



Cartilage Repair Center

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What is Matrix Autologous Chondrocyte Implantation (MACI)?

Matrix Autologous Chondrocyte Implantation (MACI) is a surgical procedure for the treatment of painful full thickness cartilage defects in the knee. MACI is a two-part surgical procedure. The first surgical procedure is an arthroscopic procedure. At the time of the arthroscopy, a thorough evaluation of the joint is made, and a biopsy of cartilage is taken for cell culture and cryopreservation. This biopsy is sent to Vericel, a Cambridge, Massachusetts-based cell therapy company, where the cartilage cells are cultured and grown to a large volume, frozen in liquid nitrogen, and stored for up to 2 years. After insurance approval for treatment, an elective surgical date is chosen for the second stage. The second surgical procedure is an open procedure during which the cultured cells that are seeded on a collagen membrane (MACI) and then re-implanted into the area(s) of damage within the knee joint.

Who is a candidate for MACI?

MACI is designed for the treatment of isolated cartilage defects in symptomatic young active patients. These isolated cartilage defects are often referred to as 'potholes,' as they tend to resemble potholes in a street. Patients who have demonstrate joint space narrowing on x-ray or who have been told they have 'bone-on-bone' osteoarthritis may not be suitable candidates for MACI.

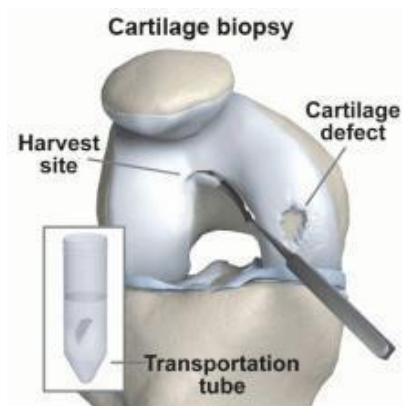
MACI allows patients to return to pain-free activities of daily living, such as walking, stair climbing, and cycling. MACI is not predictable in allowing patients to return to high-level sports competition, such as long distance running and competitive team sports.

What can I expect from my surgical arthroscopy?

The first step of your surgical management is an outpatient surgical arthroscopy. This means that your surgeon will use a camera and two or three small 1/4-inch portholes to examine the inside of your joint. Several photos will be taken inside your joint to document the areas of damage. During this procedure, your surgeon will also take a small piece of cartilage from a non-weight bearing area of your joint about 5-mm wide ×10-mm long (the size of a thumbnail clipping or 3 'tic-tacs'). This small piece is called a cartilage biopsy. This biopsy will be sent to Vericel to be cultured and grown to a large volume of cells and seeded on a collagen membrane to be used for the second stage surgery.

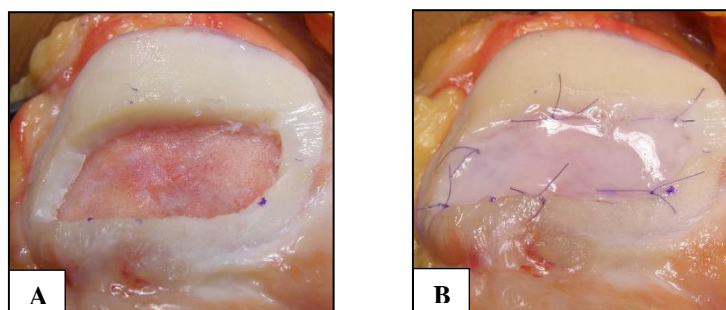
Your arthroscopy will be done using general anesthesia and will take approximately 30 minutes. You will go home the same day of your surgery. You will be given crutches to use following your arthroscopy. You will be permitted to put full body weight on your leg immediately following surgery. However, it is a good idea to use crutches for support, as you will be sore the first few days following this surgery.

When you return to the office for your post-operative appointment, you will meet with your surgeon to discuss the findings of your arthroscopy. This is the appointment during which the final plan for your MACI will be made.



What will happen during my Matrix Autologous Chondrocyte Implantation (MACI)?

The second stage surgery is the MACI (matrix autologous chondrocyte implantation) procedure. This procedure is done as an open procedure, which means that you will have a larger incision, measuring anywhere between 3-6 inches in length. During this surgery, your surgeon will open your joint through an incision to locate the areas of damage. Once these areas have been identified, the damaged cartilage will be debrided (or 'removed') in preparation for the implantation of your new laboratory grown cells. Once the areas of damage are debrided and are ready to accept the new cells, your surgeon will cut the MACI membrane precisely to fit the prepared damaged area. The MACI implant(s) (is)/ are then carefully placed into your defects or 'potholes,' where they are glued into place with possible supplemental sutures to secure them. Once all the 'potholes' have been treated, your incision will then be closed using 'dissolvable stitches.' Depending on the number of cartilage 'potholes' and their size(s), this surgical procedure will take between 1-3 hours. This procedure will be done using either general anesthesia or spinal anesthesia, depending on your preference. At the end of the surgery, your surgeon will inject a long-acting combination of medications into the tissues that are operated upon to minimize your discomfort when the anesthesia wears off. The medications usually relieve pain for 12-24 hours.



A. Damaged cartilage debrided ('removed') from patella showing the size of the defect ('pothole'). **B.** Kneecap with MACI graft filling the defect.

What can you expect post-operatively after MACI?

When you awake from surgery, you will have a brace on your leg that will keep your leg straight. It will be important for you to wear this brace when you are up and about. You will also be given crutches. The location(s) of the 'pothole(s)' will affect how much pressure you can put on your foot while walking with your crutches. Most "potholes" require you to be touch down weight bearing (the weight of your leg to the ground) only with your foot flat for balance. This restriction will be in place anywhere from 6-10 weeks.

Depending on the complexity of your procedure, you may be required to remain in the hospital 1-2 nights. The length of your inpatient stay will be discussed prior to your surgical intervention and re-evaluated each day of your inpatient stay. Your discharge from the hospital is largely based on your pain level. It is important to make sure that your pain is well controlled prior to leaving the hospital.

You will begin outpatient physical therapy within the same week of your MACI surgery. Your surgeon will provide you with prescriptions and detailed physical therapy protocols. These protocols are tailored to your specific surgical procedure.

How will my pain be controlled after surgery?

Immediately following the MACI surgery, your pain will be controlled using IV pain medication. During your inpatient stay, one of the goals of your care will be to transition you from IV pain medication to oral pain medication. This is often achieved by day 1 after surgery. You will be sent home from the hospital with a prescription for oral pain medication to be filled at your local pharmacy. The most prescribed post-operative pain medications are oxycodone and tramadol. Most patients will require regularly scheduled doses of pain medication for the first week. By the end of the first week, Tylenol and ice therapy are often all that is needed to manage pain. You may still need pain medication at night for sleep or prior to physical therapy.

Following week 1-2, you will begin to decrease your pain medication use to prior to physical therapy and prior to bedtime. Most patients will not require any pain medication past week 8-10.

For pain medication refills, you will need to come to the office for a face-to-face, in-person appointment. Florida State Law does not allow us to call in prescriptions or refill pain medication without an office visit. We are only allowed to give 7 days of pain medication at a time. Be sure to follow the directions carefully. It is important to know how to obtain your pain medication refills appropriately and in a timely manner.

When will I follow-up with my surgeon after surgery?

Your first post-operative visit will take place 2-3 weeks after your surgery. This appointment is critical for checking your incision healing and range of motion and to answer any questions you may have in the first few weeks following surgery. You will then follow up 6 weeks, 12 weeks, 6 months, and one year after surgery. At one-year post-operative, you will discuss with your surgeon your return to higher level activity. After your first year you will follow with your surgeon on a yearly basis.

Frequently Asked Questions

How long will I have to wait between my arthroscopy and my MACI? This is slightly different for each patient. It depends largely on your insurance approval and your surgeon's schedule. On average, most patients are required to wait between 3-4 months.

How long will my biopsy last? Your cartilage biopsy can be held at Vericel for up to 2 years.

How do I get insurance approval for surgery? Your insurance approval will be handled by your surgeon's finance office. Often, you do not need to do anything but wait for the administrative assistant to contact you to let you know you have been approved. In some instances, appeals need to be made to your insurance company for denial of services. If this is the case, the administrative assistant will contact you and instruct you on how to proceed.

How long is my insurance approval good for? Most insurance approvals are good for a few months from the date of approval.

When will I start physical therapy? You will start physical therapy the day after surgery in the hospital. This will be continued once you are discharged.

What will I do during physical therapy? Each defect area has a specific physical therapy protocol. You will be provided with these protocols after your surgical intervention. Your physical therapist will instruct you on each exercise.

I've heard about a CPM machine, what is this and will I use one? A CPM machine is a Continuous Passive Motion machine that is used following knee surgery to help patients regain range of motion. You will begin using a CPM machine 1-2 days after surgery and will continue using it for a period of 3-6 weeks for 3-8 hours per day. The CPM machine will be provided to you and is usually covered by your insurance.

When do I need to wear my brace? You will need to wear your brace anytime you are up moving around on your crutches. You will use your brace for 6-10 weeks on average. You do not need to wear your brace in the CPM machine, for sleeping, or when you are sitting.

How long will I need to use my crutches? Depending on the extent of your surgery, you will need to use your crutches between 6-10 weeks on average.

When can I drive? For patients undergoing right leg surgical intervention, you may not return to driving until you have good leg control, depending upon the extent of the reconstruction, anywhere from 4-10 weeks. For patients undergoing left knee surgery who do not drive standard transmission vehicles, you may return to driving between 2-4 weeks, when you are no longer taking pain medication.

When can I shower? You can remove the ACE wrap and gauze/ foam dressing 24 hours following surgery. Under the ACE wrap and gauze/foam dressing, you will have a large adhesive bandage covering your incision. You can shower directly on the large adhesive bandage and allow water to run over the bandage. This bandage can be removed 7 days after

surgery at home. You can then shower normally with the incision uncovered. Do not submerge your operative knee in a bathtub, pool, ocean, etc., until cleared by the surgeon.

When can I go back to work? This will be different for each patient and depends largely on the extent of your surgery as well as the type of work you do. Most patients who work in a sedentary position or desk work will be back to work by 6 weeks. Those patients who work in more labor-intensive jobs or manual work may be out of work for 3 months to a year.

When can I resume my regular activity? Return to regular activity depends highly on each individual patient's definition of regular activity. Low impact activity such as walking, swimming, bike riding, and elliptical trainer can all be resumed by 4-5 months. Higher demand activity, such as running and sports, will not be able to be resumed until at least one-year post operatively.

How long will it take me to recover from the arthroscopy? Most patients have their arthroscopy on a Friday and are back to regular activity by Monday or Tuesday.

How long will it take me to recovery from my MACI? Each patient is different. Depending on the complexity of your surgery, your recovery time may differ. However, on average, most patients feel a sense of improvement in the surgical joint by approximately 4-6 months. You will work to regain your muscle strength over the entire year following your surgery.

Will I need to stay in the hospital? You may be required to spend 1-2 nights in the hospital. This will depend largely on the complexity of your procedure and any other associated procedures that are performed at the time of your MACI surgery.

I don't like how narcotic pain medication makes me feel, can I take something else? You may use Tylenol (acetaminophen) for pain control following surgical intervention. Ice therapy is very effective for pain and swelling. However, you should refrain from using any anti-inflammatory for the first year following surgery as it can slow the growth of your cells. These anti-inflammatory medications include medications such as Advil, Aleve, Ibuprofen, Naproxen, and Celebrex.

What happens if I don't use my cells? If your cells are not used within the two years following the date of biopsy, they will be discarded by Vericel. If you would like to have your cells held longer for possible use in the future, you can pay a fee to Vericel for additional storage time.

Who do I call if I have a question prior to my surgery? If you have questions regarding your upcoming surgery, you may call your surgeon's nurse practitioner or research assistant.