JAOA CASE REPORT

Osteopathic Manipulative Treatment of a 27-Year-Old Man After Anterior Cruciate Ligament Reconstruction

Mark R. Gugel, DO
William L. Johnston, DO†

Increasing instability of the knee developed in a 27-year-old man who had torn his anterior cruciate ligament (ACL) approximately 10 years prior to surgical intervention. After initial conservative treatment, including use of a functional brace for activity, the patient opted for surgical reconstruction with a patellar tendon graft. One of the authors conducted three preoperative examinations to assess the condition of the patient's musculoskeletal system. These manual examinations included findings of somatic dysfunction in the lumbo-pelvic region. In addition, there was extension of muscular tension from the injured left knee and ankle into the lower thorax and ribs 6 through 9. During the postoperative rehabilitation process, examination at regular intervals included documentation of somatic dysfunction and osteopathic manipulative treatment (OMT). Following ACL reconstruction and OMT, the patient showed increasingly stable mobility in the lumbopelvic region. Furthermore, episodic new dysfunctions readily resolved with OMT. The patient returned to his regular sports activities 6 months after surgery.

J Am Osteopath Assoc. 2006;106:346–349
http://www.jaoa.org/content/vol106/issue6/

The anterior cruciate ligament (ACL) is the major stabilizer of the knee. Disruption or laxity of the ACL results in anterior-medial instability of the knee. Chronic instability may result in degeneration of the articular cartilage and traumatic arthritis, as well as changes in gait and activity levels.

Surgical reconstruction of the disrupted ACL is a frequently performed procedure, and a variety of surgical techniques exist.[1] Postoperative instructions require patients to limit their weight-bearing activities for a number of weeks to avoid causing further disruptions in normal biomechanics.[2]

Case management of ACL damage and reconstruction in osteopathic medicine includes attention to two of the four traditional precepts of osteopathic medicine: the body is a unit, and structure and function are interrelated.[3] A damaged ACL alters knee function and results in instability and changes in weight-bearing capability. As long as the instability exists, the entire musculoskeletal postural system is likely to experience added stress and alterations in structural alignment. Such dysfunction in the musculoskeletal system can be a serious impediment to a patient's postoperative healing. To optimize a patient's return to normal functioning, osteopathic manipulative treatment (OMT) can address preoperative musculoskeletal findings and trends of somatic dysfunction that develop during rehabilitation.

The present report documents the case of a patient who underwent ACL reconstruction. The patient was examined structurally before surgery and periodically throughout the rehabilitation process. Presence of somatic dysfunction was documented, and localized segmental dysfunctions[4] provided the focus for OMT at each examination.[5]

Evaluation and Management of Case

Medical History

The patient was a 27-year-old man with a 10-year history of instability and swelling of his left knee, which resulted from a blow to his extended knee from the side. Arthrocentesis and radiographs led to a diagnosis of an ACL tear.

The patient opted initially for conservative treatment, using a functional brace for activity (eg, sports) for more than 9 years. When not using the brace during this time, he experienced repeated episodes of instability while planting his foot and turning. These episodes were followed by periods of swelling and pain. During the tenth year after his initial injury, the patient noted increasing instability with daily activity. He then chose to undergo ACL reconstruction using a patellar tendon augmentation graft.

The patient's medical/surgical history included no major medical conditions. A review of past symptoms revealed that the patient had experienced a head blow with loss of consciousness at the age of 12 years. The history also showed that the patient had suffered a variety of sports-related injuries without major sequelae. The remaining review of symptoms was noncontributory. The patient denied having any medical allergies and said he was taking no medications.

Physical examination of the patient's left knee included a Lachman test (2+), which indicated anterior cruciate laxity; a

From Michigan State University College of Osteopathic Medicine in East Lansing.
† Dr Johnston died June 10, 2003.
Address correspondence to Mark R. Gugel, DO, Michigan State University, College of Osteopathic Medicine, A–428 E Fee Hall, East Lansing, MI 48824-1316.
E-mail: gugel@msu.edu

McMurray test, which had negative results for medial meniscus looseness; and a pivot shift test, which had positive results. No other signs of ligament laxity were revealed by physical examination.

Preoperative Evaluation

During the 3 months prior to arthroscopic surgery, the patient underwent three manual musculoskeletal examinations to assess the general preoperative condition of his somatic system and to record palpable findings of somatic dysfunction. The patient's response to each manual examination was used to evaluate local segmental dysfunctions that could be resolved in a relatively stable manner.[5] These responses were in contrast to the increased tissue changes of chronic segmental motion asymmetries, which—though responsive to manipulation—persisted with signs of dysfunction during the follow-up period.

In this patient, three body regions exhibited persistent trends of somatic dysfunction. Each is an area susceptible to postural and other physical stresses:

- **Neck**—In the cervical area, dysfunctions involved segmental spinal muscular attachments extending to ribs 1 and 2. The patient's associated history revealed intermittent occasions of pain and limited mobility, which were periodically acute during the preceding 3 years. These dysfunctions were probably related to accidents and sports injuries.
- **Thoracic**—Localized dysfunction at the third through fifth thoracic vertebrae (T3–T5) involved linkage with the right ribs. Palpable motor asymmetries that characterize such linkage have been reported in association with a significant viscerosomatic reflex.[6] Inquiry into related history, physical findings, and current complaints revealed no distinguishable source of visceral input.
- **Lumbar, Sacrum, Pelvis**—A large area of musculoskeletal stress was present in the lumbopelvic region, with extension of muscular tension from the injured lower extremity into the lower thoracic cage, including ribs 6 through 9. Because previous sports-related injuries had occurred in this region, followed by several episodes of limited activity and weight-bearing capability, this region was considered a likely site of biomechanical stress.

A report of the patient's musculoskeletal condition leading up to the time of surgical intervention included the following: a recent incident of acute neck pain (since improved); T3 through T5 relatively asymptomatic; the fifth lumbar vertebra (L5)/pelvis relatively asymptomatic; and limited activity of the left lower extremity.

Surgery

The patient elected to receive spinal anesthesia during intervention. The surgery proceeded without complication.

Operative findings revealed complete disruption of the left ACL, tears of both the medial and lateral menisci, and slight degeneration of articular cartilage. The menisci were repaired, and the posterior horn of the lateral meniscus was removed.

Postoperative Management and OMT

In the immediate postoperative period, the patient was placed in a continuous passive motion machine and hospitalized overnight. The patient was discharged the next day. Discharge instructions included limited weight-bearing activities, the use of crutches and a hinged-knee immobilizer, and prescriptions for an antibiotic (cephalexin, 250 mg three times a day for 10 days) and analgesic (acetaminophen/hydrocodone, to take when needed for pain).

The patient followed a prescribed rehabilitation protocol at home. At 3 months after surgery, the patient began to participate in a formal physical therapy program, which lasted 8 weeks. During the postoperative period, the patient reported a variety of physical complaints.

The patient was reevaluated regularly by an osteopathic physician (W.L.J.)—initially once per week, then once per month. Osteopathic manipulative treatment during these evaluations was used to address discrete locations of somatic dysfunction in each of the three areas previously described, as well as in new areas of musculoskeletal stress that appeared during the recovery period. The techniques of OMT used were mostly the functional method and the indirect method.[5] *Figure* indicates the timing of each intervention and the body regions treated when palpable findings warranted treatment. In general, the record of the patient's response to treatment revealed a decreasing intensity in the somatic dysfunction at each area.

The footnotes of *Figure* indicate the patient's increasing physical activities after surgery, in addition to other factors monitored during the recovery period. For example, local reactions were monitored and treated at L2 after spinal anesthesia, at the upper extremities during crutch use, and at areas of biomechanical stress as physical activities increased.

The patient resumed his full level of activities 6 months after surgery. The use of a functional knee brace while playing basketball allowed him to return to a preoperative level of activity. At 9 months after surgery, the patient received OMT to address a complaint of right heel pain, which resulted from several falls while playing basketball. The heel area improved after this treatment.

During the 9-month period of follow-up care, there was mild intermittent dysfunction assessable in the cervical region and reflex area of T3 through T5, but this dysfunction was asymptomatic. Stable improvement became evident in the lower back and left lower extremity during the follow-up period. At the end of the 9-month period, the patient was

	Week																									
	−1	0†	1‡	2	3§	4	5	6//	7	8	9	10	11	12¶	13	14	15	16	17	18	19	20#	21	22	23	24**
Somatic Dysfunction*																										
■ **Site identified preoperatively**																										
□ Neck	**X**				**X**			**X**			**X**						X					X			X	
□ Thoracic (T3–T5)	**X**		**X**	**X**			**X**		**X**		**X**				X		**X**					**X**				
□ Ribs 6–9	**X**		**X**	**X**	**X**		**X**	**X**	**X**		X						X					X				
□ Lumbar (L5)	**X**		**X**	**X**	**X**	**X**		**X**	X		X															
□ Pelvis	**X**		**X**	**X**	**X**	**X**		**X**							**X**		**X**					**X**			**X**	
□ Lower extremity, left	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**				**X**		**X**					**X**				
■ **Site identified postoperatively**																										
□ Lumbar (L2)				**X**																						
□ Upper extremity																										
– Left			**X**	**X**	X																					
– Right						**X**																				

* **X** denotes the presence of marked to moderate somatic dysfunction; X, the presence of mild somatic dysfunction; no entry, no somatic dysfunction.
† Patient undergoes surgery.
‡ Patient uses two crutches.
§ Patient uses one crutch.
// Patient is off crutches.
¶ Patient begins physical therapy.
\# Patient ends physical therapy.
** Patient returns to full physical activity.

Figure. *Somatic dysfunctions in a patient who underwent anterior cruciate ligament reconstruction, by site of dysfunction and preoperative or postoperative time that the dysfunctions were identified and treated with osteopathic manipulative treatment. The footnotes indicate the timing of key events during the patient's recovery and resumption of activity.*

released from care with no recommendation for immediate follow-up.

During the following 6 months, the patient returned one time for a local complaint of neck pain and stiffness, which was responsive to OMT.

Comment

Disruption of the ACL is one of the most common and debilitating injuries of the knee. The ACL functions to stabilize the knee while running and changing direction and during deceleration. It attaches inferiorly to the anterior aspect of the tibial spine and superiorly to the posterior part of the medial surface of the lateral femoral condyle.[6] A classic history of ACL tear includes hyperextension with rotation of the knee, usually during deceleration and with an audible pop and immediate swelling of the knee.

Injury to the ACL may lead to abnormal knee mechanics and possibly functional instability, especially during cutting and pivoting movements.[7] Because this type of injury is common, several surgical techniques have been developed to repair a damaged ACL.[8–9] In some cases, the patellar tendon, semitendinosis units, or iliotibial band may be used as an augmentation graft.[8] In other cases, an allograft may be used, or a torn ACL may be sutured.[8] The type of surgical technique selected is dependent on various factors, including the patient's age, activity level, and occupation, as well as the surgeon's preference. Surgery can restore the passive stability of the knee, and subsequent rehabilitation can restore the knee's functional stability.[9]

The rehabilitation protocol for patients with ACL continues to evolve. Patients can return to full weight-bearing capability more quickly today than the standard protocols called for 10 years ago. The goal of any rehabilitation program should be the rapid return of the patient to complete preinjury strength and performance.

To optimize the rehabilitation program of the patient in the present case, osteopathic principles were applied to case management. One of these principles is that the body is a unit; another is that structure and function are interrelated.[3] George W. Northup, DO,[10] wrote,

> The proper function of any one joint area is dependent to a greater or lesser degree upon the proper function of the total musculoskeletal system. One cannot just "treat" a painful knee without considering the totality and interrelationship of body parts and physiologic systems.

Therefore, the physician must consider the knee; the surrounding ligaments, cartilage, and musculature; and the feet, fibula, patella, spine, and hip when treating a patient with a damaged ACL.

Northup[10] added,

> It is almost axiomatic that the knee joint is never in trouble by itself. If the pelvic and spinal structures are not involved in the initial stress, they most certainly are by the time the patient reaches the doctor. Commonly lesions are found in the low-back area and in particular around the second lumbar level.

Northup[10] also noted that lesions of the calcaneus, cuboid, and talus are common with knee injuries. Strachan[11] reported a reflex type of spinal muscle tension near L2 when the knee joint was irritated.

There are multiple sequelae that may occur after reconstructive surgery as the patient progresses through the postoperative period. These sequelae include changes in gait, posture, and weight-bearing capability. In addition, the patient may experience compensatory structural changes resulting from the injury.

With all of these changes in motor performance, somatic dysfunction is likely to result. Such dysfunction represents an impediment to the healing process. Dysfunction as represented by limited mobility and tension of muscular and myofascial components is known to decrease blood flow to, and lymph flow from, the healing area.[12] Additional physical stress to the healing area may result from the alteration of gait.

Management of the somatic dysfunction can reduce these impediments and optimize the rehabilitation process, returning the patient to levels of preinjury functioning and strength. In the present case, OMT led to increasingly stable mobility. This was a noteworthy result, especially considering the large area of preexisting dysfunctions in the patient's lumbopelvic region. Furthermore, the physical stresses that followed surgery were immediately accessible and readily resolved. These improvements made it possible for the patient to return to his regular sports activities 6 months after surgery.

Conclusion

The application of osteopathic principles, such as reported in the present case of ACL reconstruction, is an important aspect of patient care. The osteopathic principles relevant to this case included documentation of physical findings of musculoskeletal dysfunctions and use of OMT to assist in treatment of the whole patient. The removal of recognized impediments to the healing process by the application of osteopathic principles can promote the rapid return of injured patients to levels of normal function.

Acknowledgment

Dr Gugel thanks Dr Johnston for his years of mentoring and his service to the osteopathic medical profession, noting that Dr Johnston is missed.

References

1. Beynnon BD, Johnson RJ, Abate JA, Fleming BC, Nichols CE. Treatment of anterior cruciate ligament injuries, part 1 [review]. *Am J Sports Med*. 2005;33:1579–1602.

2. Beynnon BD, Johnson RJ, Abate JA, Fleming BC, Nichols CE. Treatment of anterior cruciate ligament injuries, part 2 [review]. *Am J Sports Med*. 2005;33:1751–1767.

3. Glossary Review Committee, for the Educational Council on Osteopathic Principles and the American Association of Colleges of Osteopathic Medicine. *Glossary of Osteopathic Terminology*. April 2002. Available at: http://www.do-online.osteotech.org/pdf/sir_collegegloss.pdf. Accessed May 10, 2006.

4. Johnston WL. Segmental definition: Part 1. A focal point for diagnosis of somatic dysfunction. *J Am Osteopath Assoc*. 1988;88:99–105.

5. Johnston WL, Freidman HA. *Functional Methods: A Manual for Palpatory Skill Development in Osteopathic Examination and Manipulation of Motor Function*. Indianapolis, Ind: American Academy of Osteopathy; 1995.

6. Moore JR, Wade G. Prevention of anterior cruciate ligament injuries. *Natl Strength Cond Assoc J*. 1989;11:35–40.

7. Swenson TM, Harner CD. Knee ligament and meniscal injuries. Current concepts [review]. *Orthop Clin North Am*. 1995;26:529–546.

8. Cross MJ, Harris J, Slater HK. Recent developments in the treatment and repair of anterior cruciate ligament injuries in the athlete [review]. *Sports Med.* 1990;10:349–354.

9. Thomee R, Renstrom P, Grimby G, Peterson L. Slow or fast isokinetic training after knee ligament surgery. *J Orthop Sports Phys Ther*. 1987;8:475–479.

10. Northup GW. A study in osteopathic mechanics. *J Am Osteopath Assoc*. 1954;53:618–621.

11. Strachan WF. The knee joint; applied anatomy. *J Am Osteopath Assoc*. 1954;53:616–618.

12. Ward RC, ed. *Foundations for Osteopathic Medicine*. 2nd ed. Philadelphia, Pa: Lippincott, Williams & Wilkins; 2003.