

Knee Replacement

Specialty Paper for
Structural Yoga Therapy Certification
2005 Yogaville Program

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The United Nations, the World Health Organization and 37 countries have proclaimed the year 2000-2010 as the Bone and Joint Decade. This global initiative is intended to improve the lives of people with musculoskeletal disorders, such as arthritis, and to advance understanding and treatment of musculoskeletal disorders through prevention, education and research.

Case studies

Case Study #1 – Carol

a - initial intake – 5/26/05

Client Self Evaluation: Carol has a complete left knee implant. Installation date on May 23, 2003. The operation was needed because of being hit by a car. She was walking. We asked her if we could ROM and muscle test her as a case study to be included in our final paper. We were very happy when she agreed.

Intake conversation reveals that Carol has just returned from a seventeen day Peruvian holiday, and she will be staying in this Memorial Day weekend and playing with her grandchildren. Carol is 67 years old, and is looking at her NCSU teaching duties to be reduced by 50% this July first. Health insurance will be a concern soon. Medicare will be the primary and they will not authorize physical therapy visits. Carol has been seeing her physical therapist once a month. This is down from a 3 times a week in her post op period, to once a week for several months, and now finally once a month. The knee replacement operation recovery period aggravated a tarsal tunnel problem Carol had been having in her right ankle and in November 2003 this was operated on. Carol's comments on her recent history include the word tragic. In October 2004, she lost her partner of twelve years, James. One of Carol's daughters has just divorced this past month and has lost her job this past week. Lots of life.

Carol is a very active woman. She described herself as not wasteful. She does her make-up classes when she pays yoga tuition, and she also takes advantage of the Raleigh Parks free Sunday 7:30 am yoga class. In addition, to these classes Carol visits a wellness center three or four times a week, either 6am or 5pm for her regular 2-3 hour routine. This includes stretching in the sauna, twenty minutes on a stationary bike at hi-speed, a varied thirty minute treadmill routine and weight work on five leg machines, curls including flexion and extension, squats, and abduction-adduction.

Diet: avoids salt and fats. She avoids salt because of concerns with fluid retention in her left ankle. She says the fluid retention may be the result of the accident.

Shoulder - General tightness on right side from shoulder including elbow up to neck noted.

a - intake – 1/13/06

Carol says she is fine. She is getting used to working part-time. She continues to maintain an aggressive fitness program, going to the wellness center at least three times a week (routine pre-viously explained) and yoga class at least once a week and often two or three. She is currently in physical therapy working on upper body strength, using hand weights while performing wrist exercises. She is especially concerned about the arthritis in her hands and the resulting loss of strength. She has also completed a six week nutrition class at the wellness center.

Generally, Carol has many of the same physical complaints as previously. Her right shoulder is especially tight with tightness carrying up into her neck and down the arm into the wrist. Carpal tunnel is a concern. She says her lower back makes itself known. She says, "You get to know your body when you have aches and pains. I don't want to have another surgery."

b physical assessment –

Carol is petite: 4'9" and weighs 108 lbs. Recent weight has ranged from 127 pounds to 105 pounds.

Range of Motion (ROM)

Exam Dates 5/26/05 6/22/05 | 1/13/06

Lower Body Supine Position				
		Left/Right	Left/Right	Left/Right
Knee				
Flexion	150 ⁰	125/150		118/152
Extension	0 ⁰	0/0		0/0
Hip				
Flexion-bent knee	135 ⁰ -150 ⁰	134/136		130/145
Flexion-straight knee	90 ⁰	96/98		90/90
External Rotation	45 ⁰	49/56	44/33	48/50
Internal Rotation	35 ⁰	28/28	35/36	35/28
Lower Body Prone position				
		Left/Right	Left/Right	Left/Right
Knee				
Flexion	135 ⁰ -150 ⁰	110/130		110/130
Hip				
External Rotation	45 ⁰	51/50	48/44	50/42
Internal Rotation	35 ⁰	38/24	28/35	38/40

Muscle Tests

Exam Dates 5/26/05 6/22/05 | 1/13/06

5/26/05 - Note that the leg length difference observed when standing is less noticeable, almost not measurable, when lying. She perceives as left leg is shorter than the right leg. She wears lifts in her shoes. Pelvic height noted at 4.5" both sides. **1/13/06** – Supine leg length difference is about ¼", right leg appears longer, and is still wearing lifts. This difference is most apparent at the ankle. Heels appear almost even while supine.

Lower Body Supine			
	Left/Right	Left/Right	Left/Right
Hip			
Flexion-Rectus Femoris, Psoas, etc	3.5/4		3.5/4
Psoas (isolation)	3/4.5	4/3.5	4.5/4
Sartorius (isolation)	2/3.5	4 / 4	3.5/3
Lower body – Side lying			
	Left/Right	Left/Right	Left/Right
Hip			
External rotation-deep 6	4.5/4.5		5/5
Internal rotation-gluteus medius & TFL	4.5/4.5		5/5
Abductors-gluteus medius	4.5/4.5		5/5
Adductors-gracilis & adductors	4/4		3.8/4
Lower body - Prone			
Knee			
Extension-quadriceps	4.5/4.5		4.5/4
Flexion-hamstrings & gastrocnemius	4/3.5		3.8/3.3 cramping
Hip			
Extension-gluteus maximus & hamstrings	3.5/3.5		3/3.5
Gluteus maximus isolation	4.5/4		5./5
External rotation	4.5/4		4.5/4.8
Internal rotation-gluteus minimus & TFL	3.5/4		4/5 cramping felt on left knee

Please note that complete ROM and Muscle test results are given in the appendix.

C findings –5/26/05

No spinal curvature noted with a visual exam.

Muscles to Stretch	Muscles to Strengthen
Didn't see anything that needed stretch	Left psoas, left sartorius

In general, ROM over expected value.	
C findings – 1/13/06	
Muscles to Stretch	Muscles to Strengthen
Psoas, quadriceps	Psoas, hamstrings, gracilis, sartorius Triceps, latissimus

d recommendations

5/26/05:

Carol tells us that since the operation her left leg is one half inch shorter than her right. SI test shows upward movement on right, less movement on left. We decide the SI stabilizer will be helpful. Gave Carol joint freeing series (with sunbird variation fire hydrant leg).

Next visit: need to check that she is timing movement and breath. Need to give her SI stabilization hard copy. Would like to add Energy freeing pose, Apanasana. Bridge is nice for her. Also adding more attention to breath.

6/22/05:

Gave SI stabilization with adaptation on hassock due to knee limitation. Went over coordinating breath with movements in JFS. Continued to suggest that she slow down. She said the shoulder release treatment was worth everything else.

1/13/06:

Again, did a right shoulder release, and again we reviewed the SI stabilization series with hassock adaptation. We went over doing the modified JFS with awareness and breath. Recommended locust for hamstrings. Bridge for latissimus and hamstrings, emphasizing grounding feet and shoulders. Went over arthritis diet, squash and rice, as an option for dealing with arthritis worries.

e summary of results

5/26/05

Carol has the knee replacement under control. She might benefit trying to cultivate focus with simple movement. Maybe slowing her own practice would help maintain energy for her busy schedule.

Found differences in internal hip rotation depending upon test was done. Left side increased ROM when tested prone.

Plan to remeasure and test wrists due to her complains about wrists and shoulders.

6/22/05

Carol needs to work on slowing down and engaging more awareness. Left DVD of JFS so she can see how to practice. When left to her own devices, Carol did not seem to be doing the movements with her breath. Kept homework the same.

1/13/06

Carol appears to be working more effectively with her pitta nature. She continues to work well with her knee, strengthening all the muscles around the device. Breath awareness seems to be taking hold. Carol continues to integrate her major life changes, loss of a long-time partner,

looming retirement, and the daily drama of family life.

Carol had just come back from a baby sitting weekend with her three grandsons so that mom and dad could get away. In summary, Carol has taken the modified JFS and added it and the SI series to her fitness routine. She says that what she has learned working with us has made it easier to adapt so that her knee is happier when she is in other settings, such as at work and in yoga classes.

Case Study #2 – Caroline

a - initial intake – 7/10/05

Client Self Evaluation:

Background: Husband died from cancer in Fall of 1999. Son died from heart attack in Spring of 2003. Caroline has two knee replacements. Both were placed in on April 22, 2004. They were needed because of torn ligaments, which she said was caused by doing too much high impact aerobics. (She also has arthritis.) She was in class at least three times a week and power walked three miles five times a week. Her knees had been previously operated on and were still giving her problems, so replacement was the next option. It should be noted that the recovery described is nothing like the books. It was a lot faster. Again, the cause of the fast recovery is credited to exercise.

She was operated on, on a Thursday. She was out of bed and walking the next day, and moved to rehab on Monday, five days after her surgery. On her first day in rehab, she was doing steps. She stayed only one week in rehab and was released home with a walker.

She went to physical therapy three times a week and worked for an hour and a half. She remembers that these early sessions ended with ice packs applied to her knees to ease the pain. Her first round of physical therapy lasted about a month and ended because it was time to go to the beach. The beach house entrance is reached by climbing a long flight of steps, more than ten. She unloaded her luggage and her dog's food and moved herself in for a vacation, less than eight weeks after surgery.

After vacation, Caroline returned to physical therapy at three times a week for three weeks and gradually left the program. She complains that she cannot move as fast as she wants because there are no nerves in her knees and she has to think about moving them. Her doctor says that she can do anything she wants and she hopes to be back to power walking soon. Her recovery inspired her doctor to do a double hip replacement. She has fallen some, a few hard, mostly tripped by dog's leash.

a - intake – 9/10/05

Over the summer, she continued with the JFS but sometimes only once a week. She feels that when she goes to the gym to exercise that it would be useful to walk backwards on the treadmill. She still is in training for resuming more power walking, now twenty minutes a mile. She reported having strained her back cleaning out the low cabinets and thus has stopped doing leg lifts. Since she was unclear about the SI stabilization series, we reviewed that and mailed her a copy of the movements. She has shifted some of her outside activities because of absorbing and demanding projects at church.

a - intake – 1/13/06

Carol reports good results drifting off to sleep with relaxation tape we provided. She was also motivated to "dig up" and go over her bio-feedback tapes from several years ago and has been incorporating more of those techniques to relax and wind down. She is very pleased with the Joint Freeing Series and asked to review the SI movements because they had helped too. She is currently walking a mile at a time one to three times a week. She says she's "letting other stuff

interfere with my taking care of myself. I'm looking after everyone else. I tell myself I won't be any good to others unless I look after myself."

b physical assessment

Age 75. Height 5' 8" and weight 140 (gained some after losing a great deal of weight after son's death)

Range of Motion (ROM)

Exam Dates		7/10/05	9/10/05	1/13/06
Lower Body Supine Position				
		Left/Right	Left/Right	Left/Right
Knee				
Flexion	150 ⁰	135/128	130/130	123/134
Extension	0 ⁰	0/0	0/0	0/0
Hip				
Flexion-bent knee	135 ⁰ -150 ⁰	123/125	115/115	120/120
Flexion-straight knee	90 ⁰	90/90	90/90	90/90
External Rotation	45 ⁰	65/60	56/50	65/57
Internal Rotation	35 ⁰	28/30	29/38	30/25
Hip Supine				
Adduction	30°	35/38		
Hip Side Lying				
Abduction	45°	38/33	45/45	
Lower Body Prone position				
		Left/Right	Left/Right	Left/Right
Knee				
Flexion	135 ⁰ -150 ⁰	120/123	112/114 cramping	115/115
Hip				
External Rotation	45 ⁰	60/67	65/75	55/58
Internal Rotation	35 ⁰		40/42	45/48

Muscle Tests

Exam Dates		7/10/05	9/10/05	1/13/06
Lower Body Supine				
		Left/Right	Left/Right	Left/Right

Hip			
Flexion-Rectus Femoris, Psoas, etc	2.5/2.2	4/4	3.8/4
Psoas (isolation)	4/4		4.5/4.5 recruitment
Sartorius (isolation)	4/4		3/4
Lower body – Side lying			
	Left/Right	Left/Right	Left/Right
Hip	7/10/05	9/10/05	1/13/06
External rotation-deep 6	3.5/3.5		3.5/3.5
Internal rotation-gluteus medius & TFL	4/4		4/4
Abductors-gluteus medius	4/4		4/4
Adductors-gracilis & adductors	3.5/3 rite side test caused pain inside left knee		3.5/3
Lower body - Prone			
Knee			
Extension-quadriiceps	5/5		5/5
Flexion-hamstrings & gastrocnemius	3/2.5	4/4	3/3
Hip			
Extension-gluteus maximus & hamstrings	5/5		2.5/3 cramping
Gluteus maximus isolation	4.5/4.5		Lifted knee on both sides
External rotation	4/4		4.5/4.5
Internal rotation-gluteus minimus & TFL	4/4		3.5/3.5

Please note complete exam findings are in appendix.

c findings – 7/10/05

Bodyreading – Standing Position

SI Test – more movement felt on the left side – Caroline says she feels more comfortable raising her left leg. This is reflected in the knee flexion numbers. Less movement is felt in the right SI joint.

Spinal Analysis – When Caroline bends at the waist her right hand is noticeably lower. The scoliometer starts out reading 1° to the left at the sacrum comes to zero at the pelvis and starts moving to the right by the time the waist is reached. A long “C” curve is described to the right reaching a max of 5° in the upper thoracic region and comes back to zero at the center of the neck.

Muscles to Stretch

Muscles to Strengthen

Wrist ROM is compromised due to arthritis
Rectus femoris
All of deltoid
Pectoralis
Latissimus dorsi
Teres major

Rectus femoris
SCM
Hamstrings

c findings – 9/10/05

Muscles to Stretch

SCM, upper trapezius
anterior deltoid
Pectoralis
Latissimus dorsi
Teres major

Muscles to Strengthen

SCM
Hamstrings

c findings – 1/13/06

Muscles to Stretch

Gluteus maximus, latissimus dorsi
Teres major, pectoralis

Muscles to Strengthen

Erector spinae
Hamstrings, psoas, quadriceps, left sartorius
Gluteus medius, TFL

d recommendations – 7/10/05

Joint freeing series was recommended and a tape given to reinforce instruction. Locust was given to strengthen hamstrings. SI stabilizing exercise was also given.

d recommendations – 9/10/05

Suggested continue JFS & SI with attention to breath and to consider more relaxation.

d recommendations – 1/13/05

We gave her modifications to JFS for #4 to recline on elbows to keep from hurting her back. General instruction was given to keep from rounding lower back while performing JFS and to be aware of extension in lower back as more beneficial while seated. Because of the continuing problems with back, we went over SI Series using chair adaptation.

e summary of results 7/10/05

Worked with Caroline to incorporate the breath while doing the JFS. Difficult for her because it was such a different approach than the Physical Therapy/Aerobics model. Caroline reported after some time with JFS that she experienced the first time in quite awhile that her back wasn't bothering her.

e summary of results 9/10/05

Caroline reported that she can tell when she hasn't done the JFS often enough. She noted how much easier it was to turn her head when driving.

e summary of results 1/13/05

"I really fell better. It really does help." As well as the benefits of JFS, Caroline has recently joined a meditation class. She reports that she can tell the difference in her day when she's taken time for centering prayer. Caroline is doing well with both replaced knees and has broadened her program to include more than power walking. She is sleeping better using the

relaxation tape and biofeedback. She moves more comfortably showing much less hesitancy. She truly enjoys her yoga. The implications have been broad in her daily life.

2 a) name and description of condition

Joints, such as the knee, are complex structures made up of bone, muscles, synovium, cartilage and ligaments, designed to bear weight and move the body through space. The knee consists of the femur (thigh bone) above, and the tibia (shin bone) and fibula below. The patella, or kneecap rides on top of the lower portion of the femur and the top portion of the tibia. The muscles and ligaments connect these bones and the space between them is cushioned by fluid-filled capsules (synovia) and cartilage. When muscles are exercised, they pull on the bones, strengthening them. The range of motion of a joint represents how far it can be flexed (bent) and extended (stretched).

Overall knee pain can be due to bursitis, arthritis, tears in the ligaments, osteoarthritis of the joint, infection, or injury. Instability, or giving way, is also another common knee problem. Instability is usually associated with damage or problems with the meniscuses, collateral ligaments, or patella tracking.

Knee replacements are considered when joint deterioration has reached the point where medication and exercise no longer give relief from pain and stiffness. The most common cause of chronic knee pain is arthritis. Osteoarthritis, rheumatoid arthritis and traumatic arthritis are the most common forms. Osteoarthritis usually occurs after the age of 50 and often contains a genetic component. The cartilage of the knee softens and wears away. This results in bone on bone contact causing pain and stiffness. Rheumatoid arthritis is a disease in which the synovial membrane becomes thickened and inflamed. The joint produces too much synovial fluid which overfills the joint space. This chronic inflammation damages cartilage and eventually it is lost again causing pain and stiffness. Traumatic arthritis follows a serious knee injury. A knee fracture or severe ligament tear can damage the articular cartilage causing knee pain and limited function.

b) gross and subtle body: common symptoms

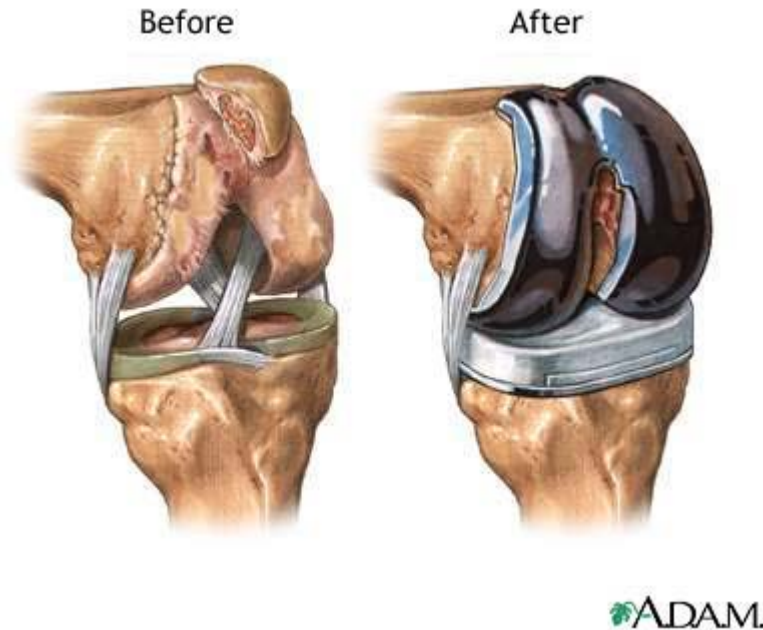
In You Can Heal Your Life, Louise Hay says that issues involving the knees derive from concerns related to pride and ego; too proud to bend, too rigid, inflexible. Knees are part of our locomotion system. They move us forward in life where inevitably we encounter change. When one approaches the unknown, one may feel vulnerable or unsure. Knees can also represent humility, the wisdom to be yielding in the face of change. Stiff, sore knees can also be a symptom of kidney deficiency, whose emotion is fear, a difficult feeling to admit to ourselves.

In knee replacement, the diseased joint is removed and a new one inserted. This idea first appeared in the 1950's. First models were single axis, metal on metal hinge type devices. Their use spread rapidly because they offered pain relief. Their use became commonly accepted by the 1970's and they are still evolving. Tim McGloughlin of the University of Limerick offers a fine history of the subject from a bioengineer's point of view. He details the evolution of modern devices as an understanding of all the complex forces at work in the knee grew. One pound of body weight translates into ten pounds of force at the knee joint and range of motion happens in two planes. The knee, although mainly a flexor/extensor joint, can rotate. Rotational forces loosened early devices from their bony moorings spurring improvements in fixation as well as design.

Today over nineteen companies in the United States distribute roughly 300,000 total knee implants. The devices are mainly of three different types: cruciate-preserving, cruciate-substituting and TC-III stemmed system. It is difficult to find an average cost. One implant manufacturer, Zimmer quotes a range of between \$4000 to \$6500. While in a 2003, Cheryl Speight, a North Carolina State University researcher estimated the cost of a total knee

replacement to be about \$9000. Costs vary depending on which device is chosen and where the surgery is performed. A hospital that does more total knee replacements, TKR, charges less per surgery than a hospital that does fewer.

McGloughlin documents improvements in the device itself, from a single hinge metal axis to a bearing and polymer platform. The picture below is the most popular TKR prosthesis, the tricompartmental device. Here surfaces of the femur, tibia and patella are trimmed removing worn edges are reconfigured to fit the exact shape of the inside of the implant. Today, improvements continue with an aim to as closely as possible match the implant to the individual. (See appendix for news on bone morphing imaging and minimally invasive total knee arthroplasty.)



Unicompartmental devices also exist which replace only a portion of the joint. The procedure involves a small incision and insertion of small implants. It retains important knee ligaments, which in theory should preserve more movement than a total knee replacement. The procedure is not widely available and is controversial, since the implants may not be as reliable as those in total knee replacement, but new developments may soon make this option more viable.

c) Related challenges

The main challenge is surgery. TKR is elective surgery. The National Institutes of Health from a consensus development conference in December 8-10, 2003, has concluded that TKR is safe and cost effective and, because of innovations in technique, the candidate base now spans all ages from the very old to the young.

When considering the TKR, the consensus paper states, "There are few absolute contraindications for TKR other than active local or systemic infection and other medical conditions that substantially increase the risk of serious perioperative complications or death. Obesity is not a contraindication to TKR; however, there may be an increased risk of delayed wound healing and perioperative infection in obese patients. Severe peripheral vascular disease and some neurologic impairments are both relative contraindications to TKR."

The paper says that between 85 and 90 per cent of patients are well satisfied and that this statement is supported by 20 years of follow-up data. The data also states that perioperative mortality approximates 0.5 percent:

“Complications following TKR include wound-healing problems; wound and deep-tissue infection; deep-vein thrombosis and pulmonary embolism; pneumonia; myocardial infarction; patellar fracture and/or extensor mechanism disruption; joint instability, stiffness, and/or misalignment; and nerve and vascular injuries. Factors associated with wound and deep-tissue infection include a diagnosis of RA, diabetes mellitus, obesity, and use of glucocorticoids. One of the most important factors leading to successful TKR is proper surgical technique; the rate of complications in some studies that utilized national administrative databases was inversely related to both surgeons’ and hospitals’ volume of operations per year.”

“Rates of prosthesis failure requiring revision increase with duration of follow-up after surgery from about 10 percent at 10 years to about 20 percent at 20 years (~1 percent per year). Prosthesis failure rates vary substantially across studies; factors associated with shortened time to prosthesis failure include age younger than 55 years, male gender, diagnosis of OA, obesity, and presence of comorbid conditions, (they are the other conditions that one may have in addition to the TKR). It is hypothesized that the higher rate of prosthesis failure observed in young obese men with OA is related to higher levels of physical activity after TKR in this population.”

See question 6 for specifics on what an average patient can expect.

3 - Ayurvedic assessment and Ayurvedic based yoga recommendations.

All the following information is from the website, Holistic Online.com. The URL is: http://www.holistic-online.com/Remedies/Arthritis/arth_ayurveda.htm

The most common underlying condition necessitating knee replacement is arthritis.

Ayurveda

Ayurveda suggests that arthritis is caused primarily by an excess of [ama](#) and lack of [agni](#). This can be caused by [poor digestion](#) and a weakened colon, resulting in the accumulation of undigested food and the buildup of waste matter. Poor digestion allows toxins to accumulate in the body, and problems with the colon allow the toxins to reach the joints.

The way to treat arthritis is to stimulate the digestive fire (agni) and to suppress the ama. Ayurveda distinguishes three categories of arthritis, corresponding to vata, pitta, and kapha.

Types Of Arthritis

Type	Vata	Pita	Kapha
Characteristic	joints crack and pop; become dry and are not swollen	inflammation; joint becomes swollen and painful even without movement; looks red and feels hot to the touch	joint also becomes stiff and swollen, but feels cold and clammy rather than hot’ a little movement, rather than aggravating the pain, tends to relieve it
Diet Detoxification	three- to five-day	five- to seven-day	one- to two-week
Diet General	warm, heavy and moist foods that give one strength.	cool, slightly dry, and heavy foods	light, dry and warm; Avoid cold, oily, and heavy foods
Herbs	cinnamon, cardamom, cumin,	guggul, sandalwood, aloe, saffron, chaparral	cinnamon, dry ginger, turmeric, trikatu

	ginger, cloves		
Yoga asana	Forward Bend Chest-Knee pose Maha Mudra Half Bridge pose	Boat; Bow; Camel; Cow; Locust; Moon Salutation; shitali pranayama (12 rep)	Tree, Triangle, Forward Bend, Twist

Visit [Ayurveda Supersite in Holisticonline.com](http://AyurvedaSupersite.in) for more information about vata pacifying diet, and also specific treatments, recipes, and formulas.

4 – common body reading (refer to SYT pg. 103),

It may be difficult to determine that a person has replaced their knee without them telling you. In certain circumstances, limited ability to bend the knee will show a previous surgery. Obvious scarring on the kneecap will indicate presence of knee replacement.

5 - contraindicated yoga practices and general activities to modify or eliminate

Those with knee replacements will have limited flexion. Poses such as hero, eagle, and pigeon require flexion beyond what is available to the new knee. Modifications can be made such as doing pigeon on the back, hero sitting raised on a cushion or bolster, and eagle without entirely wrapping the legs. Squats should be supported. It is also important to avoid pivoting to protect the side ligaments.

Knee replacements are different from original knees. It is a sturdy device designed to be treated delicately. In order to maximize the device's lifetime, care must be taken to minimize wear and loosening of the implant. Activities to be avoided include high impact activities and activities that may result in falling. These types of activities include competitive racquet sports (such as singles tennis, squash, and racquetball), high impact aerobics, high intensity jogging, water skiing, power gliding, Alpine skiing, martial arts, rope jumping, handball and volleyball.

6 – General recommendations for the condition (not your case study) – progressive through 4 phases –

a – before surgery

When someone is preparing for knee replacement surgery, they can benefit from an overall strengthening regime ahead of time with specific attention to the upper body to be able to lift and move themselves during recovery. Keeping the weight down is also helpful because there is less to have to move around (also see diet below).

Arthritis as preexisting condition for knee replacement may benefit from Ayurvedic treatment such as those in the following table:

Selected foods and herbs	Hot, spicy foods and herbs, including galangal and cayenne are frequently used
Detoxification diet	A three- to five-day detoxification diet is often prescribed. Vegetables, juices, spices and herbs are taken during the fast, which lasts until the body shows signs that the digestive fire is burning strong. These signs include a return of the appetite, a feeling of lightness and a clear coating to the tongue
Use of Enemas/ Cleaning Colon	Enemas and other means of cleaning the colon are often used to help detoxify the body.
Gemstone Therapy	Ruby, garnet or other "hot" gems set in gold are used for all three types of arthritis.

Herbal, medicinal or essential oils	Various oils may be applied to the skin in order to help the body clear toxins, relieve pain and restore mobility
Heat Therapy	Sitting in a sauna, or having steam applied directly to the afflicted areas.
Herbs, spices and bitters	A variety of herbs, spices and bitters are used in Ayurveda, applied externally or ingested, to cleanse the body and to relieve pain and stiffness. Some used are mint, ephedra, golden seal, gentian, nirgundi, eucalyptus leaves, prasarini, quassia, coptis, scute, phellodendrom, aloe, guggul, du huo, ligusticum, Siberian ginseng, myrrh, and yucca.

It is advisable to have dental work taken care of before surgery for knee replacement.

Take time also to make the home a safe place to return to by removing throw rugs, having meals ready, keeping cords out of the way, and anything else that might trip or slip.

b - therapeutic/free of pain;

After knee replacement surgery, one will groggily wake up in a recovery room and probably find some tubes sticking out of their body, perhaps a Foley catheter in their bladder and a drainage tube in their knee. An I.V. will be found in the arm, there to administer fluids, antibiotics, and pain medications. Vital signs including pain will be closely monitored. Recovery room stays usually last only a few hours, then the patient is transferred to their room. That's pretty much it for the day of surgery.

Post operative day 1 is marked by the phrase, "Out of bed." Most patients are not in the mood to do so, but staff are prepared to overcome patient resistance. Tubes are often removed on day one and the idea of walking with the aid of a walker is introduced. In addition to all this, the patient most likely will find a CPM (continuous passive motion) machine attached to their bed. This device is to be used once or twice a day for one to two hours at a time. The machine features a cradle to hold the affected leg. There is a hinge at knee level. When the machine is turned on, the cradle automatically begins to bend and with it the knee. Having bent a certain preset distance, the cradle then straightens out. The cycle repeats for the duration of the session. Staff adjusts the bending distance so that by discharge time that bend is as close to 90 degrees as possible.

Hospital stays may last from 3 to 7 days depending on how well the patient heals. Some common goals for the patient to achieve before discharge include: getting in and out of bed without assistance, 90 degree knee flexion, 0 degree knee extension, walking on a level surface with a walker or crutches, and the ability to climb 2 or 3 stairs. The patient must also be able to do all the prescribed home exercises.

The muscles most affected by the surgery are the quadriceps muscles: vastus lateralis, vastus medialis, vastus intermedius and rectus femoris. A common exercise used to strengthen this muscle is to lie on the back with arms at sides, legs straight, together and flat. Place a rolled towel or small pillow under the ankles to slightly raise them. Tighten the muscles on the top of one thigh as the back of the knee is pushed down into the bed. Hold for 5 seconds. Relax for 5 seconds. Do 10 cycles with each leg. In addition to the quadriceps, hamstrings, gastrocnemius, soleus, and the ankle dorsiflexors are strengthened. Lumbar and hip flexors should also be worked with to aid with knee stabilization.

Exercises will include three types: range of motion (bending and straightening), strengthening (like the sample given above), and functional where one simulates common activities (like walking in the shallow end of a pool). In these early stages, watch out for unusual redness, heat or drainage at the incision site, any trouble breathing or chest pain, or fever over 101°F. Also be alert for possible formation of blood clots indicated by increasing pain in calf and swelling in calf, ankle, or foot.

There can be a great deal of pain during the initial and ongoing recovery. Some patients report being kept awake by the amount of pain even weeks later. Others have thought their knees would break before the physical therapists straightens out the joint.

After surgery and rehabilitation, the majority of individuals return to normal activity and are free of pain. When it's easy for the knee to bend and to get in and out of the car, as well as muscle control for sufficient reaction time, then it's feasible to drive again, usually four to six weeks after surgery.

c - stabilize situation and lifestyle change recommendations;

It is important to continue to be active and keep a healthy diet. Weight should be kept under control to avoid excessive pressure on the implant.

Prophylactic antibiotic treatment is advised when undergoing dental or bowel procedures. Be sure to tell the dentist or doctor that a knee replacement is present.

Blood thinners are commonly prescribed and carry their own set of do's and don'ts, so follow the doctor's advice, like avoiding foods that contain vitamin K.

Physical therapy continuing after the hospital stay will stabilize the use of and adaptation to the new device. Those who don't follow the recommendations of their physical therapists find resuming normal activities takes longer and effects of surgery are less satisfactory.

The Joint Freeing Series is recommended with modifications. In # 4, flexion will be around 130°, and care needs to be taken in extension to support the lower back, such as reclining on the elbows. In any kneeling position, padding may be desired for the knees. For #9 -21, sit in stick (Dandasana) or easy pose (Sukhasana) instead of hero (which is to be avoided). The SI stabilization series is also suggested; use cushions for elevation to accommodate limited knee flexion or just sit in a chair.

d – maintenance and long term considerations.

Because of the vata issues, continuing work on relaxation and meditation will be important for full long-term progress.

Practice of yoga is very useful in learning to live with a new knee, standing and moving in space, developing awareness, a sense of balance, etc. Standing poses strengthen the legs: Warrior I and Warrior II to strengthen the quadriceps. Keep the knees together in Bridge to strengthen the hamstrings. Tree will help develop balance. Be sure to ground the Spinal Twist (Marichyasana) in both sits bones to avoid any torque in the inner knee. For Gomukhasana (Face of Light), modify sitting to accommodate flexion and avoid stress of ligaments connected to knee. In the Structural Yoga Therapy series, modify Apanasana (energy freeing) due to limited flexion by holding to back of thigh behind the knee. A continuing practice of yoga will help alert one to any changes such as tendencies to limp or list which can occur with altered physiognomy.

Be aware of and respond to any situation with infection which is an ongoing concern. Bacteria lodged around the new device is the major cause of rejection of implants.

Metal detectors used for security in airports and other buildings may be activated by the implant. Be ready to tell any security personnel that you have had knee replacement surgery.

7 – Questions and Answers from www.yogaforums.com –

Question – posted July 24, 2004

I have searched the forum and I was not able to find a question similar to mine. I hope these questions get to you alright.

So I have had rheumatoid arthritis for almost 10 years, have been practicing yoga for the past eight years and just recently (April) became certified as a yoga instructor. Throughout my years with the disease I have gone in and out of flares, and subsequently have had to adapt my yoga practice to suit my needs or had the help of teachers (you and Arden Pierce, specifically). I was turned onto the Joint Freeing Series because it was so beneficial to my own personal health condition and now have begun to teach mostly the JFS (with some other poses added).

My health for the past two months has been worse than just about any limitations I had experienced. Tremendous hip pain, **knee** pain (inability to walk down stairs), wrist flexion diminished, along with the diagnosis of a torn rotator cuff and significant erosion of the humeral head (both left shoulder).

From this background info, I have two very different questions:

1) How do I respect my own pain levels while still being a competent teacher? I went in to teach one day and was in such pain that I truly felt that I should not have been there. Simply raising my arms over my head was painful. This was only my fourth time teaching a large group class at the YMCA and it felt like the worst class I had ever taught. During Savasana I prayed that my students forgave me for my lacking class and that I could also forgive myself. My confidence was also injured a bit by negative feedback by one of the students after that class. She wanted something more vigorous and I was not able to give that. How can I meet my student's needs while I am in pain? Do I need to figure out how much pain is too much pain to teach or can I keep teaching but modify?

2) After I got the diagnosis of my shoulder I was told I would need a shoulder **replacement**, eventually. About a month later I got x-rays of my knees because I became frightened that all of my painful joints were deteriorating just like my shoulder. The x-rays did show signs of erosion in my knees and the doctor said 'you're just buying time'. To me this meant that eventually I would be looking at **knee** replacements as well. Since visually seeing the MRI of my shoulder and the x-ray of my knees, I cannot get the visual image of my joints deteriorating out of my head. In my past, I would direct my energy toward visualizing the body healing and repairing itself. Now I cannot help but see erosion. My hope has been severely compromised as well. I try not to think about the future much because it is too hard not to think negatively. So I am staying present but with little positive thinking and/or hope. I think that this energy may be hurting my physical state as well. Any suggestions for prayer, meditation or asking for guidance. Thank you for all of your help.

Answer:

1. First of all get a student to be doing demo. for you regardless of the level of pain you are in. Do not show movements yourself. Rather have one of your more motivated students at the front of the room and use them. They will benefit more too. Also be frank with students one will respect you more if you are telling the truth. Accept your rheumatoid condition and show them that it is best not to do asana while you teach it because you cannot pay attention to your own feelings. You do not know when you are in pain when you are teaching. I would not expect you to be able to. Besides they know you are in pain, they need a role model to show how to handle it by being a Yogini, not a push through it role model. Be truthful you will be amazed at what happens from holding onto that. Satyagraha - holding onto the truth, that was Ghandi's motto.

2. As far as prayer goes, i would recommend you send email to prayers@ananda.org that is Ananda Ashram in Calif. affiliated with the famous Paramahansa Yogananda. They regularly pray for anyone wishing it for themselves or others. Miracles have been known to occur through their interventions. For getting yourself into a deeper state with meditation, I would recommend sitting

and putting yourself in God's hands if you are religious and if you are spiritual do what you can to go beyond your mind. If you need help in that regard read Yoga Sutras chapter 2 regularly for guidance. namaste Mukunda

Question- posted March 21, 2003

I have an 84 year old women in a weekly yoga class that has had **knee replacement** surgery in both knees, about seven years ago. She is energetic, fit, strong, flexible and very aware of her limitations. She has been a great teacher for me ! I would appreciate any suggestions you can offer that would allow me to offer her something new to her practice. She has 45o bend at the knees, and above average mobility of the hip. Transition from poses offers a challenge for her, specifically moving form the floor to standing and vice versa. We make use of a chair for Child pose and as a prop for other standing poses. I think any suggestion you could offer that would take her practice to a new place would be beneficial. Regards, Susan

Answer:

I think this student has done a great job with maintaining her body. Keeping the hip joint flexible is a tremendous factor for stabilizing the knees and the lower back. I would suggest that you focus her attention on strengthening her hip flexor muscles. Those are the psoas, rectus femoris and also include the adductors. I would suggest Warrior II, bridge (standard and knees squeezing together), chair pose (Utkatasana), and dynamic runner or lunge pose (SYT pg. 162) in which you inhale and raise pelvis then exhale and lower the pelvis repeatedly to both tone and release the hip flexors (if necessary weight can be held by a chair to facilitate this without stress on the forward **knee**). best wishes mukunda

8 - References

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Websites

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|---|---|
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British Association of Surgery for the Knee information on UK replacement practices

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2003 NIH Consensus Development Conference on Knee Replacement

9 – Appendix – Complete Exam Findings for Carol and Caroline

Complete Exam Findings for Carol

Range of Motion (ROM)

Exam Dates		<u>5/26/05</u>	<u>6/22/05</u>	<u>1/13/06</u>
Lower Body Supine Position				
		Left/Right	Left/Right	Left/Right
Ankle				
Dorsiflexion	20 ⁰	22/17		20/20
Plantar Flexion	50 ⁰	67/65		52/55
Eversion	20°	24/30		25/28
Inversion	45°	45/45		47/48
Knee				
Flexion	150 ⁰	125/150		118/152
Extension	0 ⁰	0/0		0/0
Hip				
Flexion-bent knee	135 ⁰ -150 ⁰	134/136		130/145
Flexion-straight knee	90 ⁰	96/98		90/90
External Rotation	45 ⁰	49/56	44/33	48/50
Internal Rotation	35 ⁰	28/28	35/36	35/28
Lower Body Prone position				
		Left/Right	Left/Right	Left/Right
Knee				

Flexion	135 ⁰ -150 ⁰	110/130		110/130
Hip				
External Rotation	45 ⁰	51/50	48/44	50/42
Internal Rotation	35 ⁰	38/24	28/35	38/40
Shoulder				
Extension	50 ⁰	55/45		55/58

Upper Body Supine Position

		Left/Right	Left/Right	Left/Right
Shoulder				
Flexion	180°	180/180		180/180
External rotation	90°	<u>90+/90+</u>		90+/90+
Internal Rotation	80 ⁰	90/75		80/80
5/56/05 - Elbow - 20 degree left, 18 degree right carrying angle present				
Wrist				
Extension	80 ⁰	60/45		80/80
Flexion	90 ⁰	90/90		90/90
Ulnar Deviation	30 ⁰	38/45		60/55
Radial Deviation	20 ⁰	18/28		26/25

Seated Position

		Left/Right	Left/Right	Left/Right
1/13/06 – Right shoulder was very tight. Release was done, should have waited till exam done.				
Shoulder				
Horizontal Adduction	130 ⁰	165/145		126/134
Horizontal Abduction	40 ⁰	75/60		30/55
Neck				
Flexion	45 ⁰	60		40
Extension	55 ⁰	75		58
Lateral Flexion	45 ⁰	31/39		40/42
Rotation	70 ⁰	70/78		49/45

Muscle Tests

Exam Dates	<u>5/26/05</u>	<u>6/22/05</u>	<u>1/13/06</u>
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5/26/05 - Note that the leg length difference observed when standing is less noticeable, almost not measurable, when lying. She perceives as left leg is shorter than the right leg. She wears lifts in her shoes. Pelvic height noted at 4.5" both sides. **1/13/06** – Supine leg length difference is about ¼", right leg appears longer, and is still wearing lifts. This difference is most apparent at the ankle. Heels appear almost even while supine.

Lower Body Supine			
	Left/Right	Left/Right	Left/Right
Ankle			
Dorsiflexion-anterior tibialis	5/4.5		5/5
Plantar flexion-gastrocnemius, soleus	5/5		5/5
Eversion-peroneus longus & brevis	5/5		5/5
Inversion-anterior & posterior tibialis	5/5		5/5
Hip			
Flexion-Rectus Femoris, Psoas, etc	3.5/4		3.5/4
Psoas (isolation)	3/4.5	4/3.5	4.5/4
Sartorius (isolation)	2/3.5	4 / 4	3.5/3
Lower body – Side lying			
	Left/Right	Left/Right	Left/Right
Hip			
External rotation-deep 6	4.5/4.5		5/5
Internal rotation-gluteus medius & TFL	4.5/4.5		5/5
Abductors-gluteus medius	4.5/4.5		5/5
Adductors-gracilis & adductors	4/4		3.8/4
Lower body - Prone			
Knee			
Extension-quadriceps	4.5/4.5		4.5/4
Flexion-hamstrings & gastrocnemius	4/3.5		3.8/3.3 cramping
Hip			
Extension-gluteus maximus & hamstrings	3.5/3.5		3/3.5
Gluteus maximus isolation	4.5/4		5./5
External rotation	4.5/4		4.5/4.8

Internal rotation-gluteus minimus & TFL	3.5/4		4/5 cramping felt on left knee
Spinal muscles			
Lower erector spinae	5		4.5
Upper erector spinae	5		4
Neck extension	5		4
Shoulder - Prone			
Middle Trapezius	4/4		4/4
Extensors-latissimus, teres major, triceps	4/4		3.5/3.8
Abductors-posterior deltoid, m. trapezius	4/4		4.5/4.5
Supine Position	<u>5/26/05</u>	<u>6/22/05</u>	<u>1/13/06</u>
	Left/Right	Left/Right	Left/Right
Shoulder			
Adductors-ant. Deltoid, pectoralis, biceps	4/3.5		5/5
External rotators-p. deltoid, infraspinatus	4/4		2.5/2.5
Internal rotators-latissimus, teres major	4/4		4.5/4.5 recruitment
Flexors-deltoid, pectoralis, biceps	4.5/4.5		4/4.5
Wrist			
Flexors-flexor carpi radialis, ulnaris			4.5/4.5
Extensors-extensor carpi radialis, ulnaris			4.5/4.5
Ulnar deviation-extensor & flexor carpi Ulnaris			5/5
Radial deviation-extensor carpi radialis			5/5
Elbow			
Flexion-biceps brachii			5/5
Extension-triceps brachii			4.5/4.5
Neck			
Flexion-sternocleidomastoid (SCM)	4		6 breath hold
Lateral Flexion-SCM/U. trapezius (same side)	4/4		4/4
Rotation-SCM/U. trapezius (opposite side)	4/4		4/4

Hip				
External Rotation	45 ⁰	60/67	65/75	55/58
Internal Rotation	35 ⁰	45/48	40/42	45/48
Shoulder				
Extension	50 ⁰	48/45		60/70

Upper Body Supine Position				
Exam dates		7/10/05	9/10/05	1/13/06
		Left/Right	Left/Right	Left/Right
Shoulder				
Flexion	180 ^o	155/162	170/170	170/175
External rotation	90 ^o	90+/90+	90+/90+	90+/90+
Internal Rotation	80 ⁰	75/60	80/80	80/80
7/10/05 – carrying angle at elbow measured 9/12				
Wrist				
Extension	80 ⁰	40/48	70/70	70/60
Flexion	90 ⁰	70/70	68/68	87/90
Ulnar Deviation	30 ⁰	36/30	40/42	60/55
Radial Deviation	20 ⁰	18/20	28/25	43/35

Seated Position				
		Left/Right	Left/Right	Left/Right
Shoulder				
Horizontal Adduction	130 ⁰	148/144		130/128
Horizontal Abduction	40 ⁰	54/50		50/42
Neck				
Flexion	45 ⁰	52	55	48
Extension	55 ⁰	68	70	60
Lateral Flexion	45 ⁰	40/40	30/30	50/45
Rotation	70 ⁰	50/52	70/70	60/70

Muscle Tests

Exam Dates	7/10/05	9/10/05	1/13/06

Lower Body Supine			
	Left/Right	Left/Right	Left/Right
Ankle			
Dorsiflexion-anterior tibialis	5/5		5/5
Plantar flexion-gastrocnemius, soleus	5/5		5/5
Eversion-peroneus longus & brevis	5/5		4.5/4.5
Inversion-anterior & posterior tibialis	4.5/5 cramp left		4.5/4.5
Hip			
Flexion-Rectus Femoris, Psoas, etc	2.5/2.2	4/4	3.8/4
Psoas (isolation)	4/4		4.5/4.5 recruitment
Sartorius (isolation)	4/4		3/4
Lower body – Side lying			
	Left/Right	Left/Right	Left/Right
Hip			
External rotation-deep 6	7/10/05 3.5/3.5	9/10/05	1/13/06 3.5/3.5
Internal rotation-gluteus medius & TFL	4/4		4/4
Abductors-gluteus medius	4/4		4/4
Adductors-gracilis & adductors	3.5/3 rite side test caused pain inside left knee		3.5/3
Lower body - Prone			
Knee			
Extension-quadriceps	5/5		5/5
Flexion-hamstrings & gastrocnemius	3/2.5	4/4	3/3
Hip			
Extension-gluteus maximus & hamstrings	5/5		2.5/3 cramping
Gluteus maximus isolation	4.5/4.5		Lifted knee on both sides
External rotation	4/4		4.5/4.5
Internal rotation-gluteus minimus & TFL	4/4		3.5/3.5
Spinal muscles			
Lower erector spinae	3.5	4	2.5
Upper erector spinae	3.5	4	3

Neck extension	3	4	3
Shoulder - Prone			
Middle Trapezius	4/4		4.5/4.5
Extensors-latissimus, teres major, triceps	4/3.5	4.5/4.5	4/3.5
Abductors-posterior deltoid, m. trapezius	4.5/4.5		5/4.5
Supine Position			
	Left/Right	Left/Right	Left/Right
Shoulder			
Adductors-ant. Deltoid, pectoralis, biceps	4.5/4.5		
External rotators-p. deltoid, infraspinatus	4.5/4.5		4.5/4
Internal rotators-latissimus, teres major	4.5/4.5		4/3.5 recruitment
Flexors-deltoid, pectoralis, biceps	4.5/4.5		5/5
Wrist			
Flexors-flexor carpi radialis, ulnaris	5/5		
Extensors-extensor carpi radialis, ulnaris	3./		
Ulnar deviation-extensor & flexor carpi Ulnaris	4/3.5		
Radial deviation-extensor carpi radialis	3.5/4		
Elbow			
Flexion-biceps brachii	4.5/4.5		
Extension-triceps brachii	4.5/4.5		
Neck			
Flexion-sternocleidomastoid (SCM)	5 breaths	12 breaths	5 breaths
Lateral Flexion-SCM/U. trapezius (same side)	4/4		
Rotation-SCM/U. trapezius (opposite side)	3/3		
1/13/06 - Test of Hip flexors and abdominus rectus was done and client was raised intact to a sitting position by pressure exerted above knees while in hip flexion with arms crossed on chest.			

9 - Appendix – And recent technique developments

(1) Biomedical Paper

Bone morphing: 3D morphological data for total knee arthroplasty

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Abstract

Objective

The clinical outcome of a total knee arthroplasty (TKA) is mainly determined by the accuracy of the surgical procedure itself. To improve the final result, one must take into account (a) the alignment of the prosthesis with respect to the mechanical axis, and (b) the balance of the soft tissues. Therefore, morphologic data (such as the shape of the epiphysis) and geometric data are essential. We present a new method for performing TKA based on morphologic and geometric data without preoperative images.

Materials and Methods

The global method is based on the digitization of points with an optical 3D localizer. For the morphologic acquisitions, we use a method based on the registration of sparse point data with a 3D statistical deformable model. To build the mechanical axis, we use a kinematics method for the hip center and digitization of anatomical landmarks for the ankle centers. The knee center is not determined by digitization or kinematics of the knee, as this would not be accurate. The surgical planning relies totally on the soft-tissue balance, which is the key issue for a good kinematics result.

Results

We have used this system for 6 months in a randomized clinical trial involving 35 patients to date. For the first 11 patients that could be measured in the navigation group, the postoperative frontal alignment was within the range of $180 \pm 3^\circ$. Fluoroscopic assessment of the soft-tissue balancing will be performed at the conclusion of an extended 2-year study to evaluate the results from a functional point of view.

Conclusion

Bone Morphing is an accurate, fast, and user-friendly method that can provide morphologic as well as geometric data. We have introduced the important notion of soft-tissue balancing into the intraoperative planning step to optimize the kinematics as well as the anatomy. Therefore, this method should be considered as an alternative to the CT-based method. *Comp Aid Surg* 7:156-168 (2002). © 2002 Wiley-Liss, Inc.

(2) NEWS ARTICLE

Longer-lasting knee joints hailed: A hard-wearing material used in jet engines is providing a new source of long-lasting knee replacements

Younger people are often not given knee surgery because the joints can wear out and patients require subsequent operations which are less successful.

But surgeons say ceramic knee joints last longer than standard implants, which often need replacing after 10 to 15 years.

They claim they offer up to 85% improvement in wear and tear over standard knee implants, which are made out of cobalt chrome.

The Oxinium joints, manufactured by the British company Smith & Nephew, are made of zirconium metal, which is heated, converting the surface to a ceramic.

This means it is more "slippery", reducing the friction with the other part of the replaced joint, which is made of plastic, but still has a strong core.

Pressure

David Whitehurst from Derby was one of the first UK patients to receive an Oxinium joint.

He damaged his knees in a car accident in the 1960s.

He said: "As an engineer I know the importance of maintaining smooth, long-wearing moving parts, and for this reason use the same ceramic component that is in my knee replacement in the engines of racing cars.

"It is interesting that this ceramic is also used in jet engines because it is an excellent heat conductor, and

can withstand huge amounts of pressure and friction.

"It doesn't surprise me that the Oxinium knee made it possible for me to have surgery at a younger age than a traditional implant would allow because it is so hard wearing."

He added: "I'm doing really well and have been able to get on with my life, enjoying working again, driving and walking around with no pain at all since the surgery.

"In fact this new knee works better than my healthy normal knee."

Brittleness

Mr Timothy Wilton, an orthopedic surgeon at Nuffield Hospital Derby and the Derby Royal Infirmary performed Mr Whitehurst's operation.

He said: "This knee replacement addresses one of the most critical issues in orthopedics today, namely that the lower the amount of wear, the longer the implant will last.

"The second issue is the brittle nature of standard ceramic components which can occasionally break, but with Oxinium there is no brittleness.

He added: "We now have a superior implant that is expected to last longer and will allow active, younger patients to benefit much earlier from a replacement knee.

"This in turn will reduce the amount of suffering a patient often experiences due to a painful knee."

More than 30,000 knee replacement operations are carried out every year in the UK.

Mr Roger Smith, secretary of the British Orthopaedic Association said the joint was a recent addition to what was available to UK surgeons.

He told BBC News Online: "It may well last longer because they don't wear at the same rate.

"They need to be shown to be effective in reducing the wear and they last and don't crack and have a low rate of failure "

But Mr Smith warned: "We can't make any judgment on a joint until it's been in use for a good five years."

Story from BBC NEWS: <http://news.bbc.co.uk/go/pr/fr/-/1/hi/health/2983798.stm>

(3) Prosthesis Development

Zimmer Announces Global Launch of Stemmed Tibial Component Designed Specifically For Minimally Invasive Total Knee Arthroplasty

(WARSAW, IN) April 28, 2005— Zimmer Holdings, Inc. (NYSE and SWX: ZMH), a worldwide leader in the orthopedics industry, today announced the commercialization of the first modular stemmed tibial prosthesis that can be assembled within the patient, making it more conducive to minimally invasive procedures. The *NexGen® Minimally Invasive Solutions™ (MIS™)* Tibial Component, which was earlier this year cleared for use in the United States, was designed specifically for use in minimally invasive procedures, although it can also be used in traditional surgical approaches for total knee arthroplasty.

"This important new product reaffirms and strengthens our leadership position within the minimally invasive knee segment," said Ray Elliott, Zimmer Chairman, President and CEO. "This product is an industry first— total knee components specifically designed to be assembled within the patient in order to further optimize minimally invasive total knee procedures. These new tibial plates add depth and scope to our minimally invasive tibial plate offering. The new implant, in combination with the *MIS* friendly *NexGen* 4-pegged Tibial Plate, clearly demonstrates Zimmer's leadership position in minimally invasive total knee instrumentation, surgical technique development and implant design." The design of the *NexGen* 4-pegged Tibial Plate was based on Zimmer's Miller/Galante Tibial Plate, giving it a 20 year history of clinical success.

Minimally invasive techniques utilize instruments that are specifically designed for the technique; however, the implants used are often the same as those used in a traditional procedure with an open exposure. Zimmer believes that the additional benefits of the new implant design will further facilitate the minimally invasive procedure.

The new implant is designed to be used with all Zimmer *MIS* Total Knee Procedures and is particularly well suited for use with the Zimmer *MIS Quad-Sparing™* Total Knee Procedure, a technique designed to avoid the quadriceps tendon and muscles rather than cutting through or manipulating them. The quadriceps mechanism is involved in extending the lower leg at the knee joint. When compared to traditional total knee replacement techniques, the *Quad-Sparing* Technique is accomplished through a smaller and less

conspicuous incision, and produces less tissue trauma. Patients typically require a shorter hospital stay, and experience a faster improvement in range of motion.

One of the design elements that allows the implant to accommodate a smaller exposure is the low profile and length of the keel. The subsequent reduced keel length allows the implant to be inserted into the joint through a smaller opening. After the implant has been fixed in place on the proximal tibia, a stem extension can be dropped down through the plate.

According to Alfred J. Tria, Jr., M.D., a developer of the *Quad-Sparing* Technique, an orthopedic surgeon at Saint Peter's University Hospital, and a clinical professor of orthopedic surgery at Robert Wood Johnson Medical School in New Brunswick, New Jersey, "The *MIS* stemmed tibial plate will allow us to insert the component within the confines of the small incision for quadriceps-sparing knee replacement with greater ease."

About the Company

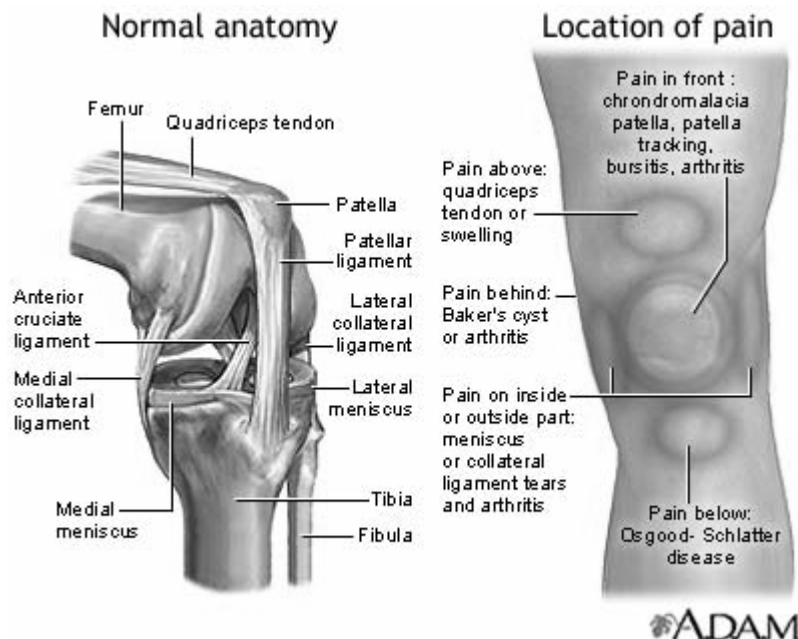
Founded in 1927 and headquartered in Warsaw, Indiana, Zimmer is the worldwide #1 pure-play orthopedic leader in designing, developing, manufacturing and marketing reconstructive and spinal implants, trauma and related orthopedic surgical products. Zimmer has operations in more than 24 countries around the world and sells products in more than 100 countries. Zimmer's 2004 sales were approximately \$3 billion. The Company is supported by the efforts of more than 6,500 employees worldwide.

Visit Zimmer on the worldwide web at www.zimmer.com

(4) Related Anatomy Illustrations

Medical Encyclopedia

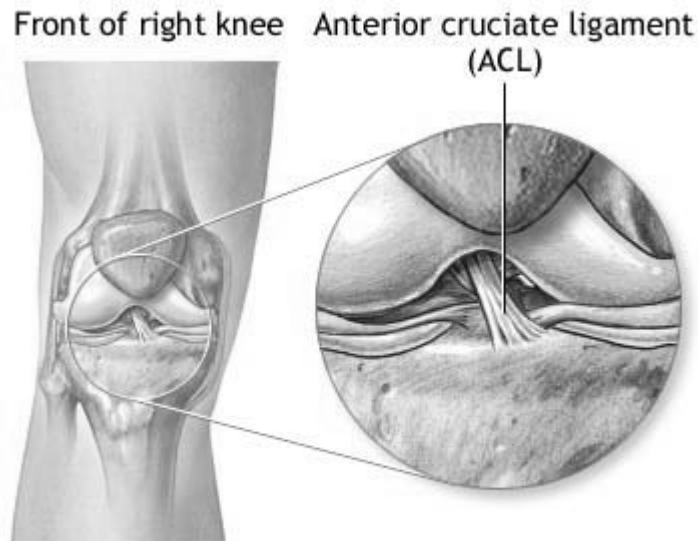
Knee pain



The location of knee pain can help identify the problem. Pain on the front of the knee can be due to bursitis, arthritis, or softening of the patella cartilage as in chondromalacia patella. Pain on the sides of the knee is commonly related to injuries to the collateral ligaments, arthritis, or tears to the meniscuses. Pain in the back of the knee can be caused by arthritis or cysts, known as Baker's cysts. Baker's cysts are an accumulation of joint fluid (synovial fluid) that forms behind the knee. Overall knee pain can be due to bursitis, arthritis, tears in the ligaments, osteoarthritis of the joint, or infection. Instability, or giving way, is also another common knee problem. Instability is usually associated with damage or problems with the meniscuses, collateral ligaments, or patella tracking.

Medical Encyclopedia

Normal knee anatomy



ADAM.

The ligaments which attach the upper leg bone (femur) to the large lower leg bone (tibia) create a hinge joint called the knee. The anterior and posterior cruciate ligaments are 2 short, strong ligaments which criss-cross each other in the middle of the joint.

The structure of a joint

Joints, particularly hinge joints like the elbow and the knee, are complex structures made up of bone, muscles, synovium and cartilage and ligaments, designed to bear weight and move the body through space. The knee consists of the femur (thigh bone) above, and the tibia (shin bone) and fibula below. The patella, or kneecap rides on top of the lower portion of the femur and the top portion of the tibia. The muscles and ligaments connect these bones and the space between them is cushioned by fluid-filled capsules (synovia) and cartilage. When muscles are exercised, they pull on the bones, strengthening them. The range of motion of a joint represents how far it can be flexed (bent) and extended (stretched).

Update Date: 7/3/2004

(5) Itemized Related Areas from MedlinePlus

- Knee arthroplasty see [Knee joint replacement](#)
- [Knee arthroscopy](#)
- [Knee cap dislocation](#)

- Knee injury - anterior cruciate ligament (ACL) see [Anterior cruciate ligament \(ACL\) injury](#)
- Knee injury - lateral collateral ligament (LCL) see [Lateral collateral ligament \(LCL\) injury of the knee](#)
- Knee injury - medial collateral ligament (MCL) see [Medial collateral ligament \(MCL\) injury of the knee](#)

- Knee injury - meniscus see [Meniscus tears](#)
- Knee injury - posterior cruciate ligament (PCL) see [Posterior cruciate ligament \(PCL\) injury](#)
- [Knee joint replacement](#)
- [Knee Microfracture Surgery](#)
- [Knee pain](#)
- Knee scope, Arthroscopic lateral retinacular release see [Knee arthroscopy](#)
- Knee swelling see [Joint swelling](#)
- [Knock knees](#)

Indications

Knee joint replacement may be recommended for:

- [knee pain](#) that has failed to respond to conservative therapy (including medication, injections, and physical therapy for 6 months or more)
- knee pain that limits or prevents activities of importance to the patient
- [arthritis](#) of the knee
- decreased knee function caused by arthritis
- [inability to sleep](#) through the night because of knee pain
- some tumors involving the knee

Knee joint replacement is usually not recommended for:

- current knee infection
- poor skin coverage around the knee
- [paralysis](#) of the quadriceps muscles
- severe [peripheral vascular disease](#) or neuropathy affecting the knee
- severe limiting [mental dysfunction](#)
- terminal disease (metastatic disease)
- morbid obesity (over 300 lb.)