test grading scale (0 = no contraction, 1 = evidence of slight contractility but no joint motion, 2 = complete range of motion with gravity eliminated, 3 = complete range of motion against gravity, 4 = complete range of motion against gravity with moderate resistance, 5 = complete range of motion against gravity with maximal resistance).

The Lequesne and WOMAC Indices

Lequesne Index

The Lequesne index correlates with physical signs ($r = 0.327$; $P < .0001$), but not with radiographic measures ($r = .065$; $P = .47$).[11] Therefore, clinical findings do not correlate with radiographic changes of worsening.[14] Table 1 illustrates the point system for this questionnaire. The total score is summed up and interpreted with Table 2, where the severity of OA is categorized as extremely severe, very severe, severe, moderate, or minor.

Table 2
Score of Lequesne index and common label of the handicap[15]

Points	Handicap
≥ 14	Extremely severe
11–13	Very severe
8–10	Severe
5–7	Moderate
1–4	Minor

* A score of greater than 8 might indicate the need for knee replacement surgery.

Table 3
Items of WOMAC Index[12]

PAIN	PHYSICAL FUNCTION
Indicate the level of knee pain (0 to 4) associated with:	**Indicate the level of difficulty (0 to 4) associated with:**
1. Walking	8. Descending stairs
2. Stair climbing	9. Ascending stairs
3. Nocturnal	10. Rising from sitting
4. Rest	11. Standing
5. Weight bearing	12. Bending to floor
	13. Walking on flat surface
	14. Getting in/out of car
STIFFNESS	15. Shopping
For the following 2 items, indicate the level of knee stiffness (0 to 4):	16. Putting on socks
	17. Rising from bed
• Morning stiffness	18. Taking off socks
• Stiffness later in the day	19. Lying in bed
	20. Getting in/out of bath
	21. Sitting
	22. Getting on/off toilet
	23. Heavy domestic duties
	24. Light domestic duties

WOMAC Index for OA of the Knee

The WOMAC index has been validated in a randomized, double-blind trial ($P < .005$) comparing isoxicam and piroxicam in 39 patients with knee OA and 18 patients with hip OA.[12] Isoxicam and Piroxicam are non-steroidal anti-inflammatory drugs from the oxicam group that block prostaglandin synthesis through the inhibition of the enzyme cyclooxygenase. The WOMAC is divided into three dimensions: pain, stiffness, and physical function. Table 3 lists the 24 items in the WOMAC. The Likert scale (a verbal scale of five points: none = 0, slight = 1, moderate = 2, severe = 3, extreme = 4) is used for scoring each item.

CASE REPORT

A 54-year-old female bank teller presented with a complaint of moderate bilateral knee pain of approximately 3 years duration. The complaint was insidious in onset. The discomfort was reported to have intensified a year ago. The character of the pain was described as pinching in nature, intermittent in frequency, lasting 10–15 minutes and was said to be localized to the retropatellar region and superiolateral borders of the patellae. The pain was aggravated by kneeling, squatting, and rising from a seated or squatted position. She also experienced morning stiffness. Such pain was relieved by rest. The patient had been examined by a physiotherapist, and treatment consisted of ultrasound and heat pads to the areas of complaint. Temporary relief was achieved by the treatment. She had been taking flax seed oil (1000 mg per day), glucosamine sulphate (500 mg per day), and vitamin B complex (500 mg per day) as supplements. She had also been prescribed Fosomax for mild osteoporosis. There was no past history of knee pain and, aside from this presentation, she was in good health.

Examination revealed swollen suprapatellar bursae bilaterally with the left side more apparent then the right. Medial and lateral knee joint lines and the superolateral border of the patellae were tender to palpation. Right and left active knee flexion ROMs were pain-free and mildly reduced at 120° and 117° respectively. Passive knee flexion produced retropatellar pain, bilaterally. Knee extension, medial rotation, and lateral rotation were unremarkable. Muscle strengths of quadriceps and hamstrings were graded as 5/5, bilaterally. Passive movement of the patellar in the inferolateral direction reproduced the retropatellar pain, bilaterally. Patellar compression of the left knee also reproduced the retropatellar pain in the left knee. Retropatellar crepitus with patellar movement was noted bilaterally. Examination of the lumbar spine, sacroiliac joints, hip joints, and joints of the foot and ankle were unremarkable.

Previous radiographs of the knees were taken seven months prior to the initial visit. Mild joint space narrowing with subchondral sclerosis and osteophytosis were noted in both medial femoral tibial joints. Enthesophytes were noted at the quadriceps insertion of the patellae. Mild bone spurring was observed at the superior pole of both patellae. Several loose bodies were visualized adjacent to the tibial eminence on the left.

The patient was diagnosed with mild osteoarthritis of the medial femoral tibial and patellofemoral joints. The patient agreed to participate in the current study and to follow the proposed plan of management.

Treatment

The plan of management consisted of passive therapies, active therapies, and nutritional supplementation. Passive treatment included combination therapy with interferential current (amplitude summation) and pulsed ultrasound. The active electrode was applied at the lower quadriceps area, and the ultrasound head was placed on areas around the knee joint. Areas hypersensitive to skin rolling were targeted with the combination therapy. Mobilization and manipulation of the knees were done manually with emphasis on axial distraction and posterior-anterior glide. Anterior gapping mobilization of the knee joint was done with repetitive pumping action. Once the patient's subjective pain level dropped (this was after 5 treatments in our case), proprioceptive neuromuscular facilitation (PNF) of hypertonic muscles of the lower limb were performed, bilaterally. Knee extensors were particularly hypertonic for the patient in this study.

The patient was also given a home-based exercise program, along with a log sheet to record the type and intensity of exercises performed daily. Daily stretching of the quadriceps femoris, the iliopsoas, the hamstrings, the adductors, the abductors, and the calves were performed, bilaterally. Strengthening exercises were performed three times weekly, and included straight leg raises, drop squats, and hamstring curls. Straight leg raises were done in the supine position with the upper body moderately elevated, the resting knee bent, and the active knee in extension with the hip externally rotated. Emphasis was placed on strengthening the vastus medialis muscle in order to encourage proper patellar tracking. Drop squats were done with quick descend to no more than 90º knee flexion and with relatively slow ascend that spanned about 2 seconds. The patient was asked to do three sets of the exercises with twenty repetitions. Progress was monitored in the clinic once a week. As the patient's strength increased, progressive resistance using ankle weights, free weights, or exercise elastic bands were utilized appropriately. The patient also walked at a moderate speed approximately 30 minutes daily and rode a stationary cycle for 20 to 40 minutes twice weekly. Walking functioned to maintain activities of daily living in terms of knee capacity and to promote better proprioception in the lower limbs. The goal of the stationary cycle was to promote knee joint movement and not necessarily to strengthen the lower limbs. Hence, the cycle was set at low resistance, and seat placement/elevation guided the knees to move from 90° flexion (maximal) to

Table 4
Arthritis-Related Considerations for Exercise[21]

Knee OA
▪ maintain proper body weight ▪ maintain range of motion and flexibility ▪ condition lower extremity musculature for strength, endurance, and neuromuscular readiness ▪ alternate weight-bearing and non-weight-bearing activities throughout the day ▪ minimize use of stairs*, one-legged stance*, low seating ▪ avoid maximal isometric and high velocity muscle contraction ▪ select moderate walking speed that does not exacerbate joint symptoms ▪ perform neuromuscular warm-up prior to walking
* during the initial phase of the rehabilitation and always for patients with severe OA

Table 5
Timeline of the 5-month follow-up period

Treatment date (In year 2000)	**Significant occurrences**
April 12 (initial visit)	• Active knee flexion ROM: Right = 120°, Left = 117° • WOMAC Index = 1.52/4 (slight to moderate severity) • Lequesne Index = 6 (moderate severity)
April 19	
April 28	
May 3	• WOMAC Index = 1.06/4 (slight severity) • Lequesne Index = 4 (minor severity)
Between May 3 and June 7	• Stopped active and passive therapy (except for nutritional supplementation) during this period due to personal reasons
June 7	
June 12	
June14	• Active knee flexion ROM: Right = 125°, Left = 122° • WOMAC Index = 1.29/4 (slight to moderate severity) • Lequesne Index = 7 (moderate severity)
June 26	
July 5	
July 12	
July 19	• Active knee flexion ROM: Right = 128°, Left = 122° • WOMAC Index = 1.1/4 (slight severity) • Lequesne Index = 5 (minor to moderate severity)
July 26	
August 9	
August 14	• WOMAC Index = 0.71/4 (slight severity) • Lequesne Index = 3 (minor severity)
August 21	
August 28	
Between August 28 and September 21	• Stopped passive therapy during this period due to personal reasons, but continued with active therapy and nutritional supplementation
September 21	• Active knee flexion ROM: Right = 128°, Left = 125°
September 28	• WOMAC Index = 0.29/4 (none to slight severity) • Lequesne Index = 3 (minor severity)
October 5	
Beyond October 5	• Patient seen at the clinic once a month

full extension. Additional proprioception exercises, such as rocker board routines, were considered as they enhance the overall function of the lower limbs. Water exercises were also considered as knee mobility could be increased with minimal pressure on the knee mechanism. However, the exercise program presented above already demanded patient commitment of at least one hour a day. To maintain a practical and effective program that the patient could commit to, additional proprioception and water exercises were not enforced.

Safety is always a concern in any exercise routine. When performing muscular strengthening and cardiovascular exercises, warm-up and cool-down stretches were performed. Table 4 outlines several considerations when prescribing the exercise routine.

The patient was advised to supplement her diet with glucosamine sulphate (sodium-free) at a dosage of 500 mg three times a day. She continued to take flaxseed oil (1000 mg/day) and Vitamin B complex (500 mg/day).

RESULTS

Table 5 outlines the treatment dates and the significant occurrences during the patient's 5-month follow-up period.

There was gradual improvement in knee flexion ROM, WOMAC index scores, and Lequesne index scores. Between May 3 and June 7, active and passive therapy temporarily ceased. Patient evaluation on June 14 revealed worsening values for outcome measures, regressing almost to baseline levels. Between August 28 and September 21, passive therapy was again halted. The evaluation of the patient on September 21 and September 28 demonstrated continued improvement in the patient's outcome measures. The percentage improvement in knee flexion range of motion from April 12 to September 21 was 6.67% for the right knee and 6.84% for the left knee (see Figure 1). The percentages of improvement in the WOMAC index score and Lequesne index score were 80.9% and 50%, respectively (see Figure 2).

DISCUSSION

The treatment protocol described in this case study consisted of passive therapies, active therapies, and nutritional advice. Passive therapies aimed at pain reduction and joint restoration. Combination therapy with interferential current and ultrasound temporarily desensitized nerve endings. The intent of knee joint mobilization and manipulation was to restore mobility to the hypomobile or fixated joint. Muscle hypertonicity contributed significantly to joint fixation; hence, PNF technique was also employed to lengthen short muscles that cross the knee. Other joints and structures were also evaluated to determine whether they biomechanically affect the loading of the knees. The lumbar spine, sacroiliac joints, hip joints, and joints of the foot and ankle were unremarkable for the patient in this study.

The benefits of active exercise therapy have been supported by at least 30 randomized controlled trials.[19,20] The home-based exercise program described here focused on improving the flexibility, strength, proprioception, and movement fluidity of the knee mechanism. Effectiveness, safety, and patient compliance were considered in developing the program. Not every exercise shown to be effective in treating knee OA had been prescribed. The patient's degree of joint degeneration, the exercise equipment available to the patient, and the patient's level of commitment helped narrow down and refine the rehabilitation program.

The short-term benefits of glucosamine sulphate in the treatment of OA have been established by several RCTs.[16,17,18] For this study, 1500 mg per day was recommended in three 500-mg doses. 500 mg three times a day of glucosamine sulphate is the preferred dosage because of greater experience in clinical trials.[22] Chondroitin was not prescribed in conjunction with glucosamine sulphate because the ability of the body to absorb chondroitin into the joints remains controversial. Glucosamine sulphate has minimal side effects that mainly consist of minor gastrointestinal problems.[22] No drug-disease interactions or interactions with antibiotics, antidepressants, or treatments for lung diseases were noted for glucosamine.[16] However, as a derivative of glucose, potential adverse effects on glucose metabolism should be considered in patients with diabetes or glucose intolerance.[16] Glucosamine administered as the sulphate salt may provide the articular cartilage with the hexosamine precursor and the sulphate anion required for synthesis of glycosaminoglycans.[16] Glucosamine inhibits the inflammatory response to nonspecific agents such as acetic acid, but has no activity against serotonin, bradykinin, or histamine.[18,23] It is antireactive rather than anti-inflammatory because it does not affect cyclooxygenase.

The patient in this study had symptomatic OA of the knee for about 3 years. With the treatment protocol described above, most symptoms were resolved in less than 6 months, with the percentage improvement in knee flexion range of motion of 6.67% for the right knee and 6.84% for the left knee. The only symptoms remaining at the 6-month mark were inability to kneel pain-free with full knee flexion and weakness in standing from a squat position. Since radiographs demonstrated osteophytosis, enthesophytes, and several loose bodies in both knees, the patient may not be able to achieve pain-free kneeling posture with

Figure 1
Pre- and Post-Program Outcome measure Values

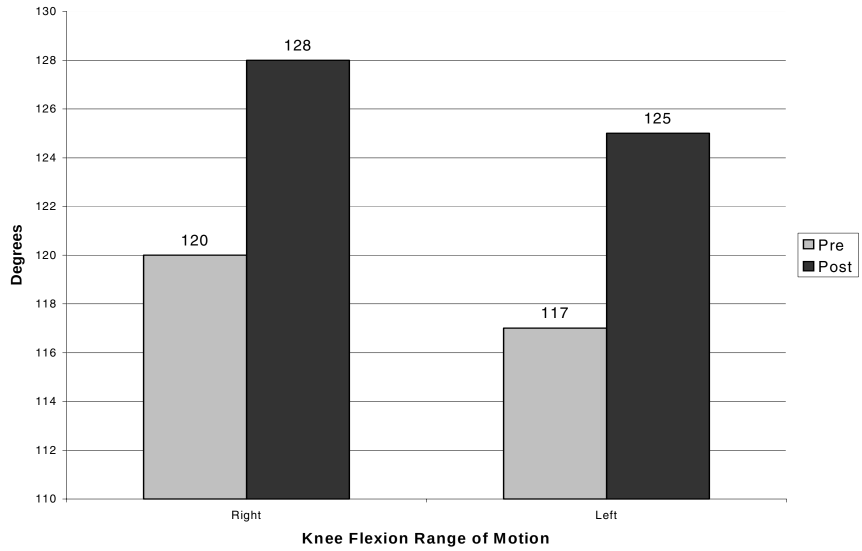
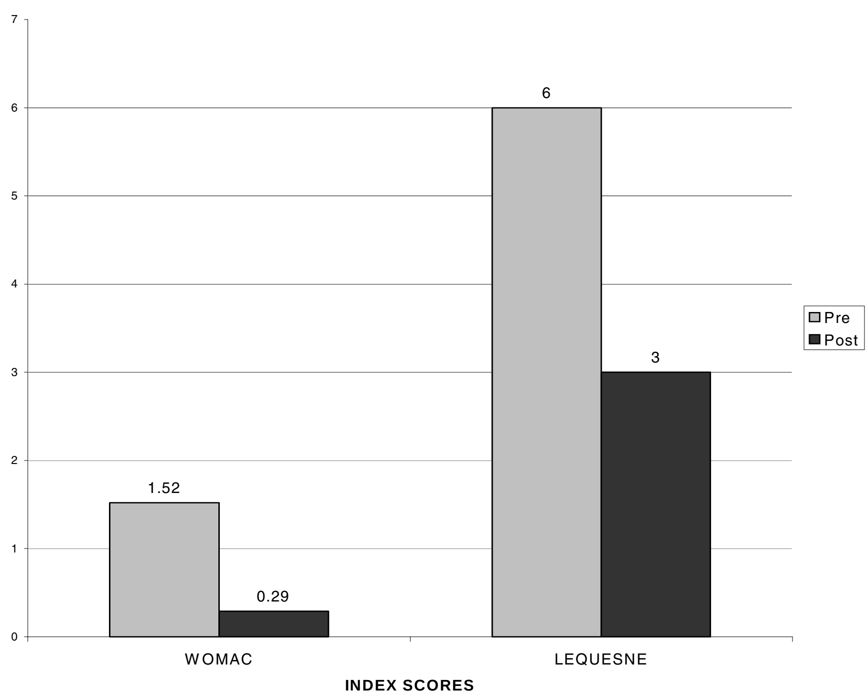


Figure 2
Pre- and Post-Program Index Values



full knee flexion. The weakness in standing from a squat position should resolve with continual active therapy.

This study attempted to be objective with respect to outcome measures, such as validated index questionnaires and quantified active/passive ranges of motion. However, the strengths of knee flexion and extension were evaluated subjectively. The case study could be improved if quantitative data on strength was collected by electronic means. Since OA has a long progression, this five-month study examined the short-term effects of chiropractic treatment. Long-term effects would require longer follow-up periods in the magnitude of years.

Conservative chiropractic treatment of knee OA has not been well documented in the literature. Only two papers have outlined the importance of chiropractic care in the treatment of OA. Berkson[9] (1991) stressed the importance of chiropractic and nutritional support; however, the paper did not strongly support the claims. In the 1997 review by Gottlieb,[10] the management of spinal OA with glucosamine sulphate and chiropractic treatment was presented. There is a need to document the effect of chiropractic care on the progression of OA. This case report may serve as a stepping-stone for prospective controlled trials concerning the chiropractic management of knee osteoarthritis.

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