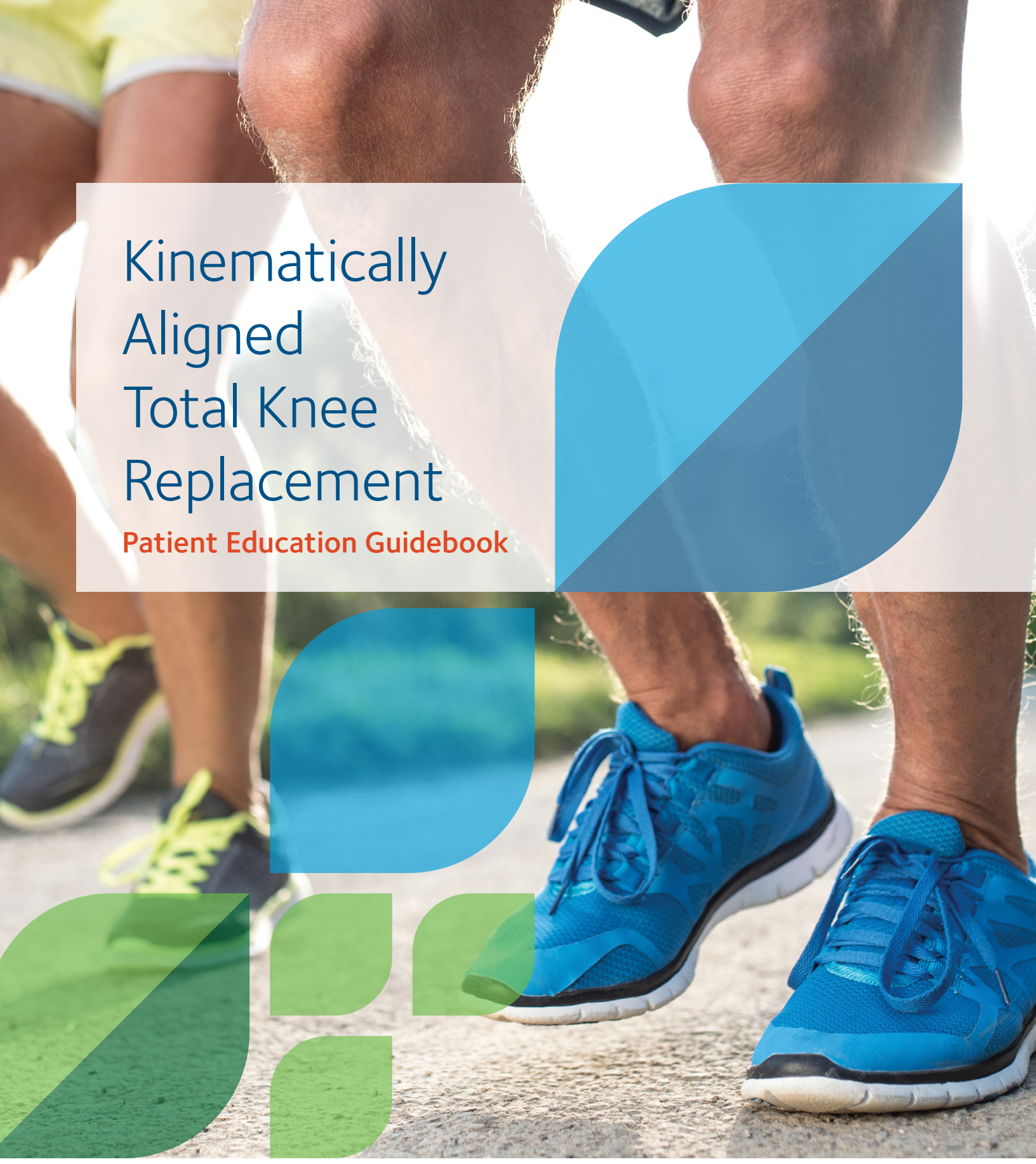


Kinematically Aligned Total Knee Replacement

Patient Education Guidebook

STEPHEN M. HOWELL, MD
ALEXANDER NEDOPIL, MD

Adventist Health
Lodi Memorial


Cook
Memorial
Hospital

Table of Contents

Section 1: Overview of Adventist Health Lodi Memorial

Introduction

We are delighted you have chosen Adventist Health Lodi Memorial to perform your kinematically aligned total knee replacement surgery. Our staff will provide you with a personalized experience designed to meet your needs and exceed your expectations. Please review the information in this Patient Education Guidebook as it is intended to:

- Prepare you, family members and caregivers for your knee replacement surgery.
- Introduce Adventist Health Lodi Memorial and the resources available to you.
- Educate you about preparations needed at home before surgery, what to expect during your hospital stay, and how to prepare for discharge home.
- Reduce anxiety by reviewing proven methods for managing nausea, discomfort and constipation.
- Provide a list of equipment for use at home.
- Instruct you on activities and exercises, managing swelling, and safe techniques for moving your knee while walking, dressing, bathing and climbing stairs.
- Provide a convenient place to store all handouts received during pre-surgery appointments.

Visit DrSteveHowell.com to download an electronic version of the Guidebook to your computer, tablet or mobile device and easily share it the with family and friends who will take care of you.

Directions and contact information

ADVENTIST HEALTH LODI MEMORIAL

Medical Center

975 S. Fairmont Ave., Lodi, CA 95240
Main phone number: 209-334-3411

Directions to Medical Center:

From the North on CA-99: Follow CA-99 south toward Fresno. Take Exit 264B. Turn right on Kettleman Lane. Drive 2 miles and turn right on Ham Lane. The hospital is less than a mile on the right.

From the North on I-5: Follow I-5 south towards Lodi. Exit CA-12 east to Lodi and turn left onto Hwy.12 after exiting the freeway. Drive 5.9 miles and make a left on Ham Lane. The hospital is less than a mile on the right.

From the South on 99: Follow CA-99 north towards Lodi. Take Exit 264A. Turn left on Kettleman Lane. Drive 2 miles. Turn right on Ham Lane. The hospital is less than a mile on the right.

From the South on I-5: Follow I-5 north towards Lodi. Exit CA-12 and turn right onto Hwy. 12 after exiting the freeway. Drive 5.9 miles and make a left on Ham Lane. The hospital is less than a mile on the right.

Sacramento Office - Orthopedics

Adventist Health Physicians Network
Medical Office – Orthopedics
8120 Timberlake Way, Suite 112
Sacramento, CA 95823
916-689-7370

Lodi Office - Orthopedics

Adventist Health Lodi Memorial
Medical Office – Orthopedics
1235 W. Vine St., Suite 22
Lodi, CA 95240
209-334-8535

CONTACT INFORMATION

Pre-admitting Nurse 209-339-7502
Patient Financial Services 209-339-7543
Orthopedic Nurse Navigator 209-339-7870

To register for the pre-surgery educational class on kinematically aligned total knee replacement, please call 209-339-7870.

ADDITIONAL LODI MEMORIAL SERVICES/ RESOURCES

Adult Day Services 209-369-4443
Fitness Center 209-333-3011
Home Care Services 209-333-3131
(after hours 209-334-3411)
Outpatient Rehabilitation Services
Physical, Occupational,
Speech Therapy 209-333-3136

HOTELS NEAR THE HOSPITAL

Wine and Roses
4-star hotel 2.9 miles (9 min) from the hospital
2505 W. Turner Rd.
Lodi, CA 95242
209-334-6988

Hampton Inn & Suites – Lodi
2-star hotel 2.2 miles (8 min) from the hospital
1337 S. Beckman Rd.
Lodi, CA 95240
209-369-2700

Candlewood Suite Hotel
2-star hotel 2.4 miles (8 min) from the hospital
1345 E. Kettleman Lane
Lodi, CA 95242
209-333-3355

Holiday Inn Express – Lodi
2-star hotel 2.4 miles (8 min) from the hospital
1337 E. Kettleman Ln.
Lodi, CA 95240
209-210-0150

Upon booking your reservation, please ask for the Adventist Health/Lodi Memorial special rate.

In-Hospital Dining

Adventist Health Lodi Memorial visitors can choose from a number of meal options.

Vineyard Café

Full cafeteria offering breakfast, lunch, dinner and snacks
Monday-Friday 7 a.m. – 6:30 p.m.
Saturday-Sunday 7 a.m. – 2 p.m.

Vineyard Express

Coffee bar with grab-and-go meal options
Monday-Friday 6 a.m. – 1 p.m., 3 – 9 p.m.
Saturday-Sunday 2:30 – 9 p.m.

In-Room Dining

Visitors staying with a patient are welcome to order meals from an ambassador. The meal tray will be delivered with the patient's food. Guest meals may be paid for by cash, check or credit card in the Vineyard Cafe or Vineyard Express.

Your orthopedic team

Hospital

At Adventist Health Lodi Memorial, we are committed to providing the best care and experience for you and your family. Our care team is dedicated to making your stay pleasant and the transition home as smooth as possible.

Orthopedic Surgeon

Stephen M. Howell, MD, is a board-certified orthopedic surgeon and world-renowned expert in the treatment of arthritic disorders of the knee. He will work with you to provide the most advanced care. Learn more about Dr. Howell at DrSteveHowell.com.

Orthopedic Surgeon

Alexander J. Nedopil, MD, PhD, is a board-eligible orthopedic surgeon specializing in primary and complex hip and knee reconstruction. He cares for patients with osteoarthritis, sports injuries, failed arthroplasty and more. He has published more than 15 studies on calipered kinematically aligned total knee replacement.

Physician Assistants

Tom Carmody, PA-C, is an orthopedic specialist who has worked alongside Dr. Howell for many years. He assists in surgery and will monitor your care throughout your stay.

Manpreet Gill, PA-C, specializes in orthopedics. She assists Dr. Howell in surgery and will guide you through the surgical process.

Orthopedic Nurse Navigator

Our navigator, Gail Rodriques, RN, will coordinate your care journey from pre-surgery through recovery, including appointments, therapy and other services. Gail can be reached at 209-339-7870.

Anesthesiologist

Your anesthesiologist will consult with you before surgery and manage any discomfort, medical conditions and vital functions during surgery and in the recovery room.

Nursing Team

During your hospital stay, our nursing staff will be here to meet your needs 24 hours a day. Nurses will assist with your recovery and work with the rest of the team to ensure your stay is as pleasant as possible.

Physical and Occupational Therapists

Our therapists will instruct and assist you with mobility and exercises for bending and straightening your knee after surgery, provide tips for safely performing daily activities and managing swelling of the knee.

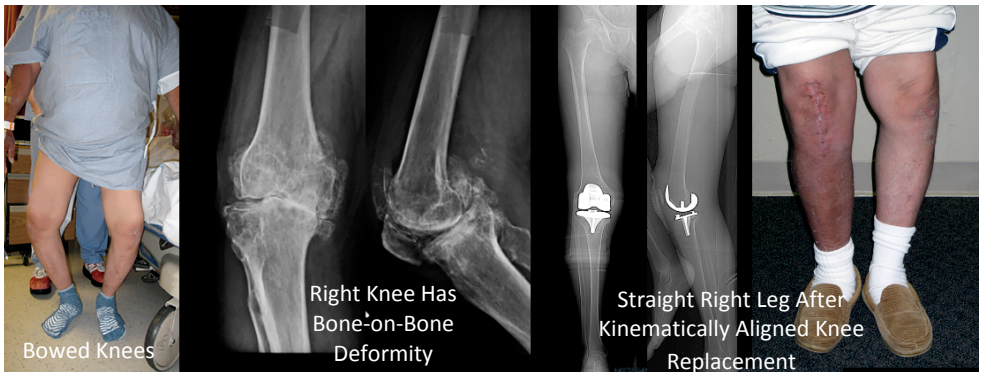
Chaplain

Our chaplains are specially trained to serve your spiritual needs, as well as those of your family, regardless of your denomination. A chaplain is available upon request.

Section 2: Introduction to knee arthritis and kinematically aligned total knee replacement

What is arthritis of the knee?

The cause of osteoarthritis of the knee is cartilage wear that often results in severe pain, stiffness, loss of knee motion, a bowed or knock-kneed deformity at the knee, and a limp. The loss of cartilage narrows the space between the femur, tibia and patella and is referred to as "bone on bone" contact on radiographs. Knee replacement surgery restores a smooth joint surface by replacing worn surfaces with femoral, tibial and patella implants made of metal and plastic.



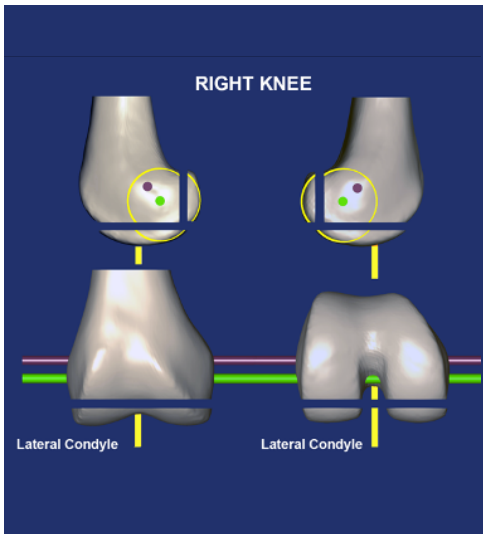
Are you a candidate for total knee replacement?

The goal of total knee replacement is to improve the patient's function in daily life. The ideal candidate is someone who has difficulty walking short distances, shopping, getting in and out of a car, ascending and descending stairs, and participating in recreational activities such as gardening, tennis, golf, biking, bowling and hiking. Pain in the knee should be present for three months or more and persist after a trial of anti-inflammatory agents, weight loss, exercises, injections, and/or use of a knee brace or cane. A patient who has knee pain for 1-2 months or walks 1-2 miles a day is not ready for total knee replacement.

Is a calipered kinematically aligned total knee replacement right for you?

In 2006, Dr. Howell developed a surgical technique known as calipered kinematic alignment, so patients would experience a quicker recovery and have a more normal feeling knee after total knee replacement than those treated with an old technique called 'mechanical alignment'[1]. Mechanical alignment changes the patient's joint lines, which requires the release of perfectly normal ligaments and causes pain, stiffness and instability[2,3].

Kinematic alignment uses a series of intraoperative steps or 'rituals' to perform the total knee replacement accurately. These steps consist of making caliper measurements of the bone resections, recording verification checks, and following a decision-tree to restore the patient's pre-arthritic joint lines and tibial compartment forces without ligament release more accurately than robotics and navigation instrumentation. The kinematic alignment of the prosthetic components with the three kinematic axes of the knee has the same beneficial effect on function as aligning new tires on the axels of a car to restore a smooth ride [4-7].



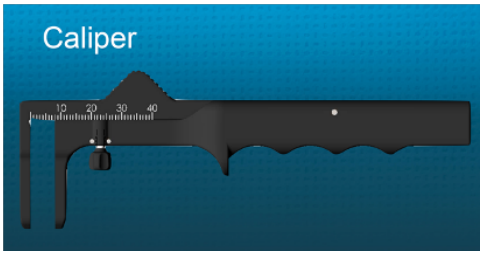
The schematic shows four views of the right femur and the three kinematic axes of the knee that are either parallel or perpendicular to the patient's pre-arthritic or native joint lines. The flexion axis of the tibia is the green line, the flexion axis of the patella is the magenta line, and the longitudinal rotational axis of the tibia is the yellow line. The four resections separated from the femur are intraoperatively measured with a caliper and adjusted in thickness to match those of the prosthetic femoral component (https://www.youtube.com/watch?v=VW9-GdUYBcs).

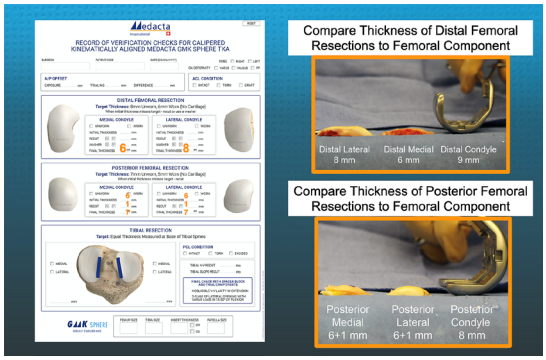
The most important tool in total knee replacement is the caliper, which measures the thicknesses of the small portions of bone removed from the femur. These are adjusted until they are within ± 0.5 mm of the thickness of the replacement parts and recorded as verifications. Dr. Nedopil's studies have shown the calipered technique restores the patient's joint lines more accurately than robotic surgery [5,6].

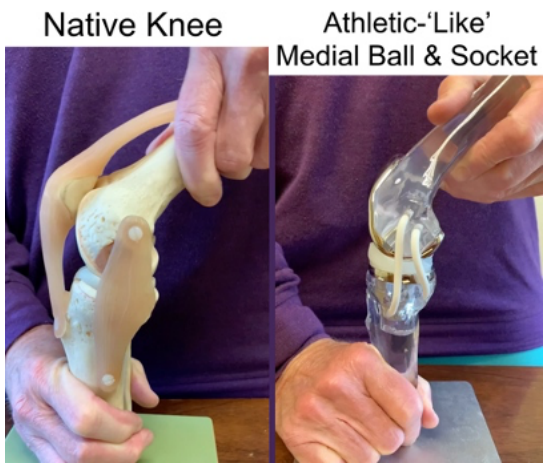
Ten randomized or case-control studies from around the world showed patients treated with Dr. Howell's calipered kinematic alignment technique experienced better results in terms of patient satisfaction, function, quicker recovery, fewer ligament releases, better motion and orientation of the components during weight-bearing than mechanical alignment. [8-16]

In 2017, Drs. Howell and Nedopil began using an ' athletic-like' knee prosthesis with a ball and socket designed to provide the stability of the ACL and function like a normal knee [17,18]. An Australian study reported the combination of Dr. Howell's kinematic alignment with a ball and socket prosthesis resulted in higher function, as measured by the forgotten knee score than the use of traditional components that perform like a knee without an ACL and with a partially removed meniscus[12]. Collectively, Drs. Howell and Nedopil perform more than 600 calipered kinematically aligned total knee replacements each year with the 'athletic-like' prosthesis.

There are many benefits from using calipered kinematically aligned total knee replacement, including more accurate implant alignment than robotic surgery, use of a minimally invasive surgical (MIS) exposure, low risk of infection from short anesthetic and surgical time (approximately 50 minutes), negligible risk of blood transfusion, a hospital stay of one night for 97 percent of patients, and a low risk of readmission within 30 days of surgery [19]. The kinematically aligned implants survive a long time with only 1.5 percent of patients requiring another reoperation within 10 years on the same knee. This means most patients older than 60 likely will not need a reoperation for a worn-out or loose implant in their lifetime [20].







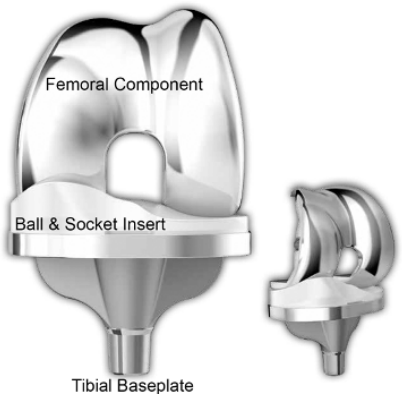
Section 3: Initial office visit

Assessment of the severity of arthritis

During the initial office visit, we will assess the severity of your limitations and disability based on your history, physical examination, treatments, and a review of your radiographs. You will answer questions using an iPad that computes patient-reported function scores, including the Oxford Knee Score. These scores are used to measure the severity of your knee arthritis before surgery and the pace of recovery after surgery. We will educate you about calipered kinematically aligned total knee replacement and what to expect after surgery. This Patient Education Guidebook and other information found online at DrSteveHowell.com are comprehensive resources for learning about total knee replacement and sharing with family, friends and your personal coach.

Design and material of a total knee replacement

In the office, you will examine a life-size model of a normal knee and a knee with the ball and socket implants used to replace your knee. The femoral component and tibial baseplate are made of stainless steel, and the ball and socket insert is made of high-density polyethylene plastic. The stainless-steel components are cemented onto the bone like a dentist cements a crown on a tooth. The insert, with a thickness that optimizes knee stability, is locked into the baseplate. A plastic button is cemented on the underside of the kneecap (not shown). The cement quickly sets in 10 minutes, which enables the patient to put full weight and walk on their knee within an hour after surgery. Because the implants are made of plastic and metal, they may click or make noise when they contact each other. Although a small amount of clicking is normal, the frequency becomes less as the swelling subsides in the knee and is not a sign of a loose implant.



Take the Oxford Knee Score: a reliable indicator of preoperative disability and pace of recovery after knee replacement

The Oxford Knee Score asks 12 questions, each worth four points, and is very helpful for assessing the satisfaction and function of your knee before and after total knee replacement. The score for a normal knee is 48 points. The range of scores of those patients needing a total knee replacement is between 0 to 30 points, with an average of 20 points [2,7,15]. Patients with an Oxford Knee Score of 30 points or lower may consider a total knee replacement. If your knee hurts, take the Oxford Knee Score online (drstevehowell.com/knee-quiz) for free.

A postoperative Oxford Knee Score indicates the pace of your recovery after knee replacement. At six weeks, when you are 50% recovered, the Oxford Knee Score ranges between 28 to 36 points with a mean of 32, which is often higher than the score before surgery. At this point, most patients walk without a cane and drive their car [15]. At three months, when you are 70% recovered, most patients enjoy recreational activities such as gardening, tennis, pickle ball, golf, biking, bowling and hiking. At six months, when you are 90% recovered, the Oxford Knee Score ranges from 36 to 48 with a mean of 43 points [2,11].

The process for undergoing total knee replacement may be broken into four steps. These include preparing for knee replacement surgery, care the day of surgery, care in the hospital after surgery, and care at home that enables rapid recovery.

Section 4: Preparing for knee replacement surgery

Scheduling the surgery

The timing of total knee replacement depends on the patient's needs. There is never a rush, as waiting a few months or even a year rarely affects the outcome. Surgery may be scheduled on the day of your initial visit or afterwards by calling your surgeon's office. Scheduling surgery 6-8 weeks in advance increases the likelihood your requested date will be available.

- Visit your family physician or internist as soon as surgery is scheduled. If you have a history of heart disease, also see your cardiologist. Instruct each office to fax:
    1. A form titled 'Assessment of Patient's Risk for Knee Surgery' signed by the physician
    2. One copy of a read EKG.
    3. A copy of the consultation to Dr. Howell's office at 916-688-5610 or Dr. Nedopil's office at 209-334-2109.
- We will give you a laboratory order for blood tests, which should be completed three to four weeks prior to surgery. When convenient, use an Adventist Health laboratory as the lab results are linked directly to your electronic health record (call 209-339-7897 for locations and hours of operation).
- If you are taking an anti-inflammatory medicine, you may continue until the day before surgery. If you are prescribed aspirin, take until the day before surgery.
- Stop all herbals and supplements at least one week before surgery. Specific agents with known risks in the perioperative period include: echinacea, garlic, gingko, ginseng, kava, St. John's Wort and valerian.
- If you take a blood thinner or anticoagulant medication, PLEASE ask your cardiologist, internist or family physician who prescribed it, to specify the number of days you should discontinue prior to surgery. From a surgical perspective, we prefer stopping Coumadin (Warfarin) five days before surgery. We prefer stopping Eliquis (Apixaban), Xarelto (Rivaroxaban), Pradaxa (Dabigatran), or Pletal (Cilostrazol) two days before surgery. We prefer stopping Plavix (Clopidogrel) or Brilinta (Tricagrelor) seven days before surgery. If taking aspirin, continue until the day before surgery.
- If you take medication for rheumatoid arthritis, consult your rheumatologist about when to stop medication before surgery and when to restart after surgery.
- Review this Guidebook in its entirety.

Attend a Pre-Surgery Educational Class on Kinematically Aligned Total Knee Replacement

Contact Orthopedic Nurse Navigator Gail Rodriques, RN, at **209-339-7870** or rodriqgm@ah.org to register for a free, pre-surgery educational class on kinematically aligned total knee replacement. For your convenience, the class is held multiple times each month. When arriving at Adventist Health Lodi Memorial Medical Center to attend the class, please bring your coach and enter through the main lobby, which faces Ham Lane. If you cannot find parking nearby, have your coach drop you off at the front entrance before parking. Check in at the information desk to the right, and you will be escorted to the classroom.

Adventist Health Patient Outcomes Assessment Tool

Approximately one month before surgery you will receive an email from 'Adventist Health Patient Outcomes-(Surgeon's name)'. You are encouraged to complete this electronic assessment, which is used to measure the quality of your recovery. We ask you to take the assessment before surgery, as it provides a baseline measurement of how you are functioning, and then repeat the assessment at three months and one year after surgery. This enables us to compare the results and make sure you are recovering properly.

Checklist of things to bring to the hospital

- ○ Personal items – glasses, dentures, hearing aids, toiletries, insurance cards, photo ID and a detailed list of your medications. Cell phones and charging cables are allowed.
- ○ Clothing items – clean, loose-fitting pants or shorts with elastic waist and ability to view the knee (no metal zippers/buttons/snaps and no elastic at the ankles), non-skid shoes with a back (no flip-flops, Crocs are acceptable), and a light robe.
- ○ Specific medications, only if directed to do so.
- ○ Advance Healthcare Directive/Healthcare Power of Attorney, if you have one.
- ○ A front-wheeled walker, if you have one at home. If not, we will work with your insurance provider to have one available for you at discharge.
- ○ This Patient Education Guidebook.

PLEASE DON'T BRING: Bottles containing prescription medication (unless otherwise directed), jewelry, large amounts of money or keys. You may use a credit card or write a check for your co-pay on the day of admission.

Choose A Personal Coach

Select a family member, friend or caregiver as your personal coach to assist during your preparation and recovery from knee replacement surgery. Encourage them to stay with you the first 2 weeks following your surgery to help with cooking, driving, medication reminders, exercises, bathing and dressing changes. The state-of-the-art patient rooms at Adventist Health Lodi Memorial have a comfortable pull-out sleeper chair for a family member or coach and a private bathroom with walk-in shower.

Prepare your home

Purchase and prepare meals ahead of time. We will teach you to walk up and down stairs, so you can use a bedroom on the second floor. However, this is not encouraged for the first few weeks. Consider setting up a temporary bedroom on the first floor near a bathroom.

Checklist for reducing the risk of a fall

- ○ Check each room and conceal electric cords and store small objects on the floor that may be a tripping hazard.
- ○ Place a phone or your cell phone in easy reach.
- ○ Install nightlights for trips to the bathroom at night.
- ○ Use a cushion to raise the seat of a low chair. A chair that sits higher, with a firm back and armrests, will help you stand more easily.
- ○ Consider installing handrails on stairs inside and outside your house.
- ○ If you have pets, consider boarding them for a few days after your return home.

Follow the advice of the pre-admitting nurse

Expect a phone call from a pre-admitting nurse at Adventist Health Lodi Memorial one week before surgery. You also may call 209-339-7502 within one week of your scheduled surgery. The nurse will review and update your health history, medications, allergies and confirm the date and time of surgery. When speaking with the pre-admission nurse, you may request a visit with an anesthesiologist to review your health history and risks prior to surgery.

The nurse will instruct you to arrive at the hospital approximately two hours before surgery. The following list is helpful to review in advance of arrival:

- · Have an accurate list of your medications including the name, dose and frequency. (Make a note of which medications you should stop taking before surgery.)
- · Remember the time you are told to arrive at the hospital.
- · **Do not eat, drink fluid or chew gum beginning at midnight the night before surgery. Surgery will be canceled if these instructions are not followed.**
- · **NEW: You may have sips of water, no more than 4 ounces, up until 5:30 a.m. the morning of surgery.**

- · On the day of surgery, **take only the medications the nurse or physician instructed you take** for

hypertension, seizures, Parkinson's disease, indigestion, thyroid problems or depression with a sip of water (no orange juice, coffee or food).
- Expect to stay in the hospital one night. After completing an education course about caring for yourself after discharge, you may go home before noon the next day.

Administer special cleansers to reduce infection before surgery

Most patients who develop a postoperative wound or knee infection have high concentrations of bacteria on their skin and in their nose and mouth before surgery. We will provide a cleaning kit to kill bacteria at your office visit, or you can pick one up when you attend the pre-surgery education class. The kit contains chlorhexidine (CHG) soap and five one-time use wash mittens for scrubbing your entire body during a shower, povidone-iodine (PI) swabs for painting the inside of the nose, and antiseptic oral rinse swabs for wiping your mouth and teeth. Let us know at your office visit if you have an allergy to any of these agents, and we will prescribe a different agent.

Beginning five days before surgery, place clean sheets on your bed (only the first night is necessary), scrub your body, paint the inside of your nose, and swab your mouth and teeth with these antibacterial agents, as directed. Performing this cleansing protocol daily reduces the risk of infection [21-23]. After each shower, dry yourself with a clean towel and wear a fresh set of pajamas to bed each night. During these five days, do NOT shave the leg that is to be operated upon and do not apply skin moisturizers, body lotions, perfumes or powders anywhere on your body.

Ways to reduce the risk of postoperative knee infection

- **Dental care:** All dental work, including cleaning, must be completed before surgery. If any dental problems arise prior to your scheduled date, you must call the surgeon's office.
- **Clean hands:** Hand hygiene is very important. You will notice caregivers use alcohol-based hand sanitizer when entering your room. We encourage the use of the hand sanitizer by your visiting family and friends to reduce the spread of bacteria that cause infection.
- **Illness:** If you become ill with a fever, cold, sore throat, flu or any other illness, let the
- surgeon's office know as soon as possible, so your procedure may be rescheduled.
- **Nutrition:** Healthy foods provide your body with the energy and nutrition it needs to fight off infections, accelerate healing and increase strength. Be sure to include assorted fruits, vegetables, good fats, dark leafy greens, protein and water in your diet. Even if you are not hungry, be sure you are getting adequate nutrition (try a smoothie loaded with lots of fresh produce). Avoid sugars and processed foods.
- **Skin rash:** Broken skin or rashes should be reported to your surgeon.
- **Shaving:** It is very important you do not shave your leg or use any hair removal products anywhere near the surgical area for FIVE days prior to surgery. Studies show an increased risk of surgical site infection associated with shaving. This is attributed to microscopic cuts in the skin that allow bacteria to enter. If necessary, we will use a clipper to remove hair from the skin in the preoperative area prior to surgery.
- **Stop smoking:** Not smoking for six weeks prior to surgery lowers the risks of infection. Smokers have a higher risk of developing post-operative infections and delayed wound healing because smoking deprives the body of the oxygen required to repair and build cells. Cessation of smoking increases oxygen delivery, which is the foundation for healing the skin incision and deep tissues in the knee.
- **Special safety notice for pet owners:** Do not let your pet touch or lick your incision site in any way. Avoid sleeping with your pet, and do not allow them onto your bedding for five days before surgery and until your first post-op appointment. Always wash your hands after touching your pet and before touching the incision or bandage.
- **Manage your blood sugar:** If you are diabetic, monitor your blood sugar and keep your A1c below 8.0. The risk of wound complications is more than three times higher for patients who have high blood glucose before and after surgery and for those with poor long-term diabetes control.

Arrange transportation home from the hospital

The day after surgery, plan for someone to drive you home before noon. Typically, this is the time when 90% of patients are discharged.

Section 5: Care the day of surgery

Check in at Adventist Health Lodi Memorial Medical Center

Arrive at the hospital at the time instructed by the pre-admitting nurse. Enter the building at the Outpatient Services entrance located on Vine Street between Ham Lane and South Fairmont Avenue. Park in the outpatient services lot in front of the entrance. If you require assistance, use the phone located at the bottom of the entrance ramp. Check-in at the registration window, where you will be directed to the pre-operative area. Please note: This entrance is locked between the hours of 6 p.m. and 5:30 a.m.

Care in the pre-operative area (ambulatory procedure unit)

One family member or friend may stay with you while you are being prepared for surgery in the pre- operative area. You will wash your body with a warm cloth containing a special cleanser (Chlorhexidine) and apply nasal and oral disinfectants. Within 1-2 hours of surgery, we will start an intravenous (IV) line and infuse two antibiotics to reduce the risk of infection. One of the antibiotics (Vancomycin) may cause itching or flushing of the upper body, which is reduced by Benadryl. We will also give you IV Toradol for discomfort. Sequential compression devices will be applied to compress the calf area of the lower legs to reduce the risk of blood clots. You will be asked by your surgeon which knee is to be operated on, and they will draw the course of the skin incision and write their initials in large letters above the kneecap for everyone to see.

Your anesthesiologist will visit you in the pre-operative area. Your medical history will be reviewed and the anesthetic options, benefits and risks will be discussed with you. Because the calipered kinematically aligned total knee replacement has a relatively short surgical time, the use of general anesthesia is preferred. Let the anesthesiologist know if you are prone to nausea. They are experts at administering the right combination of medications to reduce the risk of post-operative nausea.

Your family and friends may stay in the surgical waiting room, and your provider will speak to them after surgery.

Care in the operating room

We use a sequence of ten caliper measurements within 0.5 mm that accurately position the implants and balance the ligaments of the knee, which are shown in this online video (https://www.youtube.com/watch?v=ZnfOLRWbVJI&t=1430s). An antibiotic (Vancomycin 1 gm) is added to the cement that binds the implants to the bone to reduce the risk of infection. Just before applying the dressing, two medicines that numb the knee for 12-24 hours (Maracaine and Toradol) and one medicine that reduces the risk of bleeding (Tranexamic acid) will be injected into the knee.

Care in the recovery room

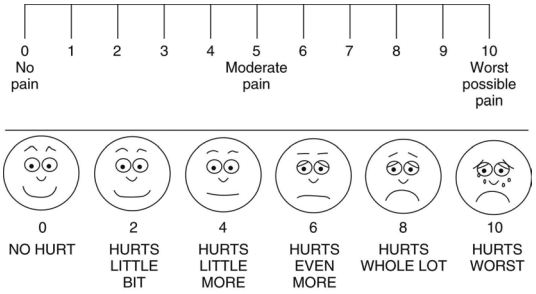
You will stay in the recovery room for 60-90 minutes and be closely monitored by a specialized nurse as you recover from the effects of anesthesia. The nurse will monitor your blood pressure, heart rate, respiratory rate, oxygen saturation and assist with managing any discomfort you may experience. Oxygen may be administered through soft tubing placed in your nose. Compression devices will be used around the lower legs to reduce the risk of blood clots, and ice therapy will be placed on the surgical area.

Section 6: Care in the hospital after surgery

Rest in a spotless, quiet, comfortable private room

From the recovery room, we will take you to a private room equipped with a walk-in shower, flat screen TV, Wi-Fi and a pull-out sleeper bed for an overnight guest. Your family will be notified of your room number as you are being transferred. We encourage one family member, friend or your personal coach to spend the night. You may eat when you feel hungry. Let the nurse know if you need a special diet. Usually, within an hour after arrival to your private room, you will begin ambulating, or walking, short distances with a physical therapist and sitting at the bedside bending your knee 80-90 degrees. If you need to use the restroom prior to this, an associate will assist you.

Managing discomfort



Our goal is to make you as comfortable as possible during your hospital stay and throughout recovery, so you can walk and care for yourself. The nurse will ask you to rate your discomfort on a scale of 0-10, with 10 being the worst. The nurse will administer intravenous or oral medication, along with monitoring vital signs and sedation, until your discomfort is reduced to a **tolerable** level. Always eat a little something when taking oral pain medication. Complete relief of discomfort has drawbacks as it may compromise breathing and nauseate you.

- During your stay, you will receive intravenous doses of an anti-inflammatory medication called Toradol. When you are able to tolerate liquids, your nurse will administer oral pain medication if needed. Anti-nausea medicine may be requested if your stomach feels queasy. Discomfort in the upper thigh area of the operated leg is normal and a result of the tourniquet used to prevent blood loss during the surgery. It will resolve itself within a week or so after surgery.

Managing swelling and reducing the risk of blood clots

Your legs will be elevated on a bolster above your heart to decrease swelling and discomfort and promote bending and straightening of the new knee. A bolster provides better knee motion and is more comfortable than a constant-passive motion machine. We encourage use of the bolster under your surgical leg, and preferably both legs, while in bed. At night, if you are unable to sleep this way, you may ask the nurse to remove the bolster as sleep is more important. You also may lie on your side for comfort. When awake, frequently pump your ankles up and down to reduce the risk of blood clots. When sleeping, compression devices will squeeze the calf area of both legs to reduce the risk of blood clots.

Managing constipation

Pain medication frequently causes constipation. Consider taking a stool softener, such as over-the-counter Colace or Metamucil, starting 1-2 days before surgery. If you become constipated in the hospital, let your nurse know. There are a variety remedies you also may use at home.

Day after surgery

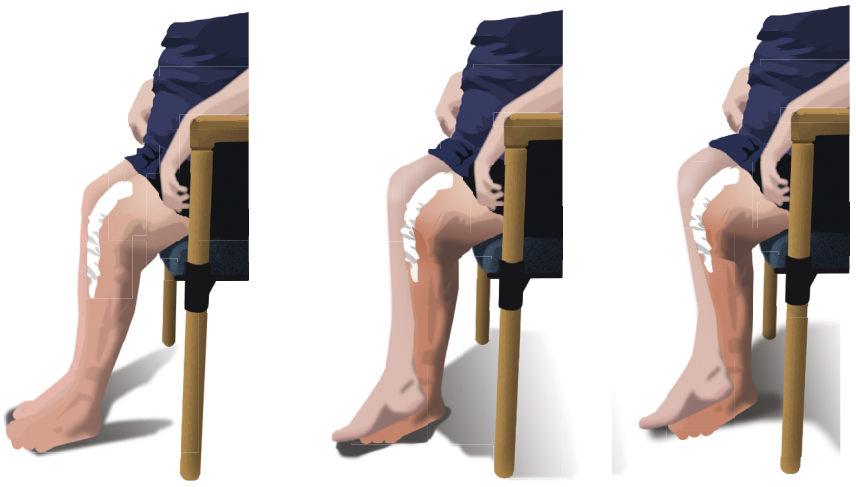
This morning is a busy one: Early in the morning you will change from the hospital gown into your own clothes (loose fitting sweatpants or shorts with no metal) and be taken to the radiology department by wheelchair for a CT scan of both knees. If your coach did not spend the night, please have them return around 7:30 a.m. the following morning. Your therapist will teach you and your coach how to change the dressing, ambulate with a walker, bend and straighten the knee, get in and out of the shower and car, and walk up and down stairs. Your coach is encouraged to take notes. Around 10 a.m., you and your coach will attend a group class to learn about what to do and expect as you return home Finally, your surgeon or physician assistant will visit and provide the necessary information to go home. Most patients feel well enough to leave in the late morning before lunch.

Section 7: Activities and exercises to rehabilitate your knee

It is important to begin rehabilitating your total knee replacement within a few hours after surgery. Because the implants are cemented to the bone, you may place all your weight on the new knee. Physical and occupational therapists will teach you how to get in and out of bed, straighten and bend your knee, walk down the hall with a walker, go up and down stairs, and take care of yourself while recovering at home. Recovery is faster when you get out of bed and use the bathroom rather than staying in bed and using a bedpan. Activate the bedside call light to request a nurse, aide or therapist assist you. Patients who can get in and out of bed, walk 50 feet with a walker, climb stairs and feel 'peppy' are discharged home.

Sitting exercise for bending the knee

1. Sit on the edge of a bed or chair.
2. Place the ankle of the non-surgical leg in front of the ankle of the surgical leg.
3. Use the non-surgical leg to bend the surgical knee until you feel a stretch and no discomfort.
4. Hold this bend while slowly counting to 10 and then relax.
5. Repeat your bend of the non-surgical knee to bend your surgical knee until you feel a stretch and mild discomfort.
6. Slightly increase bend for an additional 10 seconds.
7. Repeat this cycle of stretches 5 to 10 times every time you walk.



Sitting exercise for straightening the knee

1. Sit on the edge of a bed or chair and place the heel of the surgical leg on a chair in front of you.
2. Push on the front of the thigh (arrow) to move the back of the knee down towards the floor.
3. Hold this position while slowly counting to 10 and then relax.
4. Repeat this stretch 5 to 10 times every time you walk.

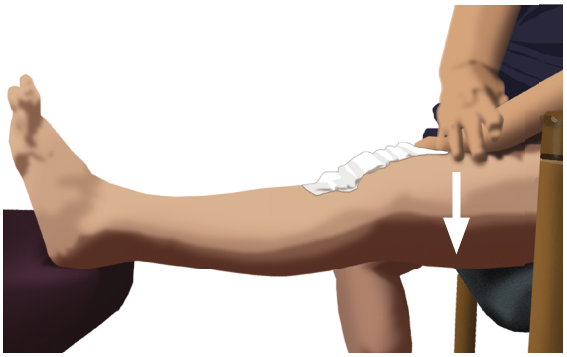


Figure 1

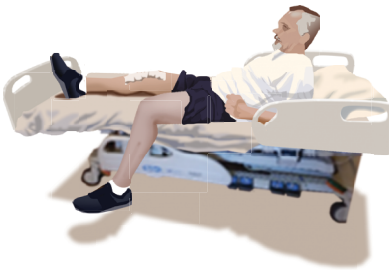


Figure 2

Figure 3

Tips for getting out of bed

1. Use the non-surgical leg to shift your body to one edge of the bed. (Figure 1)
2. Use your elbows and hands to help you sit up. (Figure 2)
3. Bring your legs over the edge of the bed to sit up. (Figure 3)
4. Reverse these steps to get back into bed.

Figure 1

Figure 2

Figure 3

Standing up and walking with a walker

We will contact your insurance company to provide a walker if you don't have one.

1. Use your arms to slide your body to the edge of the chair while keeping the surgical leg out in front of you. (Figure 1)
2. Push up using the armrests and the non-surgical leg for support. (Figure 2)
3. Transition hands from armrests to your walker, one at a time. (Figure 3)
4. Reverse this process to sit down, reaching back for the armrests and slowly lowering yourself.
5. When walking with a walker, first advance the walker, step forward with your surgical leg, then step forward with the other leg, supporting some of your weight with your arms on the walker as needed.

Figure 1

Figure 2

Figure 3

Figure 4

Climbing stairs

1. To climb stairs, grasp the railing and place the foot of the non-surgical leg on the next step and extend the knee. (Figures 1, 2)
2. Next, lift the foot of the surgical leg up to the same step. (Figures 2, 3)
3. When going downstairs, step down with the surgical leg then follow with the non- surgical leg. (Figure 4)
4. When no railing is available, use a cane in one hand for support.

Figure 1

Figure 2

Figure 3

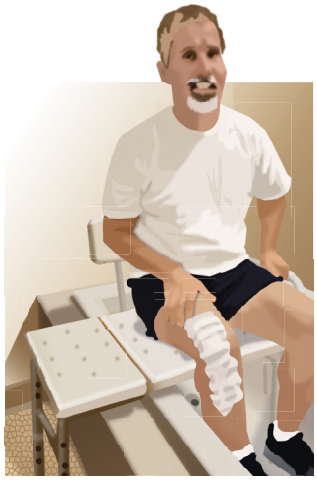


Figure 4

Transferring in and out of a bathtub

1. If you only have a tub/shower combo bathroom set-up, consider buying a bathtub bench. (Available on Amazon for approximately $60.) (Figure 1)
2. Sit down on the bathtub bench with your back facing the bathtub. (Figure 2)
3. Pivot into the bathtub and lift each leg one at a time over the side of the bathtub. (Figures 3, 4)
4. Reverse these steps to get out of the bathtub.

Transferring in and out of a walk-in shower

1. If you have a walk-in shower at home, consider buying a shower chair. (Available on Amazon for approximately $30.)
2. Enter and exit the shower using a side-step technique. (Figures 1, 2)
3. Sit on the shower chair when washing your body.
4. Consider adding slip-resistant bath mats and wall-mounted grab bars for stability.

Figure 1

Figure 2

Figure 1

Figure 2

Figure 3

Figure 4

Going up and down a curb with a walker

5. When going up a curb step, get as close to the curb with the walker as possible.
6. Lift the walker and place it on top of the curb and check that the four legs of the walker are secure. (Figure 1)
7. Step up with your non-surgical leg, lean forward on the walker, then step up with the surgical leg. (Figures 2, 3)
8. Go down the curb by lowering the walker to the ground and step down with the surgical leg followed by the non-surgical leg. (Figure 4)

Figure 1

Figure 2

Figure 3

Figure 4

Getting in and out of a vehicle

1. Park the car several feet away from the curb to allow entry from a level surface.
2. To maximize leg room, move the passenger seat as far back as it will go and recline the seat.
3. Back up to the car, reach back for the seat. (Figure 1)
4. Gently sit on the car seat while keeping your surgical leg straight and in front of you. (Figure 2)
5. Slide back, pivot into the seat and face forward bringing one leg at a time into the car. (Figures 3, 4)

Section 8: Learning what to do at home in the first six weeks after surgery

We invite all patients and their coaches to attend a group physical therapy class before discharge home. Therapists will teach exercises and best practices to increase mobility, manage discomfort and swelling, and care for your incision.

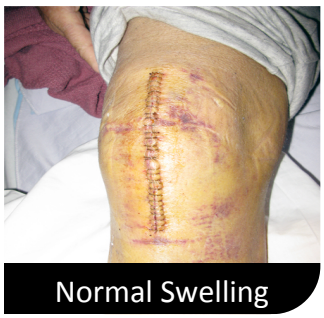
Discharge medications and instructions

If needed, at discharge your surgeon or physician assistant will electronically send a prescription for pain medication to your pharmacy. The nurse will confirm new discharge medications are ready at your pharmacy, provide written and verbal discharge instructions and answer any questions you may have.

Bathing and wound care

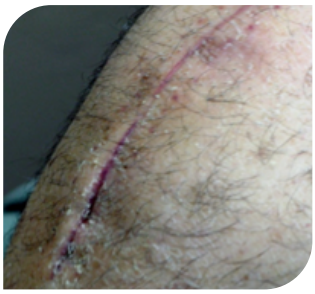
Keep the hospital dressing on the incision for 5-7 days. You may shower and get the dressing wet as it is waterproof. If you continue to notice moderate drainage after surgery, call your surgeon's office. You will receive further instructions. Expect to see bruising, swelling, blistering, redness and warmth around the knee and leg for 5-6 weeks after knee replacement.

Normal Bruising



Normal Swelling

On the seventh day post-surgery, you must change the dressing and replace it with two sterile 4" x 8" adhesive dressings. Refer to the technique demonstrated at the hospital and the handout received. Apply fresh dressings daily until the staples are removed at 12-15 days. You can purchase these dressings online for approximately $16-35 (Amazon: Coviden 7541 Telfa Adhesive Dressing box of 25, or Primapore Adhesive Dressing box of 20). .



As long as the incision is dry, you may shower. Let soapy water run over the staples and then rinse with clean water. **DO NOT** scrub the incision. Pat the incision dry with a clean towel. Don't soak the knee in a bathtub, hot tub or swimming pool until staples are removed at 12-15 days following surgery.

At 12-15 days post-surgery, you will return to the surgeon's office in Sacramento or Lodi to have your staples removed. If you traveled from a distance for the procedure and would prefer to have the staples removed by a provider closer to home, we will provide a suture removal kit to take home from the hospital. After removal, wait a day before swimming, soaking in the hot tub or applying lotions and creams on the incision.

If you see an uneven edge on the incision, please don't worry. This may occur from a shifting of the staples during motion of the knee. Nature will flatten the unevenness within 3-4 weeks.

Reducing the risk of blood clots

Patients who take aspirin or anti-inflammatory medicines will be prescribed low dose chewable aspirin (81 mg) two times a day (one at breakfast and one at dinner) for 28 days after surgery to reduce the risk of blood clots.

Patients who are on anticoagulants (blood thinners) such as Pradaxa (dabigatran), Xarelto (rivaroxaban), Eliquis (apixaban), Coumadin (warfarin), Plental (cilostrazol), Plavix (clopiogrel) or Brilinta (tricagrelor) preoperatively will have adjustments to their medication after surgery that will be coordinated with your cardiologist.

Patients who cannot take aspirin or anti-inflammatory medicines will be given one of the anticoagulants (blood thinners) listed above. These medications often need preauthorization, so let your surgeon know if you cannot take aspirin before surgery. Otherwise, your discharge may be delayed because of a medication issue.

Guidelines for exercise and activities at home

During the first six weeks, your goal is to regain knee motion, reduce the degree of swelling, and limit the use of strengthening exercises. Please follow the guidelines below as other exercises and activities may cause pain and be counterproductive.

- Every hour you are awake, get up and walk for a few minutes.
- After the walk, sit on the sofa or end of the bed and perform the bending and straightening exercises described in Section 6 for 3-5 minutes.
- When not walking, lie on the bed or sofa and elevate your leg 1½-2 feet above your heart using a bolster or pillows as described in Section 6.
- Consider buying a DMI Ortho Bed Wedge (for approximately $30) or EZ UP Pillow (available on Amazon or see flyer from class for approximately $50).
- For the first two weeks limit sitting and standing.
- When you overdo it, elevate the leg on the bolster, ice the knee and rest for the remainder of the day.
- After two weeks increase activity when the knee bends easily to a right angle or 90 degrees.
- When you can walk safely without the walker, discard it.

Prone exercise for straightening your knee after removal of staples

1. Apply a 5 to 10 pound weight around the ankle of the surgical leg.
2. Turn on your stomach and slide toward the edge of the bed.
3. Hang your kneecap over the edge and lower leg off the bed.
4. Let gravity straighten the surgical knee and hold for 1-2 minutes.
5. When discomfort is felt, flex the knee 10 degrees.
6. Repeat straightening and bending of the knee 20 times.
7. Repeat this cycle three times per day until your limp disappears.

Managing discomfort and constipation

If you can take anti-inflammatory medication like Ibuprofen (Motrin, Advil), Naproxen (Aleve) or Acetaminophen (Tylenol), take as suggested at discharge. This will serve as your base before any narcotics are added.

When the pain is not tolerable with over-the-counter medications alone, add prescribed narcotics, as needed. As the pain lessens, stop taking the narcotic. Then as pain permits, gradually stop over-the-counter medications. Before taking narcotics, always reposition your knee or walk. Fifty percent of the time, the pain will subside or be tolerable.

Continue to take over-the-counter Colace (stool softener) to reduce the risk of constipation. Narcotics and immobility are causes of constipation. As needed, you also may add prunes, Metamucil or Milk of Magnesia.

Follow-up visit at six weeks to assess the pace of recovery

The following are signs of a good pace of recovery at five to six weeks:

- Straightening the knee to 0 degrees
- Bending the knee from 90 to 110 degrees
- Walking without a walker or cane
- Climbing stairs
- Driving the car

At five to six weeks, your recovery should be 50 percent and your Oxford Knee Score should have improved to 32 [15]. It is normal to sense swelling, redness, warmth, stiffness, soreness and numbness on the outside of the incision. Patients with difficulty straightening and bending their knee before surgery take longer and work harder to regain motion than patients who have full motion. At three months, recovery is about 70 percent and you may return to recreational activities such as gardening, tennis, golf, biking, bowling and hiking. At six months, recovery is about 90 percent. The pace of recovery is best assessed by comparing improvements in your function between four-week intervals rather than day-to-day.

Section 9: Answers to frequently asked questions

Q: How long does a total knee replacement last?

A: There is a 90 percent chance that at 20 years your knee will still be working well and not require another operation.

Q: When can I drive a car?

A: You may drive a car when you are not taking any narcotics and feel safe behind the wheel. If you get into an accident, the cause should be a judgment error and not an inability to maneuver the car.

Q: When can I play golf?

A: You may return to golf at your own pace. Begin putting and chipping, progress to the short irons and then to the driver.

Q: Does the feeling of stretching when bending the knee ever cause the wound to split open?

A: No, the wound is closed in three layers with three sets of sutures and staples. Feel confident when straightening and bending that the knee with the wound is secure.

Q: When will the swelling and pain disappear in my knee?

A: Swelling is normal and will gradually subside over 3-4 months. Elevation and short frequent exercises for a few minutes are the best way to managing swelling. Forceful exercising for extended periods of time will keep the knee swollen, even with elevation. You are the best person to determine what your knee will let you do. Once the swelling subsides, the pain will too.

Q: When will the warmth and redness disappear?

A: Warmth and redness in the knee is normal and will gradually subside over 3-4 months. It does not indicate an infection and is caused by increased blood supply, which brings a high concentration of nutrients to help heal the knee.

Q: Why is there occasionally a clicking or noise in the knee when I use it?

A: Contact between the metal and plastic tibial and femoral implants causes clicking and is more frequent when the knee is swollen. It does not indicate parts are loose or broken. The frequency and loudness of the noise becomes less as the swelling of the knee subsides.

Q: Will my total knee replacement set off the metal detectors at airports, stadiums and government buildings?

A: Yes, it will. Expect to be patted down. Presenting a card showing you have had a knee replacement does not help.

Q: Is a total knee replacement like a normal knee?

A: About 30 percent of patients report their knee with the kinematically aligned total knee replacement feels normal, while others notice a difference. Those who notice a difference do sense the knee is better than before surgery.

Q: Can I kneel on my knee to do household chores and garden?

A: Kneeling will not hurt the knee. However, without practice it may cause your knee hurt. Try kneeling on a foam pad for support. Patients who kneel frequently have less pain.

Q: Is it true I might need antibiotics if I have dental work or other surgical procedures?

A: The American Dental Association **no longer recommends** the routine prophylactic use of antibiotics before dental procedures according to the following ADA chairside guide. Here is the link to the 2019 Key Points on Antibiotic Prophylaxis. (https://www.ada.org/en/member-center/oral-health-topics/antibiotic-prophylaxis)

Management of patients with prosthetic joints undergoing dental procedures

Clinical Recommendation:

In general, for patients with prosthetic joint implants, prophylactic antibiotics are *not* recommended prior to dental procedures to prevent prosthetic joint infection.

For patients with a history of complications associated with their joint replacement surgery who are undergoing dental procedures that include gingival manipulation or mucosal incision, prophylactic antibiotics should only be considered after consultation with the patient and orthopedic surgeon.* To assess a patient's medical status, a complete health history is always recommended when making final decisions regarding the need for antibiotic prophylaxis.

Clinical Reasoning for the Recommendation:

- There is evidence that dental procedures are not associated with prosthetic joint implant infections.
- There is evidence that antibiotics provided before oral care do not prevent prosthetic joint implant infections.
- There are potential harms of antibiotics including risk for anaphylaxis, antibiotic resistance, and opportunistic infections like *Clostridium difficile*.
- The benefits of antibiotic prophylaxis may not exceed the harms for most patients.
- The individual patient's circumstances and preferences should be considered when deciding whether to prescribe prophylactic antibiotics prior to dental procedures.

ADA Center for Evidence-Based Dentistry™

* In cases where antibiotics are deemed necessary, it is most appropriate that the orthopedic surgeon recommend the appropriate antibiotic regimen and when reasonable write the prescription.

Sollecito T, Abt E, Lockhart P, et al. The use of prophylactic antibiotics prior to dental procedures in patients with prosthetic joints: Evidence-based clinical practice guideline for dental practitioners — a report of the American Dental Association Council on Scientific Affairs. JADA. 2015;146(1):11-16.

Section 10: References

1. Shelton TJ, Gill M, Athwal G, Howell SM, Hull ML. Outcomes in Patients with a Calipered Kinematically Aligned TKA That Already Had a Contralateral Mechanically Aligned TKA. *J Knee Surgery.* 2019.

2. Niki Y, Sassa T, Nagai K, Harato K, Kobayashi S, Yamashita T. Mechanically aligned total knee arthroplasty carries a risk of bony gap changes and flexion-extension axis displacement. *Knee Surg Sports Traumatol Arthrosc.* 2017;25(11):3452-3458.

3. Peters CL, Jimenez C, Erickson J, Anderson MB, Pelt CE. Lessons learned from selective soft-tissue release for gap balancing in primary total knee arthroplasty: an analysis of 1216 consecutive total knee arthroplasties: AAOS exhibit selection. *J Bone Joint Surg Am.* 2013;95(20):e152.

4. Nedopil AJ, Zamore T, Shelton T, Howell S, Hull M. A Best-Fit of an Anatomic Tibial Baseplate Closely Parallels the Flexion-Extension Plane and Covers a High Percentage of the Proximal Tibia *J Knee Surgery.* 2020.

5. Nedopil AJ, Howell SM, Hull ML. Deviations in femoral joint lines using calipered kinematically aligned TKA from virtually planned joint lines are small and do not affect clinical outcomes. *Knee Surg Sports Traumatol Arthrosc.* 2019.

6. Nedopil AJ, Singh AK, Howell SM, Hull ML. Does Calipered Kinematically Aligned TKA Restore Native Left to Right Symmetry of the Lower Limb and Improve Function? *J Arthroplasty.* 2018;33(2):398-406.

7. Shelton TJ, Howell SM, Hull ML. Is There a Force Target That Predicts Early Patient-reported Outcomes After Kinematically Aligned TKA? *Clin Orthop Relat Res.* 2019;477(5):1200-1207.

8. MacDessi SJ, Griffiths-Jones W, Chen DB, et al. Restoring the constitutional alignment with a restrictive kinematic protocol improves quantitative soft-tissue balance in total knee arthroplasty: a randomized controlled trial. *Bone Joint J.* 2020;102-B(1):117-124.

9. Niki Y, Nagura T, Kobayashi S, Udagawa K, Harato K. Who Will Benefit from Kinematically Aligned Total Knee Arthroplasty? Perspectives on Patient-Reported Outcome Measures. *J Arthroplasty.* 2020;35(2):438-442 e432.

10. McEwen PJ, Dlaska CE, Jovanovic IA, Doma K, Brandon BJ. Computer-Assisted Kinematic and Mechanical Axis Total Knee Arthroplasty: A Prospective Randomized Controlled Trial of Bilateral Simultaneous Surgery. *J Arthroplasty.* 2020;35(2):443-450.

11. Laende EK, Richardson CG, Dunbar MJ. A randomized controlled trial of tibial component migration with kinematic alignment using patient-specific instrumentation versus mechanical alignment using computer-assisted surgery in total knee arthroplasty. *Bone Joint J.* 2019;101-B(8):929-940.

12. French SR, Munir S, Brighton R. A Single Surgeon Series Comparing the Outcomes of a Cruciate Retaining and Medially Stabilized Total Knee Arthroplasty Using Kinematic Alignment Principles. *J Arthroplasty.* 2020;35(2):422-428.

13. Matsumoto T, Takayama K, Ishida K, Hayashi S, Hashimoto S, Kuroda R. Radiological and clinical comparison of kinematically versus mechanically aligned total knee arthroplasty. *Bone Joint J.* 2017;99-B(5):640-646.

14. Calliess T, Bauer K, Stukenborg-Colsman C, Windhagen H, Budde S, Ettinger M. PSI kinematic versus non-PSI mechanical alignment in total knee arthroplasty: a prospective, randomized study. *Knee Surg Sports Traumatol Arthrosc.* 2017;25(6):1743-1748.

15. Waterson HB, Clement ND, Eyres KS, Mandalia VI, Toms AD. The early outcome of kinematic versus mechanical alignment in total knee arthroplasty: a prospective randomised control trial. *Bone Joint J.* 2016;98-B(10):1360-1368.

16. Dossett HG, Estrada NA, Swartz GJ, LeFevre GW, Kwasman BG. A randomised controlled trial of kinematically and mechanically aligned total knee replacements: two-year clinical results. *Bone Joint J.* 2014;96-B(7):907-913.

17. Freeman MA, Pinskerova V. The movement of the normal tibio-femoral joint. Journal of biomechanics. 2005;38(2):197-208.

18. Schutz P, Taylor WR, Postolka B, et al. Kinematic Evaluation of the GMK Sphere Implant During Gait Activities: A Dynamic Videofluoroscopy Study. *J Orthop Res.* 2019;37(11):2337-2347.

19. Barad SJ, Howell SM, Tom J. Is a shortened length of stay and increased rate of discharge to home associated with a low readmission rate and cost-effectiveness after primary total knee arthroplasty? *Arthroplast Today.* 2018;4(1):107-112.

20. Howell SM, Shelton TJ, Hull ML. Implant Survival and Function Ten Years After Kinematically Aligned Total Knee Arthroplasty. *J Arthroplasty.* 2018;33(12):3678-3684.

21. Beal S, Long-Brandt W, Tilford M. Prevention of SSIs in Total Hip and Knees Using a Preoperative Antisepsis Bundle. *American Journal of Infection Control.* 2018;46(6):S80.

22. Wang Z, Zheng J, Zhao Y, et al. Preoperative bathing with chlorhexidine reduces the incidence of surgical site infections after total knee arthroplasty: A meta-analysis. *Medicine (Baltimore).* 2017;96(47):e8321.

23. Edmiston CE, Jr., Assadian O, Spencer M, Olmsted RN, Barnes S, Leaper D. To bathe or not to bathe with chlorhexidine gluconate: is it time to take a stand for preadmission bathing and cleansing? *AORN J.* 2015;101(5):529-538

Section 11: Notes

Blank space is provided for the purpose of taking notes.

Adventist Health Physicians Network
Medical Office - Orthopedics
8120 Timberlake Way, Suite 112
Sacramento, CA 95823
916-689-7370

Adventist Health Lodi Memorial
Medical Office – Orthopedics
1235 W. Vine St, Suite 22
Lodi, CA 95240
209-334-8535

Adventist Health
Lodi Memorial

May 2020