

OFPP

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EDITOR'S MESSAGE

On Kindness

REVIEW ARTICLES

Evaluation and Management of
Anterior Cruciate Ligament Injuries

Ultimate Fighting Championship
Injuries: Two Year Retrospective Fight
Injury Study

Osteopathic Considerations in
the Management of Migraine in
Pregnancy

Reducing Early Discontinuation Rates
of Subdermal Contraception Success
in Your Clinical Practice

PATIENT EDUCATION HANDOUT

Subdermal Contraception



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PATIENT CARE SUMMARY

BLANCHARD, Floyd
 ID: 908323323
 DOB: 23-FEB-1948 (66 years)
 Gender: Male
 Primary Care: BLACKWELL, Elizabeth
 Group: Able Clinic
 Last Visit: BANTING, Frederick (21-AUG-2014) 14:30
 Next Visit: BANTING, Frederick (24-NOV-2014) 10:45

TOBACCO-FREE
 YES (28-NOV-2013)

INFLUENZA VACCINATION
 YES (1-NOV-2013)

PNEUMOCOCCAL VACCINATION
 YES (10-NOV-2013)

CLINICAL NOTES
 Last (11 Visit): 29-OCT-2013 (Cholesterol Angina)
 Last Admission: 29-OCT-2013
 Admission Diagnosis: N/A
 Specimen Type: N/A
 Specimen Name: N/A
 Practice Coordinator: Addressed Medication, Order Lab.

CHRONIC HEART FAILURE

ACEI	YES	20-SEP-2013
ARB		
Beta Blocker	YES	21-AUG-2014
Ejection Fraction	40%	21-AUG-2014
OSA Screening	YES	20-AUG-2014
Warfarin Anticoagulant	YES	20-SEP-2013

CORONARY ARTERY DISEASE

Aspirin	YES	21-AUG-2014
Beta Blocker	YES	20-SEP-2013
Low-density Lipoprotein Cholesterol	128	21-AUG-2014
Statins	YES	21-AUG-2014

DIABETES

Foot Exam		Specialty Referral for not performing a foot exam
Hemoglobin A1C	7.2	21-AUG-2014
Low-density Lipoprotein Cholesterol	128	21-AUG-2014
Microalbumin	YES	21-AUG-2014

ASTHMA

Spirometry	YES	11-OCT-2013
Long-term Control Medication		
Peak Flow	YES	20-SEP-2013
SABA	YES	21-AUG-2014

ADULT AND ADOLESCENT IMMUNIZATIONS

Tetanus, Diphtheria, Pertussis Vaccine (Td/Tdap)	YES	21-AUG-2014
Varicella Zoster Virus (VZV)	YES	14-AUG-2012

COLORRECTAL CANCER SCREENING

Colonoscopy	YES	10-NOV-2013
-------------	-----	-------------

↑ BLOOD PRESSURE
 160/105 (21-AUG-2014)

↑ BMI
 39 (21-AUG-2014)

HEIGHT
 5' 10" (21-AUG-2014)

↑ WEIGHT
 250 lbs (21-AUG-2014)

WHR
 64 (abn) (1.73m) (21-AUG-2014)

SERUM CREATININE
 YES (21-AUG-2014)

↑ FASTING BLOOD GLUCOSE
 142 mg/dL (21-AUG-2014)

TOTAL CHOLESTEROL
 200 mg/dL (21-AUG-2014)

LDL mark **HDL**
 138 61

TRIGLYCERIDES
 148 mg/dL

Symphony
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- Tobacco Usage & Exposure
- Vital Signs

Chronic Care Suites

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- Chronic Heart Failure
- Chronic Kidney Disease
- COPD
- Diabetes (Adult)
- Diabetes (Child & Adolescent)
- Hypertension (Child & Adolescent)
- Hypertension (Adult)
- Ischemic Vascular Disease

A ANALYZE

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IN THIS ISSUE

EDITOR'S MESSAGE

- 6 On Kindness
Merideth Norris, DO, FACOFP Editor, Osteopathic Family Physician

REVIEW ARTICLES

- 8 Evaluation & Management of Anterior Cruciate Ligament Injuries
Dwan Perry, DO and Michael O'Connell, DO
- 13 Ultimate Fighting Injuries: Two Year Retrospective Fight Injury Study
Matthew H.C. Otten, DO; Narbeh Ghazarian, DO; Judy Boura MS
- 19 Osteopathic Considerations in the Management of Migraine in Pregnancy
Sara Soshnick, DO; Christina Mezzone, DO; Sheldon Yao, DO and Reem Abu-Sbaih, DO
- 24 Reducing Early Discontinuation Rates of Subdermal Contraception Success in Your Clinical Practice
Ty Robinson, DO and Anita I. Register, OMS-IV; Charlotte Ebner, DO; Kim Orr, DO

29 CALENDAR

Calendar of Events

30 PATIENT EDUCATION HANDOUT

Subdermal Contraception

American Osteopathic Board of Family Physicians Exam Schedule

EXAM	DATES AND EXAM LOCATION	POSTMARK APPLICATION DEADLINE
Family Medicine/OMT Certification Performance Evaluation ONLY	ACOFPP Conference March 12-15, 2015; Las Vegas, NV March 10-11, 2015	October 1, 2014; filing with late fee thru December 1, 2014
Family Medicine/OMT OCC/Recertification Exam - Performance Evaluation ONLY	ACOFPP Conference March 12-15, 2015; Las Vegas, NV March 12-13, 2015	November 1, 2014; filing with late fee thru December 15, 2014
Undersea & Hyperbaric Medicine Conjoint CAQ	March 14, 2015; Ft. Lauderdale, FL	November 25, 2014; filing with late fee December 30, 2014
Correctional Medicine Conjoint CAQ	March 14, 2015; Ft. Lauderdale, FL	November 25, 2014; filing with late fee December 30, 2014
Family Medicine/OMT Certification - Cognitive Exam	Electronic Testing; Regional Sites April 25, 2015	October 1, 2014; filing with late fee thru December 1, 2014
Family Medicine/OMT OCC/Recertification - Cognitive Exam	Electronic Testing; Regional Sites May 16, 2015	November 1, 2014; filing with late fee thru December 15, 2014
Geriatric Medicine CAQ Certification - Cognitive Exam	Electronic Testing; Regional Sites April 25, 2015	October 1, 2014; filing with late fee thru December 1, 2014
Geriatric Medicine CAQ OCC/ Recertification - Cognitive Exam	Electronic Testing; Regional Sites April 25, 2015	October 1, 2014; filing with late fee thru December 1, 2014
Sleep Medicine CAQ Certification Cognitive Exam	Lombard, IL August 22, 2015	
Sleep Medicine CAQ - Recertification Cognitive Exam	Lombard, IL August 22, 2015	
Family Medicine/OMT Certification - Cognitive Exam	Electronic Testing; Regional Sites September 26, 2015	April 1, 2015; filing with late fee thru June 1, 2015
Family Medicine/OMT OCC/Recertification - Cognitive Exam	Electronic Testing; Regional Sites September 26, 2015	April 1, 2015; filing with late fee thru June 1, 2015
Family Medicine/OMT Certification - Performance Evaluation ONLY	AOA OMED Conference October 17-21, 2015; Orlando, FL October 16, 2015	April 1, 2015; filing with late fee thru June 1, 2015
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Hospice & Palliative Medicine Conjoint CAQ	October 18, 2015; Orlando, FL	July 1, 2014; filing with late fee July 15, 2015

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Editor's Message

On Kindness

Merideth Norris, DO, FACOFP Editor, Osteopathic Family Physician

Spring is a time of transition and moving on. The snow is melting in most parts of the country, this will be my last editor's message, and I have been evicted from my office space.

I wish I could describe a situation in which I was caught using my office as a money laundering operation for the Russian mob, or that I was discovered cooking methamphetamine over my aromatherapy candles. Unfortunately, I have been asked to move my practice for much more banal reasons: I share the fourth floor with another DO and a chiropractor, and it has been decided that my practice is "not appropriate for this environment". I was notified of this by email and given 3 weeks to relocate. What makes my patients different from theirs are two things: 1) I accept Medicaid ; 2) part of my fairly broad practice scope includes addiction medicine. So yes, their patients are having to use the same bathroom as poor people and people in recovery, and this creates tension with the folks I'm sure they regard as "paying customers".

I'm a business owner too. I get it. Your practice comes with a whole package, and if what you are going for is upscale and exclusive, then the mere threat of coming into contact with someone who may or may not have smoked crack before may undermine the feng shui, even though the positive predictive value of someone's appearance as a yardstick of drug use is remarkably less sensitive than my neighbors may imagine. I don't begrudge the right of the landlord to cater to the tenants who have been in this space for 20 years, over the community needs for a doc like me.

But here is the message I wish I could send to my "healer" neighbors and my landlord, who ironically is also an osteopathic physician: control the décor all you want, limit the exposure to hoi polloi, make your office your very own personal Studio 54 and have a velvet cord across the entry way. But accept this: you have just signed over your right to call yourself a "holistic" anything. You may be smart. You may be talented. But you are not kind.

When I was practicing in rural Maine, I remember the first

time a patient brought me a gift. She was a nice old lady and I had treated her fairly uncomplicated problem and a week later she felt a little bit better than she had before coming in. She brought me a jar of jam and a lovely note in which she expressed that she was so lucky to have "such a wonderful doctor".

I felt like a rock star. I had hit it out of the park. William Osler should read my memoir and despair.

Unfortunately, I was full of it. This nice lady did not bring me jam because I'm a great doctor. She brought me jam because she is a nice person.

She was a nice person and being kind to her was easy. She went around town collecting kindness. The bagger at the grocery probably trips over himself to give her egg carton a little TLC. She probably has not had to pump her own gas since the Nixon administration. And for every mitzvah, she probably thanks the person delightfully and makes them feel proud and wonderful.

Then we have the other people. The ones who seem to have been raised by wolves, or not at all. There is my patient Amanda, who was recently fired from a job that hires everyone, after she addressed a customer by a racial slur which I have never heard used outside of period films from the 1950's. There is my patient Jason, who uses the f-word as the universal modifier and does not appear to notice that this is not normative behavior or that it will be unlikely to help him next time he goes to court. And there is Daniel, who is huge and menacing and whose PTSD, when triggered, results in his treating everyone around him as though they had committed a recent act of aggression.

If you can find these folks colorful rather than offensive, it may be possible to be kind to them. But how would you handle Rachel, who gleefully announced that her recent home invasion charges were being dropped "because the kid who it happened to died"? And by "died" she means "killed himself after the trauma my friends and I subjected him to."



How about Scott, whose brother is the enforcer for the local chapter of the Aryan Nation and who came in one day with a swastika tattoo on his neck? When I told him he was breaking my heart and he was better than that, he replied “it’s ok that your husband is a Jew as long as he is white.”

I do not accept their behavior. I do not tell them anything they do or say is A-OK and fine by me. I discharge people from treatment when they do not adhere to my guidelines and I call the police or DHS if I feel someone is in danger. I do the right thing by my community and by the law. I have been the star witness in a case in which my patient lost parental rights to her children. I am not an enabler and I am certainly not a doormat.

But you know what else I’m not? Cruel. A bully. I’m not the orthopedist who walked in to Daniel’s hospital room and told him “I know just the surgery you need but I’m not doing it because you’re an addict and too unstable!” and then walked off clearly feeling he had scored one for the home team. I’m not the ER nurse who smugly told my chronic pain patient that her unilateral facial droop was probably due to “all the drugs you’re on,” prompting her husband to feel justified in scolding her and trying to send her to “rehab,” even though she was actually having a TIA. I’m not the tow truck driver who told my patient outside the recovery center, “move your car, junkie,” something he would have never felt empowered to say, had he not been aware of the tacit societal agreement that poor people and addicted people are not entitled to the same kindness as the nice old lady with the jam.

You know what I am? An osteopathic family physician. Where other doctors have a scalpel or a chemo drip, our most important tool is the relationships we form. And these are forged in kindness, not in sanctimony and not in power plays. Anyone can be kind to the child with strep or the pleasant older gentleman who broke his wrist falling on the ice. That’s rookie stuff. We are charged with kindness to everyone. And it’s more important. Because everyone will be kind to the jam lady. But

we may be the only people this week who will show kindness to the felon with the drug problem. We may be the only person in the world to touch them in a caring way.

It’s tempting to take out our aggressions on the people who seem to beg for it. We would have the support of our peers and the rest of the world when we tell off someone who has it coming. But we are better than that. We don’t come to work for our own benefit. We come for theirs. And it does not make the function of society or the practice of medicine better when we use our role and our power and their dependence on us to score points off of them and be anything less than respectful and considerate. Whether or not they give us gifts or remember their manners.

It is not easy, particularly when you realize that some people have done nothing to deserve gentleness or support. I need a lot of reminding. In my office hangs a print. It shows a tree, and the charge by Mother Theresa, “Do It Anyway”. It includes the lines:

“People are often unreasonable, irrational, and self centered. Forgive them anyway. If you are kind, people may accuse you of selfish, ulterior motives. Be kind anyway.....if you are honest and sincere, people may deceive you. Be honest and sincere anyway....The good you do will often be forgotten. Do good anyway.”

It has been my great honor to be the editor of this journal for the past few years. I hope you all will retain an osteopathic identity and remember what makes the practice of family medicine special and important, and that you remember that although not everyone may be held in high regard, everyone deserves respect and kindness, and to be treated as though they hold inherent worth and dignity. Because at the end of the day, the way we treat the downtrodden, and the way we treat each other, is not about who they are. It’s about who we are.

Evaluation and Management of Anterior Cruciate Ligament Injuries: A Focused Review

Dwan Perry, DO and Michael O'Connell, DO

Edward Via Virginia College of Osteopathic Medicine, Virginia Campus. Department of Sports Medicine
Virginia College of Osteopathic Medicine-Carolinas Campus

KEYWORDS:

Anterior Cruciate Ligament
Knee
Injury
Test

Anterior cruciate ligament (ACL) injuries are among the most common sports medicine complaints in the United States. There are approximately 150,000 ACL injuries annually with the majority of them occurring via non-contact mechanisms. Assessment of the knee should be performed immediately after an ACL injury and includes a comprehensive history and physical exam. The Lachman test is most accurate in diagnosing an ACL injury. Magnetic resonance imaging confirms the diagnosis of an ACL injury and also evaluates the surrounding soft tissue for concomitant injury. Treatment depends on the extent of injury as well as the activity level of what the patient desires. Both conservative treatment and post-operative care include extensive rehabilitation to increase range of motion and stability to the knee joint. Complications of ACL injuries most commonly involve chronic pain and eventual osteoarthritis. Prevention of an ACL injury requires a dedicated regimen of strength and neuromuscular training.

Sample ACL Prevention Program available for download at ofpjournal.com

INTRODUCTION

The majority of ACL injuries occur in people aged 15-45. This is reflective of a more active lifestyle and higher participation in athletic activity during that age range.¹ The total number of injuries is greater in males (due to a higher number of participants) but females have a 2-8 times higher risk of injury.² Theories on why injuries are more prevalent among women include a greater Q angle at the knee joint leading to a genu valgus alignment, a wider pelvis, increased joint laxity, and hormonal changes that occur throughout the menstrual cycle.² The classification of ACL injuries is divided into three grades.³ A grade 1 injury involves microscopic damage with a predominately intact ligament. A Grade 2 injury has partial tearing and separation of the fibers with surrounding edema. It can be further subdivided into low-grade partial and high-grade partial tears, depending on severity. A grade 3 injury is a complete tear in which the entire ligament is torn and the knee joint is unstable.

ANATOMY

The knee joint permits flexion and extension as well as rotational movement of the lower extremity.⁴ The primary structures that stabilize the knee joint include the anterior cruciate ligament, posterior cruciate ligament, medial

collateral ligament, lateral collateral ligament, and the medial and lateral menisci.⁴ Cartilage, bursae, and synovial fluid act to maintain and support the integrity of these structures.⁴ Despite this intricate support system, the knee joint and especially the ACL are subject to a variety of twisting and weight bearing stressors that make it especially prone to injury.⁴ The ACL originates at the posterior aspect of the femur and attaches to the anterior tibia.⁴ It prevents anterior displacement of the tibia relative to the femur.⁴

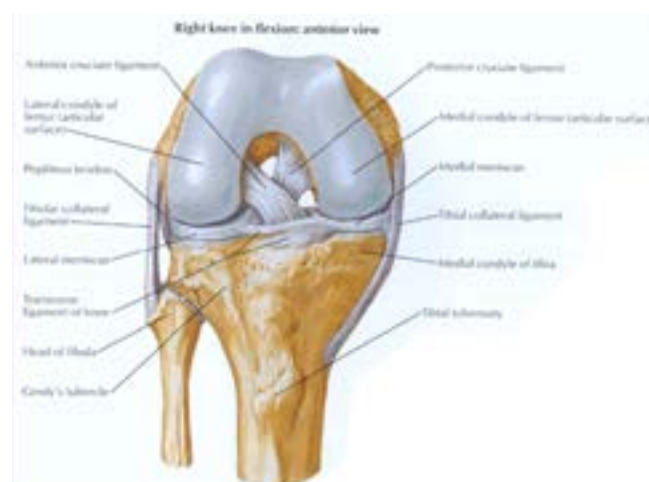


Diagram taken from. Frank H, MD. Atlas of Human Anatomy. ICON Learning Systems, New Jersey 1997. Plate 475

MECHANISM OF INJURY

Approximately 75% of ACL tears are non-contact and most commonly occur either with a sudden deceleration prior to a change in direction or landing in an extended position.⁵ Conventionally it was thought that an ACL injury occurred

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only due to anterior translation of the tibia on the femur, but recent studies have shown that a tri-planar motion of anterior translation of the tibia, abduction of the knee, and internal rotation of the knee all contribute to ACL stressors that cumulate in a tear or strain.⁶ Excessive quadriceps contraction and reduced hamstring co-contraction near full knee extension increases ACL tensile forces past its anatomical barrier, ultimately leading to an injury.⁷ Direct contact ACL tears usually involve a lateral blow to a planted leg.⁸ It is often referred to as the “unhappy triad” because they include concomitant medial collateral ligament (MCL) and meniscal injury as originally described by O’Donoghue’s classic article in 1950.⁹

HISTORY AND PHYSICAL EXAM

A thorough history and physical exam should be performed immediately after a suspected tear. The patient might often describe hearing a “pop” associated with twisting, cutting, or landing from a jump. Decreased range of motion and a feeling of instability can follow the injury. The patient may complain of mechanical symptoms such as the knee “giving way” or functional deficits which result in “rounding cuts” instead of pivoting. Pain is variable; it can range anywhere from a “mild tweak” days later to excruciating pain seconds after an injury has been sustained.¹⁰ Physical exam should begin with assessing the patient’s posture, degree of swelling, gait, strength, and range of motion. Comparing the non-injured knee to the injured knee gives a relative understanding of the deficits incurred. Roberts and Stallard noted a hemarthrosis may indicate ligamentous injury in the acutely injured knee.¹⁷ This is due to tearing of the middle geniculate artery, which runs longitudinally within the synovial sheath that envelopes the ACL.¹⁸ If tense swelling appears within a few hours of injury, this likely represents a hemarthrosis. An acute on field exam is often much easier before edema, hemarthrosis, and guarding is established. Complete immobilization is generally contraindicated due to prolonged stiffness and muscle atrophy, but is acceptable in the setting of a traumatic injury where the extent and damage is unknown.⁴⁸ Atrophy, weakness, and inability to efficiently contract the quadriceps is very common following an acute ACL injury.¹¹ EMG studies have shown quadricep dyskinesia in subjects with ACL tears when performing both static (isometric contraction) and dynamic (cyclic flexion and extension) tests.¹²

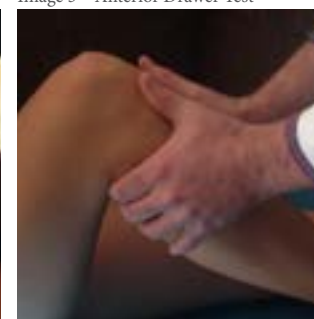
One article searched MEDLINE (1970-2000) and reviewed the literature to determine the scientific validity of the Lachman test, pivot shift test, and the anterior drawer test used in the diagnosis of an ACL injury.¹³ The Lachman test (Image 2) had a sensitivity ranging from 0.80 to 0.99 and a specificity of 0.95.¹³ To perform the Lachman test, flex the knee to 30

degrees and apply anterior force on the tibia. It was concluded that it was the most sensitive and specific test for the diagnosis of an ACL tear, especially in acute injuries.¹³ The pivot shift test had a sensitivity ranging from 0.84 to 0.98 with a specificity of 0.98 under general anesthesia, but values as low as 0.35 have been described in an alert patient.¹³ To perform the pivot shift test, flex the knee to 30 degrees while internally rotating and apply a valgus force to knee. The anterior drawer test (Image 3) had a specificity of 0.97 and a sensitivity ranging from 0.22 to 0.41 in an alert patient and 0.79 to 0.91 in a patient under general anesthesia.¹³ To perform the anterior drawer test, flex the hip to 45 degrees and knee to 90 degrees while applying anterior force on the tibia. Screening for further injury should also include testing for concomitant injuries to the posterior cruciate ligament (PCL), collateral ligaments, menisci, and the posterolateral corner (PLC) of the knee.

Image 2 – Lachman Test



Image 3 – Anterior Drawer Test



The posterolateral corner (PLC) of the knee is composed of the gastrocnemius, popliteus, LCL, popliteofibular ligament, and the arcuate –fabellofibular ligament complex.¹⁴ The PLC complex resists varus and external rotational forces as well as posterior translation of the tibia on the femur.¹⁴ Isolated injury to the PLC is rare and usually occurs with cruciate ligament injury.¹⁴ Varus testing and the dial test (patient prone, externally rotating tibia with knees flexed at 30 and 90 degrees) can screen for postero-lateral instability. Also, Hughston and Norwood described the external rotational recurvatum test in 1980 which demonstrated hyperextension of the knee with external rotation of the tibia while holding the patient’s great toes and lifting the heels off the table.¹⁵ PLC damage is confirmed with radiographic and magnetic resonance imaging. Missed PLC injuries increase the failure rate of ACL reconstructive surgery and can exacerbate disability stemming from cartilage damage and chronic instability.¹⁶

IMAGING

The decision on whether to use radiographic imaging can be determined using the Ottawa Knee Rules.¹⁹ A patient older than the age of 55, isolated tenderness at the fibular head or patella, the inability to flex to 90 degrees, and not being able to bear weight immediately after injury and in the emergency

room are indications to screen for skeletal fractures. The Ottawa Knee Rules has played an important role in ruling out skeletal fractures and avoiding unnecessary plain films. One study showed that the Ottawa Knee Rules had 98.5% sensitivity in ruling out a fracture with traumatic injury to the knee.²⁰ Plain films may show evidence of a second fracture, which is an avulsion fracture of the lateral aspect of the tibial plateau.²¹ Approximately 75% of second fractures are associated with ACL tears, and this is especially useful when physical exam is made limited by a painful and traumatized knee.²¹ Scientific literature concludes that a second fracture is a strong indirect sign of an ACL tear.²¹

Magnetic Resonance Imaging (MRI) is the gold standard in confirming an ACL tear with a sensitivity and specificity of 90.9% and 84.6%, respectively.²² An MRI is indicated and should be ordered if the diagnosis is uncertain or if concomitant meniscal or ligamentous injury is suspected. Damage to the menisci and the collateral ligaments occurs in 60-75% of ACL tears.²³ As physical exam may be limited due to pain and decreased range of motion, MRI becomes a valuable tool. It has played an instrumental role in decreasing the number of diagnostic arthroscopies in the United States.²⁴

MANAGEMENT

Acute management, post-injury or postoperatively, must focus on decreasing pain and edema. This is accomplished via pain control with nonsteroidal anti-inflammatory drugs (NSAIDs), relative rest, ice, compression, and elevation (also known as the PRICE method). Restoring range of motion using a variety of soft tissue and manipulative techniques should then be implemented 2-3 days after injury or surgery. Osteopathic Manipulative Treatment (OMT) can be especially helpful during this phase of ACL rehabilitation. Once the PRICE method is implemented and the acute stage of injury is complete, OMT can address any hypertonic muscles, restrictions of myofascial structures, and triggerpoints that may be contributing to the presence of pro-inflammatory substances and edematous fluid. Application of indirect soft tissue techniques such as myofascial release and counterstrain therapy for lower extremity trigger points will reduce the hypersympathetic state of the damaged tissue. By correcting asymmetry, restrictions, and tenderness classically seen in any somatic dysfunction, tissue equilibrium can be re-established leading to decreased nociceptor activation and increased venous and lymphatic return.²⁵ Restriction in the patella and fibular head can also hinder range of motion and thus delay the healing process, and special attention needs to be directed at these locations. Great emphasis needs to be placed on this phase of rehabilitation because studies have shown that loss of motion is one of the most important factors in the development of osteoarthritis.²⁶ Once control of pain and swelling

has occurred, along with restoration of range of motion, progression to resistance training and dynamic conditioning may be attained within the first month.²⁷ Increased resistance training, balance and proprioceptive conditioning, agility, and sport-specific activity will be added as the patient continues to meet milestones and advancement criteria.²⁷ Studies have proven that neuromuscular training along with balance and proprioceptive conditioning will have a better outcome than strength training alone.²⁸ To minimize injury in both non-operative and post-operative management, incorporate closed-chain exercises starting at 4 weeks post-operatively and progress to open-chained exercises at approximately 12 weeks.²⁸

SURGICAL TREATMENT

The decision on whether to conservatively manage or to undergo surgery depends upon the patient's age, the extent of the injury, and the functional goals of the individual.²⁹ Young and middle-aged adults, a high-grade Type 2 to Grade 3 tear, and a patient with at least a goal of moderate activity are the most ideal candidates for surgery.²⁹ Other factors that favor surgery include a history of instability or "giving out" episodes and associated meniscal or collateral ligament damage.²⁹ Surgical management in children and younger adolescents is more complex due to the potential of growth plate damage. However, delaying ACL reconstruction in a skeletally immature individual increases the risk of permanent intra-articular damage, and pediatric ACL reconstruction is recommended.³¹ One study showed that even in isolated ACL injuries, the risk of meniscal damage and eventual tearing of the medial meniscus increases without surgical correction.³⁰ An adult type ACL reconstruction is indicated in females over 15 years old and males over 16.³¹ The elderly are usually not good candidates due to decreased functional goals. Ultimately, the decision to undergo surgical intervention is a multi-factorial dilemma that must be decided on an individual basis.

REHABILITATION

Postoperative rehabilitation is a must with ACL injuries. A 2010 systematic review of evidence-based rehabilitation protocols was conducted to design an evidence-based accelerated rehabilitation return to play protocol over 6 months following ACL reconstructive surgery.³² The most important factors involved in returning to sports activity included full range of motion and stability, no pain or swelling with sport-specific activity, and at least 85% hamstring and quadricep strength compared to the contralateral side.³² Return to work varies upon the ambulatory requirements of each specific profession. This review also highlighted the importance of presurgical rehabilitation in addressing pain control and inflammation, improving range of motion

and neuromuscular control, providing clear instruction to the patient regarding the content of a rehabilitation program, and creating a realistic view of the rehabilitation process. These measures have shown to stimulate earlier recovery and decreased expected postsurgical pain. Return to activity varies depending on the functional goals of the individual, and currently there is no consensus regarding criteria on when it is safe to return to activity.³³ The rates of re-injury to the reconstructed knee or of sustaining an ACL rupture on the contralateral knee range from 3 percent to 49 percent, and this is often attributed to premature clearance to return to normal activity.³⁴ Studies have shown that ligamentization of a free tendon graft into a functional ACL takes as long as 10-12 months.³⁵ Hartigan et al even showed deficient knee motion kinematics in downhill running and single leg hopping as well as biomechanical asymmetries over a year post-operatively.³⁶

PREVENTION

Prevention of ACL injuries is critical not only due to the extensive cost and rehabilitation commitment, but also to avoid long term complications. Sequelae of ACL injuries most commonly involve chronic pain and osteoarthritis.³⁷ Neuromuscular training focused on increasing strength and stability of the knee joint, balance exercises, and plyometric-like conditioning is the most effective method in preventing ACL injury. Evidence demonstrates that many risk factors are modifiable with intervention programs and that athletic performance measures can even be enhanced. One study compared 600 semi-professional and amateur athletes split into two groups based on whether or not they received proprioceptive training using various balance boards. The proprioceptive training group trained daily for 20 minutes during the preseason and at least three times per week during the season. At the end of the season, the incidence of ACL injuries in the group who did not undergo balance training was 1.15 compared with 0.15 for the group that underwent the extra training.³⁸ Another comparative study of female soccer players showed that when undergoing balance board training throughout a season, the incidence of ACL injuries was lower than the group that did not use the balance board.³⁹ These results display the importance of proprioceptive and balance training in reducing the incidence of ACL injuries during athletic activity. Warming up before any physical activity decreases risk of injury. One study followed 4564 soccer players aged 12-17 that were split into an interventional group and a control group. The interventional group participated in a neuromuscular warm-up program for 15 minutes throughout the entire season. Results showed half as many ACL injuries during the season for the interventional group than the control group.⁴⁰ In a separate study,

844 soccer players received sports specific education, stretching, strengthening, and plyometric training as a warm up program and were compared with 1913 other soccer players who participated in a traditional warm-up. They were monitored for two seasons and the results showed an 88% decrease in ACL injury the first year and a 74% reduction the second year in the group who received the specialized program compared to the group with a traditional warm up.⁴¹

It has long been proposed that core stability improves both preventative and rehabilitative efforts in ACL injuries. Decreased core stability allows for excessive and uncontrolled trunk movements, and this adversely affects knee positioning and loading and can lead to improper alignment.⁴² Over time the body will develop inappropriate compensatory mechanisms leading to somatic dysfunction, ultimately leading to a strain or tear. 277 collegiate athletes were tested for trunk displacement after a sudden force release and then prospectively followed for three years. 25 of these athletes sustained knee injuries during this time period, and trunk displacement was greater in athletes with knee, ligament, and ACL injuries as opposed to uninjured athletes.⁴³

Core hip strength is also essential in ACL injury prevention. The gluteus medius is responsible for abduction of the hip and helps stabilize the pelvis and lower extremity.⁴ A deficiency in strength of the gluteus medius results in a valgus collapse and excessive rotational forces at the knee, resulting in an increased risk of ligamentous injury.⁴⁴ One study showed that myoelectric stimulation of the gluteus medius delivered immediately after foot strike significantly reduced knee valgus torque.⁴⁴ This result displays the importance of core hip strength in maintaining knee integrity. There has been recent literature that suggests biomechanical and proprioceptive deficits persist or may even be exacerbated after ACL reconstruction.⁴⁵ Some of these abnormalities linger up to 4 years after reconstruction. Focus has shifted to secondary prevention considering these deficits increase the rate of both reinjury and contralateral ACL injury. As most predictors of reinjury are modifiable with the exception of age and sex, there has been a push for late phase postoperative rehabilitation and symmetry training to ensure resolution of neuromuscular deficits.⁴⁵ Bracing is commonly used in both conservative treatment and post-operative management of an ACL injury. However, current studies have shown no proven benefit in making an ACL-deficient knee functional or in protecting a previously reconstructed ACL using bracing technology.⁴⁶ There has also been no supporting evidence that bracing improves pain, range of motion, or graft stability.⁴⁷ Further research is needed to investigate any therapeutic benefits that bracing offers.

CONCLUSION

ACL injuries are very common in the family practice setting. As the population becomes more active, these injuries will continue to be encountered by primary care physicians. A thorough understanding of the anatomy, presentation, evaluation, and management of these injuries will ensure a functional and healthy quality of life. Further research is needed to address the most effective methods in preventing and managing these injuries.

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Ultimate Fighting Championship Injuries; A Two-Year Retrospective Fight Injury Study

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KEYWORDS:

MMA

UFC

Ring Side Physician

Injuries

Fighter

Purpose: This epidemiologic study gives insight on management of fighters both in and out of the ring.

Methods: Data from 304 professional fighters in 152 fights were included.

Study Selection: The Fighters' Complaints, Physician Diagnosis, Imaging Results, and mechanism of win/loss were tabulated. Each fighter had a maximum of 4 injuries.

Data Extraction: All data was summated & either a Fishers Exact Test or Chi-Squared analysis was performed on individual injuries and fight outcome.

Results: 200 (66%) of the fighters were uninjured compared to 102(33%). The majority of injuries were soft tissue in nature. 43 x-rays, 7% found new fractures and 34 CTs confirmed 13 facial bone fractures and no subdural, epidural or intraparenchymal bleeds were observed. Three outcomes had a substantial increase in injury incidence; TO (armbar) 58.3% (7/12), TKO 52.9% (27/51), decisions 46.8% (37/79). Statistically significant injury rates were seen in TKO/KO compared to other outcomes; 1/3 of the total injuries occurred (9.27% of 33%, $p=0.004$), 78% of total facial bone fracture ($p<0.001$) & 83% of the total eye injuries ($p<0.001$). 34 (11.7%) competitors had CT Scans; 18 (52.9%) were negative, 13 (38.4%) identified facial bone fractures.

INTRODUCTION

Mixed Martial Arts (MMA) has recently seen an explosion in popularity worldwide. MMA is a full contact combat sport involving a variety of strikes, kicks and technical maneuvers including chokes and torsions in competitions. MMA encompasses boxing, wrestling and a variety of marital arts in competition. Open gloves, exposing the fingers and palms are used in competition in comparison to a closed glove used in boxing. Typical glove weight in MMA competition ranges from 4-6 ounces, whereas gloves worn in professional boxing typically weigh 10-12 ounces. It is conventional knowledge, albeit without statistical support, that the lighter the glove, the higher the velocity and impact of the strike. An array of minor and potentially serious injuries can occur in the ring during an MMA bout.

The Ultimate Fighting Championship (UFC), initially founded in 1993, has the lion share of both professional fighter pool and national/international fanfare. The UFC solidified their international power and fighter base with the acquisition of the World Extreme Cagefighting (WEC) in 2006, Pride in 2007, as well as Strikeforce in 2011 respectively¹. Beginning in 2009,

viewership of pay per view events surpassed the one million mark per televised event. Although the UFC typically does not release official numbers and statistics, it is public knowledge that they have experienced exponential growth in the last few years. Estimated earning of the UFC in 2008 exceeded \$250 million, with a total estimated worth of \$1 Billion¹.

As depicted above, the UFC's growth has drawn massive amounts of attention to the sport of MMA. Small and large MMA gyms have begun to open throughout the United States training interested participants the art of MMA. Due to the success of the UFC, both amateur and professional MMA events have become popular around the nation. MMA has created a new sporting venue that many medical personnel are unfamiliar with. Medical personnel's knowledge of the injuries incurred in the ring vary widely. Clearly, not only the UFC, but the sport that it has made mainstream, MMA, will have a huge impact in Sports Medicine today and in the future.

To date, only one MMA injury study has been published in the United States³. However, the following research is unique in the fact that only data obtained from UFC events was tabulated. UFC arguably is the highest level of MMA competition and is considered by most to have the most experienced fighters. At the time of authorship, no previous research has been published with specificity towards injury incurred in the UFC events.

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The goal of this study is to identify the injury patterns and frequency incurred during MMA fights at the professional level. This data was focused to help the medical professional in ringside management of the fighters and the events. Imaging including x-rays and Computed Tomography (CT Scans) were also analyzed to give further insight and reflection of the injuries. This data is aimed to help the ring side medical professional prepare for emergency situations and medical care for event coverage.

METHODS

Data was obtained directly from the Nevada Athletic Commission (NAC). All data was obtained solely from UFC events that took place in Las Vegas Nevada during a two-year period from January 01, 2007 through December 31, 2009.

Each fighter was examined immediately after the fight by a physician directly affiliated with the NAC. This occurred in the ring and/or the locker rooms. The physician then employed medical decision-making choices as to the care of the fighter. If the physician felt the fighter warranted further care not able to be given in the facilities the fighter was sent to the emergency department either via private transportation or ambulance.

A NAC physician recorded documentation of the medical diagnosis and decisions made in the facility. Emergency department documentation reviewed included chart notes, discharge documentation and radiology reports/images and were independent of the NAC. Mandatory suspension periods are given by the NAC after the exams, in which time the fighter cannot compete. These time frames range from 30, 45 and 60-day suspension depending upon the severity of the injury, injury location, fight result and possibly further consultation input. Individual fighters often fought in more than one bout during the two-year period studied. Thus, each time the fighter fought in a bout, his results were tabulated as an independent variable. No fighters' complaints or injuries were calculated as a cumulative variable. According to NAC documents, all UFC "events" had an average of 10 (min 9, max 18) fights per event. Although the UFC now has female competitors, all the data was obtained exclusively from male participants. Descriptive data points collected from the NAC included;

1. Fight outcome; win, loss, early stoppage, decision
2. If fighter lost, mechanism of loss; Knock Out (KO), Technical Knock Out (TKO), Tap outs (TO) specified in Arm/Ankle lock maneuver or a Choke-out technique
3. Anatomical location of the fighters' complaints
4. Ring-side physicians diagnosis

5. X-ray and CT Scan results from the Emergency Department
6. Follow up results from outside physicians.

Fighters occasionally had multiple injuries and complaints up to 4 separate injuries were allowed. This number was arbitrarily chosen due to one specific fighter whom reported 4 separate injury locations.

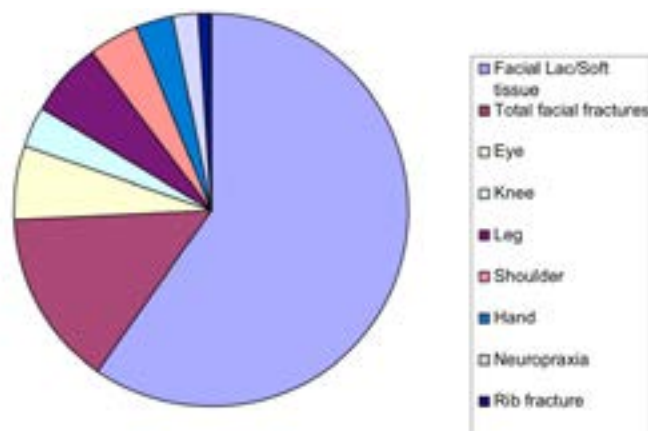
Subjects were then grouped by outcome of the fight including win, loss or decision. Following this, the total complaints, types of complaints and injuries were examined using Pearson's Chi-square tests where appropriate (expected frequency >5), otherwise Fisher's exact tests were used. Subjects were then divided by those with KO/TKO vs. all other decisions for the complaint and injury variables as previously stated for the Tap outs. All analyses used SAS for Windows 9.2, Cary, NC.

RESULTS

A total of 304 fighters (n=304) fought in 152 fights over the two-year study period. There were 15 events total that occurred in the two-year period. Of the 304 fighters, regardless of the outcome of the fight, 182 (60.3%) report no injury complaints in their bout, whereas 182 (39.7%) reported complaints of injury to the physician. Two fighters' lacked follow up and were excluded.

Fighter's complaints of anatomical locations described to the physician were as follows: 85 Face/Head (28.1%), 33 Leg/Ankle (11%), 15 Hand/Wrist (5%), 10 Knee (3.3%), 7 Arm/Elbow (2.3%) 7 Shoulder (2.3%), 4 Foot (1.3%), Chest/Rib 3 (1%), 4 Neck/C-Spine (1.3%), 2 Eye (0.6%).

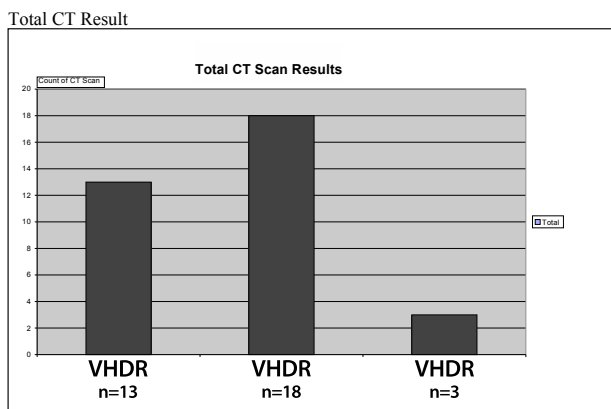
Physicians diagnosed the following identifiable injuries: 58 Facial Laceration/Soft tissue (19.2%), total facial fractures of 14 (4.6%) of which 9 were nasal bone fractures (2.9%), 4 were orbital fractures (1.3%) and 1 was a mandible fracture (0.33%), 6 Eye (2%), 3 Knee (1%) including 1 of both an ACL tear and a Meniscus tear, 6 Leg(2%), 4 shoulder (1.3%), 3 hand (1%), 2 Neuropraxia (0.7%), 1 Rib Fracture (0.3%).



31 competitors (10.2%) were sent to the Emergency Department or requested to obtain x-rays. 10 competitors were lost to follow up. Of the 21 fighters with documented x-rays, 43 x-rays were obtained and reported to the NAC. 7% (3 new fractures) of the x-rays found new fractures, reciprocally 93% were negative.

34 (11.7%) competitors had CT Scans of the head and neck performed immediately after the events. 18 (52.9%) of the CTs were read as negative with no identifiable acute abnormality. 13 (38.4% of the CT scans) identified new facial bone fractures including orbital, nasal and mandible fractures as noted above. 3 (1%) had only superficial soft tissue findings with no other major bony structure changes as seen in figure 3. Of significance, 100% of the CT Scans showed no intracranial soft tissue or vascular abnormalities including subdural or epidural hematomas were identified.

Figure 3



When comparing fight outcomes with injury rate, three fight outcomes had a substantial increase in injury incidence; Tap out via an Arm bar 58.3% (7/12), TKO 52.9% (27/51), decisions 46.8% (37/79), other rates were: Tap out via choke maneuver 29.4% (10/34), KO 20% (1/5), Tap out otherwise not specified 20% (1/5), Tap out via Ankle Lock 0% (0/3). Winning competitors were not spared injury; winning by Tap out retained an injury rate of 16.5% (18/109). (See Figure 2, Figure 4)

Figure 2
Percent Frequency of CT Scans by Fight Result

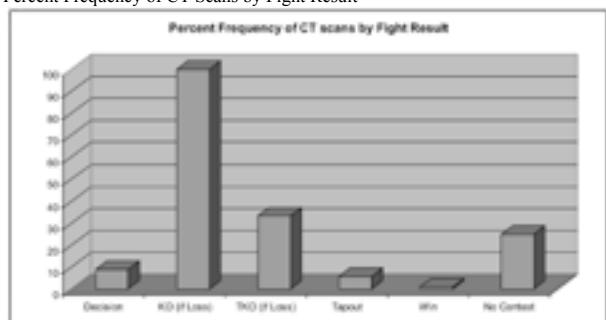
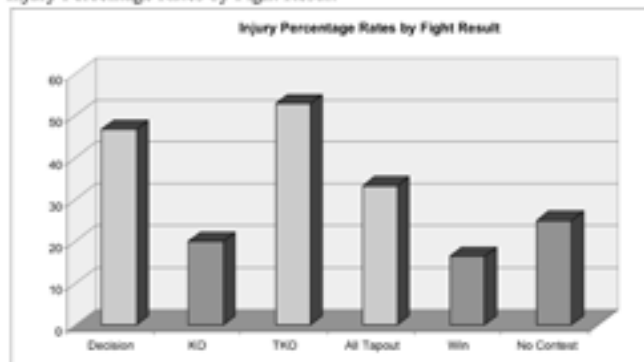


Figure 4
Injury Percentage Rates by Fight Result



Statistically significant increases in injury rates were observed when analyzing the various outcomes of the fight. If a fighter lost by TKO or KO, his injury rate (any location, any injury) was highest when compared to losing by any other method. Loss by TKO/KO when compared to all other outcomes resulted in 1/3 of the total injuries occurred (9.27% of 33% total injury rate, p= 0.004), 78% of total facial bone fractures (p<0.001) & 83% of the total eye injuries (p<0.001).

Because of this glaring correlation between facial fractures with TKO and KO's a more detailed analysis was required. The relative risk of a fighter losing by TKO/KO and acquiring a facial bone fracture was nearly 20 fold when compared to all other outcomes regardless of win or lose. Specifically, all other fighters' (win or lose) incidence of facial bone fractures was 3/246 (1.2%), whereas, a loss by TKO/KO had an incidence of 11/56 (19.6%) (p<0.0001) with a RR=19.8 (95% CI=5.3, 73.8).

Correspondingly, a higher incidence of CT scans was obtained for those losing by TKO/KO. CT Scans were obtained in the following frequency; TKO/KO 22/56 (39.3%) and all other results (win or loss) CT-Scan 12/247 (4.9%) (p<0.0001) with a RR=12.7 95% CI= (5.75, 27.9).



Table 1	Not KO/TKO No=187	KO/TKO No=6	p-value
All CT scans	21 (11.3%)	21 (35.0%)	<0.0001
Neurotrauma	0 (0.0%)	0 (0.0%)	
Brain Neurovascular Hemorrhage	0	0	
Facial bone Soft tissue	2 (1.1%) 2 (1.1%)	11 (18.0%) 1 (1.7%)	
Any complaint	51 (27.3%)	38 (61.7%)	<0.0001
Eye	1 (0.5%)	1 (1.7%)	0.74
Face	3 (1.6%)	3 (5.0%)	<0.0001
Hand/wrist	2 (1.1%)	4 (7.7%)	0.49
L/E	21 (11.3%)	9 (14.8%)	0.27
Knee	6 (3.2%)	4 (7.7%)	0.69
Foot	3 (1.6%)	1 (1.7%)	0.56
L/E	2 (1.1%)	3 (5.0%)	0.62
Chest wall	1 (0.5%)	2 (3.3%)	0.69
C-Spine	3 (1.6%)	1 (1.7%)	0.56
Shoulder	3 (1.6%)	2 (3.3%)	0.62
Any injury	74 (39.6%)	28 (46.7%)	0.664
Facial bone Fracture	3 (1.6%)	11 (18.0%)	<0.0001
RT facial injury	4 (2.1%)	1 (1.7%)	0.49
Eye injury	1 (0.5%)	1 (1.7%)	0.664
Neurotrauma	2 (0.9%)	0	1.00
Knee internal	3 (1.6%)	0	1.00
Disengagement	0	0	0.00
Leg injury	4 (2.1%)	0	0.00
Shoulder injury	3 (1.6%)	1 (1.7%)	0.56
Hand injury	2 (0.9%)	1 (1.7%)	0.66

Table 1 compares all KO or TKO to all other fight results. The complaints and injuries are not mutually exclusive and each fighter could have more than 1 complaint and/or injury. When looking at complaints and/or injuries, an adjustment must be made for the multiple comparisons. A value <0.006 would then be required for statistical significance for each of the separate complaints and injuries. The KO/TKO group had more CT scans, more complaints and statistically significant more face complaints, more injuries and specifically statistically significant more facial bone fractures and Eye injuries compared to all other fight results.

The above table compares all KO or TKO to all other fight results. The complaints and injuries are not mutually exclusive and each fighter could have more than one complaint and/or injury. When looking at complaints and/or injuries, an adjustment must be made for the multiple comparisons. A p-value of <0.006 would then be required for statistical significance for each of the separate complaints and injuries. The KO/TKO group had more CT scans, more complaints and statistically significant more face complaints, more injuries and more facial bone fractures and eye injuries compared to all other fight results.

Table 2	Not Tapouts No=187	Tapouts No=6	p-value
All CT scans	21 (11.3%)	21 (35.0%)	0.03
Neurotrauma	0 (0.0%)	0 (0.0%)	
Brain Neurovascular Hemorrhage	0	0	
Facial bone Soft tissue	2 (1.1%)	1 (1.7%)	
Any complaint	101 (54.0%)	19 (31.7%)	0.43
Eye	2 (1.1%)	0	0.51
Face	7 (3.8%)	4 (6.7%)	0.616
Hand/wrist	14 (7.5%)	1 (1.7%)	0.49
L/E	28 (15.0%)	7 (11.7%)	0.60
Knee	7 (3.8%)	3 (5.0%)	0.59
Foot	2 (1.1%)	2 (3.3%)	0.23
L/E	3 (1.6%)	2 (3.3%)	0.61
Chest wall	1 (0.5%)	0	1.00
C-Spine	4 (2.1%)	1 (1.7%)	0.60
Shoulder	3 (1.6%)	4 (7.7%)	0.62
Any injury	94 (50.3%)	14 (23.3%)	1.00
Facial bone Fracture	3 (1.6%)	1 (1.7%)	0.60
RT facial injury	4 (2.1%)	4 (6.7%)	0.10
Eye injury	1 (0.5%)	0	0.60
Neurotrauma	1 (0.5%)	1 (1.7%)	0.33
Knee internal	3 (1.6%)	2 (3.3%)	0.69
Disengagement	0	0	0.00
Leg injury	3 (1.6%)	1 (1.7%)	0.67
Shoulder injury	2 (0.9%)	2 (3.3%)	0.23
Hand injury	3 (1.6%)	0	1.00

Table 2 compares all Tapouts to all other fight results. The complaints and injuries are not mutually exclusive and each fighter could have more than 1 complaint and/or injury. When looking at complaints and/or injuries, an adjustment must be made for the multiple comparisons. A value <0.006 would then be required for statistical significance for each of the separate complaints and injuries. Therefore, nothing can be considered statistically significant different between Not Tapouts and all Tapouts.

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DISCUSSION

After the institution of stricter regulations by the Nevada Athletic Commission (NAC) in 2001, the popularity of MMA soared³. These stricter guidelines and rules qualified MMA as a skilled sport in the public eye. Although CBS's 60 Minutes and the like of other media outlets have deemed this sport "barbaric," or as John McCain deemed as "human cock fighting," its popularity cannot be refuted.

Before the fighters compete in the professional level, a complete physical exam and baseline MRI of the head/neck must be obtained. Just as in any other professional sport, strict regulations in banned substances are enforced by state regulations. These competitors are high-level athletes; often they are decorated collegiate or professional athletes in other sports.

Although it may appear to spectators as though an injury rate would be exquisitely high, this study had an injury occurrence rate of 39.7 per 100 competitors, similar to boxing injury rates⁶⁻⁹. In related combat sports, injury rates per 100 competitors has been reported as low as 0.3 in martial arts to as high as 44.7 in competition boxing^{4,10}. Published boxing injury rate observations specifically have ranged from 14.0 to 44.7 per 100 competitors⁶⁻⁹. This study showed similar total injury occurrence as boxing observations. The majority of observed injuries, 19.2% of the total 39.7% injury reports, were facial lacerations.

In this study, no structural injuries were observed to the cervical, thoracic or lumbar spine. Also, the CT Scans identified no intracranial or epidural hemorrhages, or any other abnormality in the brain's soft tissue and vascular structures directly related to competition. However, it should be noted that this is only a two-year window and does not exclude these serious implications from occurring.

Although this study showed observed injury rates similar to those of boxing and far fewer serious injuries than most would anticipate, the implications of multiple strikes to the head with smaller glove weight has yet to be comprehensively studied in MMA. Acute Brain Injury (ABI) including concussion, intracranial hemorrhages, parenchymal swelling, etc. has yet to be publicly studied in the UFC and MMA in general.

Acute Brain Injuries encompasses a reported 15.9% to 69.7% of the total injuries in boxing, and serious considerations must be made with the impacts of ABI in MMA¹¹. As noted previously, competition gloves in MMA are open fist and weigh 4-6 oz. compared to boxing's closed fist 10-12 oz. gloves. Lighter glove weight has been shown to produce a higher velocity and acceleration of a strike. The strike velocity of a 6 oz. glove was 2.7 times faster than a 12 oz. glove. Likewise, it was postulated

in this study, greater velocities and accelerations of a strike created greater forces delivered¹². Although proper large biomechanical studies are lacking, these findings are important factors in MMA. Serious concussions were observed at a rate of 15.4 per 1000 athlete exposure in one published study to date in MMA¹³. ABI's undoubtedly occur in competition and the potential short and long-term affect of lighter glove weight must be taken into consideration in the acute setting of MMA injuries.

Chronic Brain Injuries also considered Chronic Traumatic Encephalopathy (CTE) or "Punch Drunk Syndrome" has yet to be addressed or studied given the youth of this sport. The affects of repetitive head strikes in boxing has been studied in only limited quantities. A.H. Roberts published what is widely thought as the most complete study to date with CTE in professional boxing. Roberts found that CTE was found in 17% of retired boxers¹³. Differences between MMA and boxing including the lighter glove weight, the probable higher velocity and accelerations of strikes, the large difference in delivered strikes in competitions and the fact that MMA fighters deliver and receive far less strikes to the head than boxers may affect long term outcomes. Both Acute and Chronic brain injury is area of importance that needs to be addressed and studied further.

CONCLUSION

Mixed Martial Arts has become internationally popular. The UFC is widely considered to be the highest level of competition in MMA in the United States, and internationally. To the average spectator this sport would appear to have an extremely high injury rate. The gloves in MMA competition are far smaller than those worn in boxing, the fighters strike with fists and elbows, kicks are employed to the head, body and legs and choke maneuvers are all used to win a match. However, when observing two years of fights that took place in Las Vegas from 2006-2008 an injury rate comparable to boxing was observed. Of the observed injuries the vast majority were facial soft tissue injuries. The serious injury rate observed was surprisingly low. Noteworthy was the fact that no deaths, intracranial hemorrhages, spinal cord or spinal injuries were observed during this time frame.

Although this is the first study to include data exclusively from the UFC, this two-year retrospective epidemiological study appears to be reflective of the acute injuries that occur in other combat sports. Acute and Chronic Brain Injuries were not able to be properly studied due to lack of data. Available data and management of neurological injuries in MMA will undoubtedly need more attention and research in the years to come as this sport continues to grow.



This study shed light on injury trends, locations and incidences of injuries at the highest level of MMA competition. This information should give ringside physicians or medical personal information when managing the competitors acutely.

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Osteopathic Considerations in the Management of Migraine in Pregnancy

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KEYWORDS:

Osteopathic Manipulative
Medicine
OMM
Migraine
Headache
Pregnancy

Many women frequently suffer from migraines and require pharmacotherapy to alleviate and control their symptoms. Unfortunately, many of these therapies are contraindicated when a woman becomes pregnant leaving her to find alternative treatments to manage her symptoms. Osteopathic medicine provides a unique perspective for treating migraines without the use of medication. Osteopathic manipulative treatment (OMT) can provide hands-on treatment to help alleviate migraine symptoms and improve the quality of life as a woman's body changes throughout her pregnancy.

INTRODUCTION

Headaches are the most frequent neurological disorder seen by family physicians. Approximately 90% of individuals will experience headaches in their lifetime, with the most common type being tension headaches. Migraines are the second most common type of headache, specifically migraine without aura, and tend to be more chronic and debilitating than tension headaches¹. Migraines are caused by irritation of the trigeminal nucleus (see Figure 1). Irritation of the trigeminal nerve and its associated ganglion affects the release of vasoactive substances which in turn cause vasodilation of the large vessels underneath the dura mater causing pain². The International Headache

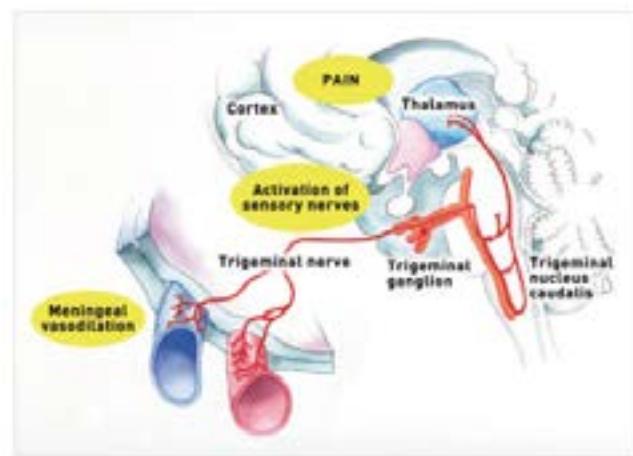


Figure 1 – Migraine pathway

Source: "Site of Migraine Generation: The Trigeminovascular System." Photo. The Role of CGRP and its Antagonists in Migraine. 10/2/2013. <<http://flipper.diff.org/app./items/5242>>

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Society reports the average lifetime prevalence of migraines is 18%, with 1 in 5 women, and only 1 in 13 men, experiencing them in their reproductive years¹. Prior literature on migraines has linked the high prevalence of migraines in females of childbearing age to hormonal influences^{1,3,4}. Many females report their first migraine to coincide with the same year of menarche¹. Additionally, migraines are commonly triggered by transitions in hormone balance of the menstrual cycle^{1,3-6}. One theory is that migraines may be precipitated secondary to a rapid drop in estrogen levels. This idea is further supported by the lower prevalence of migraines in pre-pubescent or post-menopausal females as well as those females whose migraines improve during pregnancy and rebound in the post-partum period^{1,3-5}.

Headaches are a common ailment seen in pregnancy, with migraines without aura responsible for 64% of headaches in pregnancy, and migraine with aura for another 10%^{7,8}. Studies indicate that women who suffer from pre-conception migraines tend to show improvement in migraine frequency and intensity over the course of their pregnancy^{3,4,9,10}. However, many women continue to experience migraines in the early months of their pregnancy, and some do not obtain adequate pain relief during the second and third trimesters. There are a few reports of women even having worsening of migraines¹¹. Also, de novo migraines can develop during pregnancy, often presenting as migraines with aura¹². The incidence of gestational migraines is notable for correlations with hypertensive disease, preeclampsia, vascular complications and low birth weight infants^{6,13,14}. One could theorize that by treating gestational migraines, these other potential high-risk associations may be modulated. Treatment of gestational migraines poses a challenge because the majority of pharmacologic therapies used to

treat migraines are not proven to be safe in pregnancy. For example, Sumatriptan is classified as a category C medication (potential benefits may warrant use despite risks), while the ergot medications are category X (contraindicated in pregnancy)^{3,6,14}. The American Academy of Neurology practice guidelines do not recommend pharmacologic prophylaxis for pregnant patients with migraines^{15,16}. Many patients and physicians therefore turn to acetaminophen (category B), or NSAIDs (category C), for analgesia. A recent study found that children of women who used acetaminophen (paracetamol) during pregnancy appear to be at higher risk for attention-deficit/hyperactivity disorder (ADHD)-like behavioral problems and hyperkinetic disorders¹⁷. Different forms of alternative and complementary medicine practices may help to treat gestational migraines. Some modalities being used in practice are behavior modification, biofeedback, acupuncture, chiropractic manipulation, and osteopathic manipulation^{3,6,15,18}. This article presents a patient case exemplifying how the osteopathic approach may be used to help manage patients experiencing migraines during pregnancy. Our approach encompasses the five osteopathic models and correlates OMT with recent research findings. Although some of the studies were not conducted on this specific population of pregnant women, their outcomes show support for the field and provide a foundation for further research.

CASE STUDY

A 31-year-old female, G1P0 at 20 2/7 weeks gestation, presented to the office with a chief complaint of migraine headaches with blurry vision. She reported a history of migraine headaches since age 12. Her migraines were localized to the right frontal region, rated a 7/10 in severity, and associated with nausea, vomiting, and more recently blurry vision in her right eye. She reported being migraine free in her first trimester but that in her fourth month, they became progressive and “worse than ever”. Her right eye visual disturbances began approximately 18 months prior to the office visit. She had neuro-ophthalmologist evaluations and several negative MRIs of the head prior to pregnancy. Upon further history taking, she admitted that her visual disturbances started after sustaining a sit-down fall onto her sacrum in a skiing accident with subsequent sacro-iliac pain which although much better, still flared up on either side and was currently bothering her. Since the injury, she has had right lower back pain and sacroiliac joint pain with radiation of the pain to her right groin. She states that the back pain is occasionally sharp and associated with movement. Prior to pregnancy, Rizatriptan and Sumatriptan helped to relieve her headaches. During her first trimester she had decreased frequency and intensity of her migraine headaches but after month four they had



become more frequent and progressively worse than her antepartum migraines. She missed work for a few days before her appointment because she “couldn’t see out of her right eye”. Her obstetrician recommended Acetaminophen and small amounts of caffeine for her headaches, yet she experienced little relief. Her obstetrician also suggested osteopathic manipulative treatment for her symptoms. Her medications included prenatal vitamins, calcium citrate, magnesium citrate 300mL once daily, and Acetaminophen as needed. Review of systems was positive for fatigue, weight gain, and sleep disturbances attributed to her pregnancy. Her headaches were associated with nausea and vomiting, unsteady gait, feeling off-balanced, and blurry vision.

Osteopathic Structural Exam	
Cranial	Right Sidebend; Rotation with SBS compression
Cervical	C2 FRS ₁ , C3 FRS ₁
Thoracic	T9 FRS ₁ , T10 FRS ₁ , T11 FRS ₁ , T12 FRS ₁
Ribs	Bilateral First Rib Inhalation Dysfunction
Lumbar	L1-L5 NS ₁ fl, Bilateral Paravertebral Muscle Hypertonicity
Sacrum	Forward Sacral Torsion
Pelvis	Bilateral SI Joint Restriction, Pelvic Diaphragm Restriction
Extremities	Bilateral Psoas Restriction, Lymphatic Congestion

Table 1 – Osteopathic Structural Exam Findings

On physical examination, fundal height was at the level of the umbilicus and she had a positive systolic ejection murmur of pregnancy. No focal neurologic deficits were found in the cranial nerves or the extremities. Findings on osteopathic structural exam are found in Table 1. Treatment included OMT in the cranial field with frontal lifts and venous sinus drainage techniques to relieve her sphenobasilar synchondrosis (SBS) compression and right sidebending rotation strain pattern.

Balanced ligamentous tension (BLT) and articular technique were applied to the spine and sacroiliac joints. Sacroiliac joint release and sacral rock techniques were applied to further increase excursion of the sacrum to remove any potential strain on the reciprocal tension membrane (dural attachments from S2 to the cranium). Techniques were also performed on the lymphatic system to facilitate more efficient respiratory motion and decongestion of the extremities. These techniques included diaphragm doming, thoracic outlet release, popliteal spread, and thoracic lymphatic pump. Two weeks later the patient returned with a mild, 1/10, headache. The patient stated that she had not had any migraines or visual disturbances since her last visit. On osteopathic structural exam, the patient had occipito-atlantal compression, less evident SBS compression strain pattern and decreased iliosacral restrictions. The patient was again treated with OMT in the cranial field and gentle techniques (BLT, myofascial, etc.). A month later the patient returned to the clinic for her third appointment, and admitted to being migraine-free. She remained essentially migraine and visual disturbance-free from 20 weeks gestation through the remainder of her pregnancy and up to last correspondence at eight months post-partum. She reported she only one “minor” migraine at four months post-partum which she attributed to dehydration and stress.

BIOMECHANICAL PERSPECTIVE

Throughout pregnancy, weight gain and growth of the fetus causes a shift in the body's center of gravity, placing more stress on the muscles and ligaments of the back and stretching of the abdominal musculature. During this shift, women often experience changes of the curvature of their spine such as increases in the natural cervical and/or lumbar lordoses. These physiologic changes and added weight gain can affect a pregnant woman's gait as sacral nutation and ligamentous laxity increase. Pregnancy also places stress on the surrounding organs and body systems as they too accommodate the growth of the fetus as shown in Figure 2.

As part of the physiologic changes of pregnancy, strains are placed on just about every bodily structure including the dural membranes surrounding the central nervous system (CNS). The dura mater is one of the three meningeal layers protecting the CNS. The dura splits into two layers in the cranium, the periosteal layer which lines the cranium is continuous with the fibrous tissue at each cranial suture; and the meningeal layer surrounds the CNS itself and is continuous through the foramen magnum with the spinal dura. The meningeal dura folds on itself to form the falx cerebri, falx cerebelli, and tentorium cerebelli, which attach to multiple cranial bones including the ethmoid, frontal, parietals, temporals, sphenoid and occiput. The dura also has bony attachments at C2, C3, and S2, with light attachments at the lumbar spine.

All of the areas above may be susceptible to somatic dysfunction, as seen with our patient. In osteopathic literature, the dura is referred to as the “reciprocal tension membrane” or the “core link” due to the described anatomical connections and relationships. Strains that affect one part of this tension membrane have been clinically observed to affect other parts of the entire unit. More specifically, since the dura is a pain sensitive structure, a strain involving any of its attachments may lead to cephalgia. Additionally, there are dural attachments at the level of C2 and C3, an area that can relay afferent pain stimuli to the spinal nucleus itself (19). Increased A-P curvature of the spine and sacral nutation is noted throughout pregnancy and predisposes the reciprocal tension membrane to added stress and strain at its dural attachments. Not only do these changes exacerbate low back pain throughout pregnancy, but they can directly hinder proper motion of the cranio-sacral mechanism and affect the previously described trigeminal influenced migraine pathway.

Various other studies using OMT have focused on biomechanical changes of pregnancy. Guthrie and Martin performed a study which focused on treating the lumbar spine with manipulation to decrease the amount of pain during pregnancy²⁰. A randomized controlled trial by Licciardone et al found that women who underwent OMT along with their obstetric care were statistically proven to have less deterioration of back function compared to placebo²¹. Family physicians can use gentle techniques such as myofascial release and articular techniques to provide pain alleviation and improve cervical and lumbar mobility to attempt to address not only spinal dysfunctions but also cranial ones that are related through these dural attachments. Sacral rock may also be used to enhance sacral motion and allow a woman's body to better adapt to the changes of pregnancy. Basic manipulation techniques in the cranial field such as V-spread at the occipito-mastoid suture, (dural) venous sinus drainage, naso-frontal spread, and frontal and parietal lifts can all target dural strain within the cranium. In this case, the patient's previous unresolved ski trauma was likely a factor in her migraine with blurry vision of “unknown” etiology. Recognition of the body as a unit paves the way for addressing structural abnormalities involved maintaining the patient's dysfunctional state. These techniques were successfully utilized in our patient, addressing the structural changes of her body to pregnancy and previous trauma.

NEUROLOGIC PERSPECTIVE

The structural changes that happen to a woman's body over the course of pregnancy also influence nearby tissues and organs. As changes occur within the spine, different strains can be placed on the surrounding nerve roots which may also directly influence the autonomic nervous system. The spinal nucleus of the trigeminal nerve travels into the cervical spine (see Figure 1). As stated previously, this area is involved in the

major pathway thought to be responsible for the production of pain during a migraine. Irritation at cervical and thoracic nerve roots potentially plays a role in the exacerbation of a woman's migraines during pregnancy.

The upper thoracic region provides sympathetic innervation to the head and neck. Hypersympathetic tone can cause vasoconstriction within the cranium. This may precipitate a hypoxic state within the tissues inducing specific cytokines to be released and leading to vasodilation. This quick reaction of vasodilatation of vessels may exacerbate migraines. The female body undergoes musculoskeletal changes in pregnancy which in turn influences surrounding nerve fibers that can lower the migraine threshold in a patient who has a known history of cephalgia.

At this time, research regarding migraine development has focused on non-pregnant patients with cephalgia, and has shown promising results. Unfortunately, studies are needed using pregnant patients as a subject population. Jull et al, found that cervical manipulation was shown to both reduce the degree and frequency of cervicogenic headaches²². OMT has also been compared to medicinal therapy for migraines. A study was completed looking at the effects of amitriptyline vs. OMT²³. This randomized, controlled trial proved that OMT was as effective in migraine pain control as Amitriptyline in the study population. This is a key finding and could be extremely beneficial to the pregnant population since pharmacologic therapy for migraine prophylaxis and treatment is not recommended. Both the cervical and thoracic regions remain important areas of focus to the osteopathic family physician. As seen in this patient, simple techniques such as myofascial cervical techniques, suboccipital release and thoracic outlet release may all be applied to pregnancy patients' cervical and thoracic somatic dysfunctions in hopes of decreasing neuronal irritation at these areas. OMT is a key distinguishing factor for family physicians who offer this to support their patients' inherent tendency toward health by removing restrictions in order to enhance homeostasis.

RESPIRATORY/CIRCULATORY PERSPECTIVE

As a woman's body continues to change throughout pregnancy, the vascular system adapts by increasing systemic blood and lymph volume. The increased blood volume and cardiac output can place physiologic stress on the mother and her ability to maintain hemodynamic stability. Increased stress can ensue in an overall hypersympathetic state, which, when combined with other factors may be present in other disorders such as pregnancy induced hypertension and pre-eclampsia. It is interesting to note that the same segments that supply sympathetic innervation to the head and neck (T1-4 sympathetic chain from first through fourth thoracic

segments) also supplies sympathetic innervation to the terminal thoracic duct as well as to the heart. Homeostasis of her circulatory system, including lymphatic drainage, is crucial for prevention of venous congestion or lymphatic stasis, as well as maintaining optimal perfusion to both the patient and her baby. During pregnancy, women are more prone to a state of congestion due to various factors. As the fetus enlarges, surrounding vessels and therefore proper circulation is affected. The fetus can compress the vena cava causing decreased venous return. Also, the enlarging fetus displaces the diaphragm and affects one of its key roles as a primary mover of lymph. Venous pooling has been postulated to cause nausea, headache, and light-headedness due to a decrease in oxygenation and poor blood circulation²⁴. Diaphragm restriction, nausea and lower limb edema were evident in our patient and also were reduced with OMT.

OMT may be used by physicians to treat the respiratory diaphragm restrictions to augment lymphatic drainage. Techniques for the thoracic cage and the diaphragmatic attachments such as diaphragm doming and BLT to the 12th rib or any of the costo-vertebral segments can improve thoracic motion and enhance lymphatic flow. Lymphatic augmentation techniques such as lymphatic pumps may be used to help prevent fluid congestion. A study was done looking at the influence of OMT on cardiovascular return in pregnant women at 30 weeks gestation. This study found that the effects of abnormal cardiovascular adaptation to pregnancy including decreased venous capacitance and a decreased cardiac output may be blunted by OMT during pregnancy²⁵. This can benefit women who experience migraines in pregnancy by optimizing cerebral vascular thereby decreasing the likelihood of a hypoxic state in those with a history of migraines.

METABOLIC PERSPECTIVE

Fatigue is a common complaint of women throughout their pregnancy²⁶. The strains that are placed on a woman's body as the pregnancy progresses can affect her energy levels. Within the first trimester, energy is being used to develop the embryo and placenta as well as to prepare her entire physiology for the months ahead. By the third trimester, the baby is growing to a size that places mechanical as well as physiologic stress on the mother and may cause fatigue. It is important to incorporate OMT as a mechanism to optimize the body's homeostasis in order to decrease its work of gestational physiology as the female body changes. The goal is to restore balance to the body so a woman can optimize her energy to support both her and her child. Again, soft tissue severity in migraine sufferers, but it also was able to improve the subjects' quality of life and decrease their days of disability²⁸. techniques may be helpful to relax strained musculature and enhance structural mobility throughout the pregnancy. Spinal articulatory techniques

may be used to enhance spinal mobility to allow for adaptive changes within the spinal curvature. Also, treatment of the psoas muscles can alleviate some strain as the woman's abdomen grows with each trimester. By optimizing structural motion and decreasing allostatic load, the mother's energy consumption should decrease allowing allocation of energy for supportive fetal development. .

BEHAVIORAL PERSPECTIVE

It is beneficial for a woman to remain comfortable throughout her pregnancy. By maintaining a level of comfort, she is more apt to thrive despite physical and psychological stressors that commonly surface throughout the course of pregnancy. Physical and psychological ease during pregnancy likely ensures more positive outcomes. Alleviating discomfort can lead to a better course with fewer complications throughout the pregnancy and at the time of delivery. King et al, focused on the effects of prenatal OMT on delivery²⁷. This case control study statistically showed that women who received prenatal OMT experienced less preterm labor and less meconium stained fluid during delivery in comparison to women who did not receive any osteopathic treatments. Additionally, migraines can be extremely debilitating when experienced on a daily basis. Couple this with missed work time, inability to complete household chores or childcare duties and it is no wonder pregnancy is looked upon as a time of drudgery for many women. Having this burden, in addition to the normal changes of pregnancy, may be very difficult for a woman to cope with. Prenatal patients do not have as many options for pharmacotherapy because the most common therapies are teratogenic. Previous research has been conducted on non-gravid headache sufferers to see if OMT could improve their headaches and if it had any effect on their daily lifestyles. Not only was OMT proven to decrease the pain severity in migraine sufferers, but it also was able to improve the subjects' quality of life and decrease their days of disability²⁸.

CONCLUSION

Migraines during pregnancy can be very difficult for women to cope with due to what is for many already a stressful period. Due to potential side effects, many pain-relieving medications are not recommended for use during pregnancy, and leave family physicians few options to help their suffering patients. OMT provides family physicians a safe and effective alternative treatment for their pregnant patients who suffer from migraines. OMT is helpful in reducing the pain and frequency of migraines by addressing structural causes rather than merely battling symptoms. Additionally, OMT can aid in helping a woman's body adapt to the changes of pregnancy and decreasing structural stressors which lead to a wide range of other complaints. The successful results illustrated

by this case demonstrate how family physicians may support their pregnant patients by taking a hands-on approach to optimizing the physical and psychological well-being of their patients throughout their pregnancy and beyond.

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Reducing Early Discontinuation Rates of Subdermal Contraception in Your Clinical Practice

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KEYWORDS:

Subdermal
Contraception
Nexplanon
Implanon
Unintentional pregnancy

Almost half of all pregnancies in the United States are unintentional, leading to negative social and financial impacts on families. With its less than 1% failure rate, the use of subdermal contraception is on the rise; however early discontinuation of the product deters physicians from considering it as a successful and cost-effective means of birth control. In this study, patients' charts from two teaching services at an academically oriented community based hospital were reviewed and compared to previously published data to identify risk factors for early discontinuation of subdermal contraception. In addition, counseling methods were compared between the two teaching services to help determine ways to improve premature removal of the product. It was concluded that early discontinuation was most commonly due to bleeding, and through building good physician-patient rapport and taking the time to counsel patients on the adverse effects of subdermal contraception, physicians can successfully implement its use into their practice and work towards decreasing the rates of unintentional pregnancies.

INTRODUCTION

A 2006 study showed 49% of pregnancies in the United States are unintentional, making only half of the pregnancies planned¹. Finer et al. also found that independent risk factors leading to higher rates of unintended pregnancies are women who are black, have a low-income, or are between the ages of 20-24 years old¹. In addition, 1 in 5 of unintended pregnant women are also teenage mothers, who were found to be less likely to graduate from high school, to earn less income, and to draw almost twice as much Federal aid². With these overwhelming statistics, this topic becomes an important one for family medicine practitioners.

In December 2010, Healthy People 2020 launched its ten-year agenda to improve the overall health of all Americans. Through this agenda, various topics and objectives were created to help meet overarching goals, which include attaining higher-quality living, achieving health equity, creating conducive social and physical environments to support good health, and promoting healthy behaviors across all ages². Amongst these topics was to decrease unintended pregnancies to 44% by 2020.

With numerous birth control methods currently available on the market, it is a physician's responsibility to work closely with his patient to figure out the most effective method of preventing unplanned pregnancies. Options available include intrauterine devices, hormonal patches, vaginal rings,

subdermal contraception, and birth control pills. While each birth control method has its pros and cons, it is important for a physician to take into consideration the patient's goals and values.

One of the more unique long-term contraceptive methods available on the market today is subdermal contraception, currently known as Nexplanon[®]. Nexplanon[®] recently replaced Implanon[®], which was a small 4cm by 2mm rod that was inserted subdermally into the patient's upper inner arm³. Produced by Merck & Co., Inc., it provided a continual release of progesterone, more specifically etonogestrel, for up to three years. Nexplanon[®] is essentially identical to Implanon[®] in its size and hormonal release. However, Nexplanon[®] is radiopaque, allowing physicians to view it on X-rays and confirm proper placement⁴, and has a different insertion device. This study was undertaken using Implanon[®], prior to the market conversion to Nexplanon[®].

Subdermal implantable devices fall under the category of long-acting reversible contraception (LARC), which also includes intrauterine devices. LARCs are unique in that they are inserted by a physician and last for up to 3-10 years depending on the product. Because they are long-term, non-compliance becomes less of an issue, making it a more efficacious form of birth control. Subdermal contraception has been found to have less than a 1% failure rate, which is comparable to tubal sterilization⁵. In addition, if a patient decides she wants to become pregnant during her course of contraception, the rod can easily be removed and has been shown to have a rapid return to fertility⁶. Another benefit of subdermal contraception is it does not use estrogen, which

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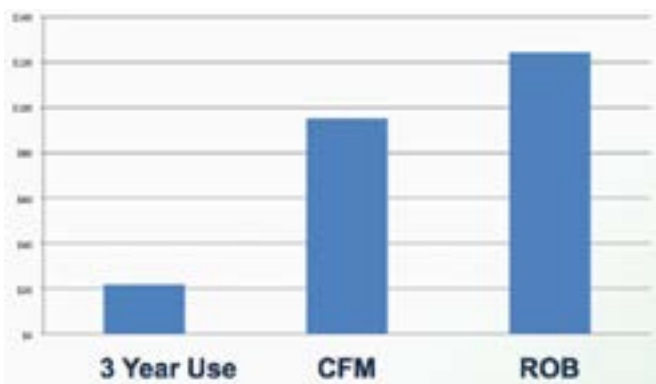


Figure 5. Cost per month of Implanon® compared to full three-year term with average due to early discontinuation rates and CFM and ROB.

has been found to increase a patient’s risk for thromboembolic events⁹. However, it is important to remember that continuous progesterone therapy also has its own adverse effect profile, and irregular bleeding has been found to be the most common reason for early discontinuation of subdermal contraception. Although subdermal contraception is more expensive when compared to other forms of birth control, it is found to be cost-effective if used for its full three-year course (Figure 5).

Nexplanon® may seem to be an obvious choice for physicians due to its efficacy, ease of use, and its theoretical cost-effectiveness. However, established discontinuation rates have been found to be up to 33% at 12 months⁷, making the product more expensive and returning the physician to the original issue: how to avoid an unintentional pregnancy. In this paper, we review causes of early discontinuation of subdermal contraception, and how physicians can work with their patients to make Nexplanon® a successful form of birth control. The goals of this study were to:

1. Compare counseling methods and discontinuation rates of a family medicine teaching service (CFM) and an OB/GYN teaching service (ROB) at an academically oriented community based hospital to established rates.
2. Identify risk factors for possible early discontinuation in patients.
3. Propose ways to decrease early discontinuation of three-year subdermal contraceptive devices through identifying effective counseling techniques.

METHODS

To accomplish the goals of this study, two outpatient clinics’ charts were reviewed: CFM and ROB, and compared to published data. Criteria for patient inclusion were the patient had to be female, 18 years old or older, and have received an Implanon® placement over a period of 24 months, between

January 2010 and December 2011. There were a total of 193 patients who received Implanon® at ROB and 84 patients at CFM. Of those, 23 ROB patients and 9 CFM patients had early discontinuation of their Implanon®.

There were two phases of data collection. Phase 1 was to determine the current early discontinuation rates at the two outpatient clinics. To be consistent with previously published data, early discontinuation was defined as removal of the Implanon® within one year of its placement. Data was gathered for both six months and one year after placement. These rates were then compared to established discontinuation rates. The goal of phase 2 was to identify trends of the population and risk factors for early discontinuation. A detailed chart review was done of those patients who had the device removed early, including age, BMI, and side effects reported by the patients.

RESULTS

Discontinuation rates. Data was analyzed using the Chi Square method to determine differences in discontinuation rates found in the chart reviews compared to a previous study done in the United Kingdom. Smith, et al. collected data from three contraception and sexual health services at 6 and 12 months after placement of subdermal contraception on women ages 13-51 years with median 24 years of age; discontinuation rates were found to be 12-16% at six months, and 22-33% at 12 months⁷. Table 1 and table 2 as well as Figure 2 show CFM discontinuation rates at 6 and 12 months respectively to be 2.3% and 10.7%, and ROB discontinuation rates at 6 and 12 months respectively to be 7.6% and 11.0%. CFM had the lowest early discontinuation rate at both 6 and 12 months when compared to ROB and published data. Both CFM and ROB had lower early discontinuation rates at both 6 and 12 months when compared to published data (Figure 1).

	Discontinuation Rate	χ ²	P-value
6 months	2.3%	8.75	P<0.01
12 months	10.7%	16.719	P<0.001

Table 1. Center for Family Medicine data on discontinuation rates at 6 and 12 months.

Table 2. Regional OB data on discontinuation rates at 6 and 12 months.

	Discontinuation Rate	χ ²	P-value
6 months	7.6%	13.186	P<0.001
12 months	11.9%	22.635	P<0.001

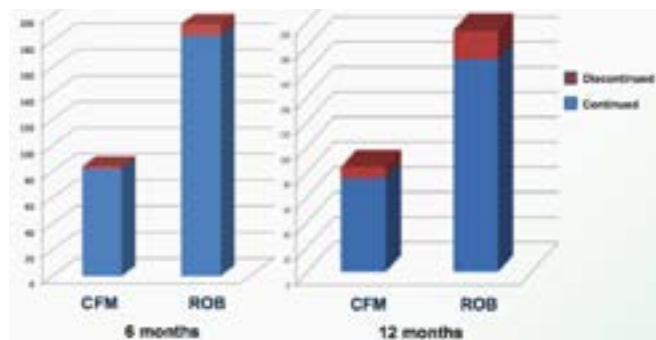


Figure 2. Comparison of CFM and ROB continuation rates with discontinuation rates at 6 and 12 months.

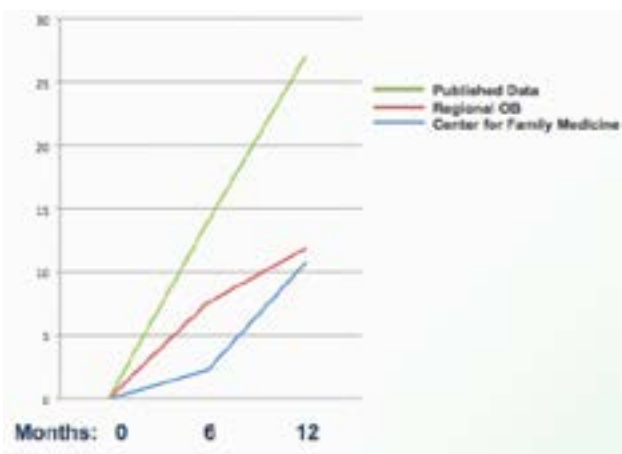


Figure 1. Comparison of discontinuation rates of ROB and CFM to published data from 0-12 months.

Counseling methods. ROB provided verbal counseling to patients receiving Implanon®, in comparison to the verbal and video counseling provided by CFM.

Patient demographics. When reviewing demographics of the patient population receiving subdermal contraception at CFM and ROB, the average age of patients at CFM was less than ROB, 20.6 years old and 23.8 years old respectively. The average BMI at CFM was also found to be greater when compared to ROB, 30.1 and 28 respectively. CFM patients kept their subdermal contraception for a longer period than ROB patients before having it removed prematurely (Table 3).

	CFM	ROB
Average Age	20.6	23.8
Average BMI (kg/m ²)	30.1	28
Minimum Months Implant was in Place	5	0.5
Average # Months for Early Removal	8.33	6.37

Table 3. Demographics of patients with Implanon® use at CFM and ROB.

Reasons for early discontinuation. The most common reason for early discontinuation of Implanon® at CFM and ROB was found to be bleeding, followed by “other” and unintentional pregnancy (Figure 3). Among the three patients found to be pregnant, patient #1, stated she had irregular menstrual cycles and had a negative urine hCG on insertion of the contraception. Ultrasound performed 3 weeks after contraceptive placement showed a gestational sac too small for measurement, indicating that she had a luteal phase pregnancy at the time of insertion. She was later lost to

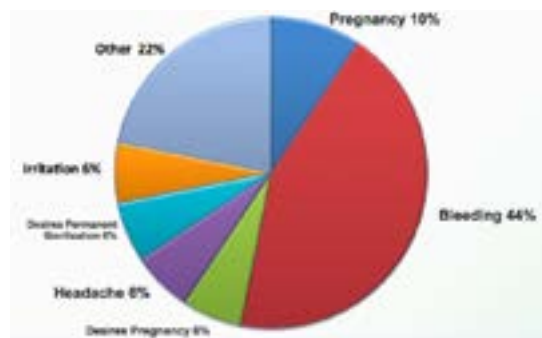


Figure 3. Documented reasons for Implanon® removal combined at ROB and CFM combined.

follow up. Patient #2 had a negative urine hCG at an appointment 12 days prior to insertion at which time she had a colposcopy. Later ultrasound showed she conceived after her colposcopy and prior to insertion of the subdermal contraception. Lastly, patient #3 claimed abstinence and stated she was on her menses at the time of insertion. She did not have a urine hCG done. Patient #3 later admitted that she intentionally deceived the provider, as she was hoping the subdermal contraception would lead to a desired miscarriage.

When comparing and contrasting early removal of Implanon® between CFM and ROB, bleeding was the most common reason for premature removal at both locations. However at CFM, headache was found to be the second most common reason for early discontinuation (Figure 4). This data seems to be fairly consistent with previously published data, which found bleeding to be the number one reason for early discontinuation, followed by mood swings and headaches⁷.

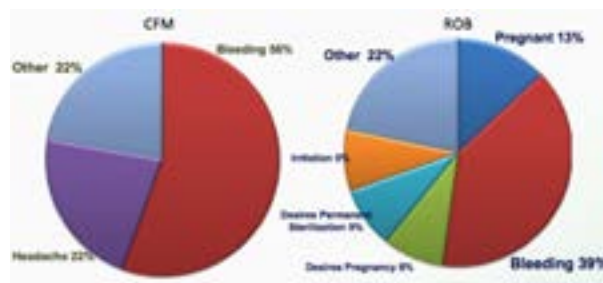


Figure 4. Documented reasons for Implanon® removal at CFM vs. ROB.

Cost. At our hospital, the total allowable cost of Implanon® was calculated to be \$789, which included the cost of the device at \$595, the insertion fee of \$90, and the removal fee of \$1048. When calculating the cost per month of the device if used for its full three-year term, we find the cost is \$22 per month. Due to early discontinuation rates, cost per month was found to average \$95 at CFM and \$124 at ROB.

DISCUSSION

Both the Center for Family Medicine and Regional OB had significantly lower discontinuation rates than published data, especially at the 12-month mark. In addition, CFM also had lower discontinuation rates when compared to ROB. One of the reasons behind these findings may be the rapport physicians build with their patients. At CFM, family medicine residents have continuity of care with their patients, seeing and following the same patients regularly. These patients build a relationship with their physician, and physicians work to gain the trust of their patients. Through these relationships, family medicine physicians have the opportunity to closely follow their patients and provide continuous counseling. On the contrary, patients at ROB are likely to see different physicians at every visit. This lack of continuous care may cause patients to receive valuable information and counseling in a disorganized fashion. Also, if a trusting relationship is not built between a physician and his patient, it makes it easier for a patient to disregard the doctor's advice.

This also seems to be the case when comparing findings from CFM and ROB to published data. In the study done in the United Kingdom, patients were referred to physicians who were qualified to insert Implanon®⁷. To follow up on the success rate of Implanon®, information was gathered from follow-up visits, as well as surveys sent through the mail to those who did not follow-up with the physician. Because patients did not necessarily receive their Implanon® from their primary physician, one can again infer that a physician's rapport with the patient can help achieve more successful counseling.

Counseling methods also seem to play a role in the success of subdermal contraception. CFM provided standard counseling through a video, whereas ROB physicians provided verbal counseling to their patients one to two weeks prior to device insertion. Because the effectiveness of counseling can vary from physician to physician, showing patients a standard video to discuss benefits and adverse effects of subdermal contraception can guarantee all of the valuable information is consistently reviewed with each patient.

Demographic data was also taken into consideration in this study so population trends can be evaluated and compared between CFM and ROB. CFM's patient population receiving

Implanon® included slightly younger patients and a greater BMI when compared to ROB. In a previously published study, it was found that as the patient's age increased, rates of early discontinuation of Implanon® decreased⁷. However, in our study, CFM had younger patients and lower rates of early discontinuation. Although these rates are more likely to be affected by counseling methods, it is important to consider age as a possible risk factor for premature removal of subdermal contraception based on several factors. For one, differences in hormone levels may put older females at an increased risk for bleeding from subdermal contraception. In addition, given that the highest rates of unintended pregnancies are amongst the younger patient population, physicians may feel more obligated to encourage younger patients to continue their contraception.

BMI may also be a risk factor for early discontinuation, and should not be disregarded. Patients at CFM were found to have a slightly higher average BMI, 30.1, than patients at ROB, 28. Although the average BMI of patients at ROB was in the overweight category, it is important to note the average BMI of patients at CFM placed those patients into the obese category. Because obesity affects female sex hormones¹⁰, it is important to consider whether more obese women may have less adverse effects of bleeding associated with subdermal contraception.

It is evident the number one reason for early discontinuation of subdermal contraception is its adverse effect of bleeding (Graphs 3 and 4). Headaches were found to be the second most common reason for early removal of Implanon® at CFM. By focusing pre-contraceptive counseling on these two common adverse effects, physicians can work with their patients to weigh the benefits with the unfavorable consequences of subdermal contraception and help decrease the rate of premature removal of contraception.

Because the failure rate of subdermal contraception is less than 1%, it is unlikely the unintentional pregnancies found in this study were due to failure of the contraception. Because it was too early to determine patient #1's gestational age at her initial obstetrical appointment and her menstrual cycles were irregular, it cannot be determined if the Implanon® was placed during the luteal phase of her cycle causing her to have a negative hCG at that time; though this is most likely the scenario. On the other hand, patient #2 and patient #3 show us the importance of checking a urine hCG at the time of insertion of subdermal contraception. To lessen the future possibility of unintended pregnancy with the use of subdermal contraception, within the ROB office it has been opted that any patient not currently on a physician administered long acting contraceptive must currently be on her menses in addition to having a negative urine pregnancy test

on the day of insertion. This will avoid the unnecessary insertion and removal of the contraception, as well as complication risks associated with using hormonal contraception during pregnancy.

CONCLUSIONS

In conclusion, both CFM and ROB were found to have lower early discontinuation rates when compared to the published baseline, and CFM was found to have lower rates of early discontinuation when compared to ROB. By identifying risk factors for early discontinuation, family physicians can target their pre-insertion counseling to include the most common adverse effects of subdermal contraception. In addition, physicians must consider additional reasons for early removal of Implanon® that may not have been documented.

Limitations of this research are the limited time frame of the data collected, patient population limited to 18 years of age and older, as well as non-parametric data analysis. Future directions can include evaluating patient complaints and data for the entire three years of the device, as well as comparing patient demographics of those inserted and removed. In addition, further exploration of why CFM and ROB early discontinuation rates are better than published results can help physicians work to decrease rates of premature discontinuation of subdermal contraception.

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2015 Calendar of Events

March 5, 2015

DO Day on the Hill
Washington, DC
www.acofp.org

March 12-15, 2015

ACOFP Annual Convention
& Scientific Seminars
The Cosmopolitan Hotel
Las Vegas, Nevada
www.acofp.org

April 16-19, 2015

Virginia Osteopathic Medical
Association Spring CME Conference
The Great Wolf Lodge
Williamsburg, VA
www.voma-net.org

April 18, 2015

MAOFP Spring Family Medicine
Update Conference
Okemos, MI
www.maofp.org/cme

April 30-May 3, 2015

Oklahoma ACOFP
Norman, OK
www.okosteo.org

June 4-7, 2015

Maine ACOFP
www.mainedo.org

July 30-August 2, 2015

MAOFP Summer Family Medicine
Update Conference
Grand Traverse Resort
Acme, MI
www.maofp.org/cme

August 6-9, 2015

CA-ACOFP 39th Annual Scientific
Medical Seminar
Disneyland Hotel
Anaheim, CA
31 1-A AOA CME Hours Anticipated
www.acofpca.org

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Pennsylvania ACOFP
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Hershey, PA
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Direct Primary Care Summit
InterContinental Kansas City
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Kansas City, MO
www.acofp.org

August 21-23, 2015

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Board Review
Loews Chicago O'Hare
Rosemont, IL
www.acofp.org

October 17-21, 2015

OMED 2015: ACOFP/AOA's 121st
Annual Osteopathic Medical
Conference & Exhibition
Hyatt Hilton and Convention
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Orlando, FL
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ACOFP Annual Convention &
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CME RESOURCE: OSTEOPATHIC FAMILY PHYSICIAN OFFERS 2 HOURS OF 1-B CME

ACOFP members who read Osteopathic Family Physician can receive two hours of Category 1-B continuing medical education credit for completing quizzes in the journal. Visit the eLearning Center at www.acofp.org to access the quizzes.

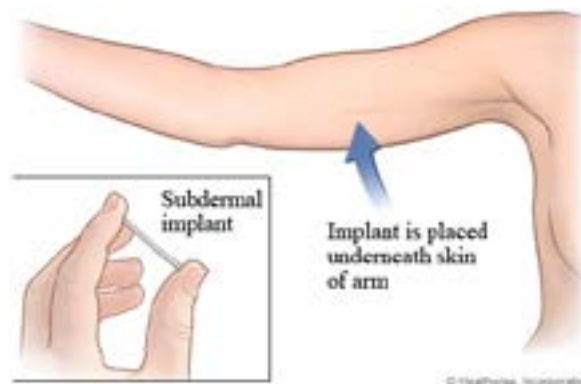
JANUARY/FEBRUARY 2015 ANSWERS: 1. B 2. D 3. C 4. B 5. B 6. C 7. C 8. B 9. C 10. A

OFP Patient Education Handout

*Peter Zajac, D.O., FACOFP, AUTHOR Merideth C. Norris, D.O., FACOFP, EDITOR
Amy J. Keenum, D.O., PharmD, HEALTH LITERACY EDITOR*

A birth control implant is a single rod that releases a dose of hormone. It is placed under the skin of the upper arm of a woman to prevent pregnancy for up to 3 years. The rod is about the size of a matchstick and can be inserted by a doctor in just minutes using a local drug to numb the area. Implants work within 24 hours of placement. Less than 1 out of 100 women a year will become pregnant using the implant. There are two implants available in the United States. With the Affordable Care Act, insurance plans, in general, must cover all prescription contraceptive methods fully at no cost to the patient. Though birth control implants are convenient, effective, and can be used safely by most women, the latex condom is still the only method of birth control that also provides protection against sexually transmitted diseases.

Subdermal Implant for Birth Control



BENEFITS OF BIRTH CONTROL IMPLANTS INCLUDE:

- Lasts for up to 3 years and is 99 % effective in preventing unplanned pregnancy. No need to remember to take pills.
- Can be used when breastfeeding.
- It does not interfere with having sexual intercourse.
- The implant can be removed at any time.
- The ability to become pregnant returns soon after the implant is removed.

DISADVANTAGES INCLUDE:

- You should not use the implant if you are pregnant, have breast cancer, a history of blood clots, or certain other conditions
- Certain drugs and supplements (e.g. St John's wort) may make the implant less effective.
- Most common side effect, especially in the first 6-12 months of use, is a change in your normal menstrual bleeding pattern. After one year, some women who use the birth control implant will stop having periods completely.
- Other possible side effects of the implant may include pain at the insertion site, mood swings, a change in sex drive, acne, headache, nausea, sore breasts, and weight gain.

MEDICAL CARE AND TREATMENT OPTIONS:

If you have any questions about birth control implants please contact your Osteopathic Family Doctor. Your family doctor will help you decide if the implant or some other method of birth control would be safe and work best for you.

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Source(s): Birth Control Implants.gov, Up-To-Date, and Web MD.

The Osteopathic Family Physician Patient Handout is a public service of the ACOFP. The information and recommendations appearing on this page are appropriate in many instances; however, they are not a substitute for medical diagnosis by a physician. For specific information concerning your personal medical condition, ACOFP suggests that you consult your Family Physician. This page may be photocopied noncommercially by physicians and other health care professionals to share with their patients. For additional patient related educational material please visit our website at www.acofp.org



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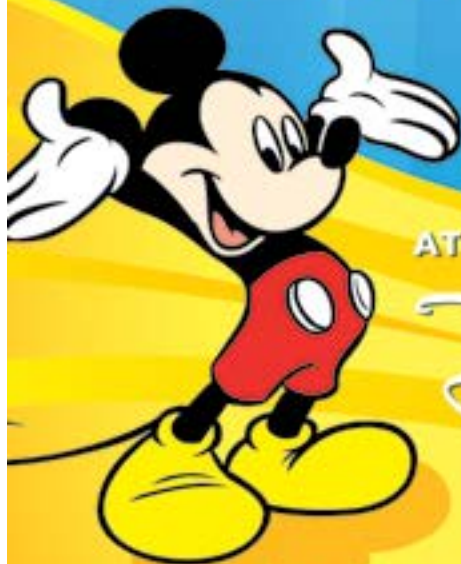
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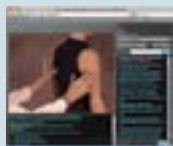
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**INTENSIVE
UPDATE
& BOARD REVIEW**

AUGUST 21-23, 2015

Loews Chicago O'Hare
Rosemont, IL

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