



**WHY KNEE AND HIP REPLACEMENT MAY  
NOT BE ALL IT'S CRACKED UP TO BE**

**10 RARELY DISCUSSED FACTS ABOUT JOINT REPLACEMENT SURGERY**

Knee and [hip replacement surgeries come with many risks and complications](#). Several years ago we queried the National Sampling System for Medicare and found that in the year 2008 alone, there were 17,500 [serious complications related to knee replacement surgery](#) resulting in 5,000 patient deaths.

If joint replacement is something you are considering, please take the time to read this report. These 10 facts come from the Regenexx website. Our goal is to provide information that will help you make the right choice for you.

## 1. Pain Levels Higher Than Patients Expect Following Knee or Hip Replacement

Hip and knee replacements are performed every day, so it seems they must work very well; after all, we perform over 1 million of these procedures annually in the U.S., they're FDA approved, and joint replacement devices are covered by every insurance company. [While there is data from various studies, a large study looking at long-term data was very disappointing. In fact, it argued that we should be looking at alternatives for knee replacement.](#) According to the study author, only those with enduring pain at night or with weight bearing, particularly just with normal walking, should consider knee replacement. The author also commented that major attention should be given to research for nonsurgical knee replacement alternatives.

Knee arthritis is caused by the wearing down or degeneration of the cartilage that lives inside and cushions the joint. The problem with [knee arthritis is that you can't typically tell if it's causing pain just by looking at the patient's X-ray or MRI.](#)

Knee replacement is one option to treat arthritis. However, [many patients surprisingly have pain after a knee replacement, with one study showing a 5 out of 10 as the most common pain score following a knee replacement!](#) Yet most patients who make the drastic decision to get a knee or hip replacement do so because they believe it will fix the vast majority of their pain. In reality, there are many research studies showing that only a small minority of patients experience no more pain.

[Back pain, for example, can have an impact on your knee, and, therefore, on the outcome of your knee replacement.](#) In one study, 54% of patients who underwent knee replacement also had low-back pain. These patients had poorer function and outcomes following their surgery than those who didn't have back pain. Our modern orthopedic surgeons are so overspecialized today that looking outside of the joint for the true pathology of the pain simply isn't in their wheelhouse. The research simply doesn't support considering our joints as individually functioning units; they are part of and connected to a whole functioning body.

[One study highlighted one way to tell if your knee arthritis is actually the cause of your knee pain.](#) A numbing medication was injected into the knee. If the patient experienced relief, it was likely the knee causing the pain; if the patient had no relief, the knee was not the problem. Interestingly, almost one-third of patients did not experience any relief following the injection. Typically, a knee replacement is determined based on exam and X-ray, but the pain source cannot be ruled out this way. In one-third of the knee-arthritis patients in this study, without numbing injections, the assumption would be the arthritis was the source of their pain.

[The importance of the early detection of arthritis was indicated in another study.](#)

Researchers took X-rays of over 500 patients every five years. Women in their 50s with mild to moderate arthritis on X-ray (KL grade 1 or 2) had about a fifty-fifty chance of needing a knee replacement 15 years later. Women in their 50s who had no arthritis on X-ray had about a 1 in 100 chance of needing a knee replacement 15 years later. Interestingly, most of the women who, by year 15, did have to have a knee replacement didn't have either moderate or mild arthritis at the start of the study. What does this indicate? Yet again, the reason for pain should not be diagnosed based on the results of X-ray or MRI images.

[Another study showed that 44% of knee replacement patients and 27% of hip replacement patients continued to experience persistent, chronic pain, even at three and four years following their surgery.](#) Additionally 15% of these patients reported severe to extreme persistent pain. The researchers stated that pain located elsewhere was associated with the pain after surgery. Interestingly, however, they attributed this to the patient's pain tolerance, saying, "The association between the number of pain problems elsewhere and the severity of persistent postsurgical pain suggests that patients...may have an underlying vulnerability to pain," rather than taking the more obvious stance—that the hip or the knee may never have been the source of the pain in the first place.

Seventy-seven percent of the patients with knee replacements in this study described their pain as numbness, meaning their pain was more likely caused by a pinched nerve in the low back, not the knee. [This falls in line with the data showing that nerve issues, or sciatica, lead to arthritis and pain, not vice versa.](#) This means that our traditional medical practitioners aren't connecting patients' knee pain with nerve issues, focusing instead primarily on the joint. Researchers also found that major depression in patients with pain after a knee replacement was more common than in those without pain, which would make sense if a patient is still in chronic pain.

Worth mentioning here as well, is the link established between [diabetic patients and chronic pain following a joint replacement.](#) In this study, 5 out of 19 patients with previously diagnosed diabetes still had persistent pain at one to two years following their joint replacement, while only 13 out of 115 patients without diabetes still had pain. In addition, [patients who are heavier or overweight and have metabolic syndrome experience more pain following hip and knee replacements.](#) These findings should allow physicians to identify diabetes and other metabolic issues as risk factors for joint replacement and allow these patients to make better informed decisions.

There are many more study conclusions regarding knee pain still being present following a knee replacement, and we've listed a few of these below:

- A study using patient questionnaires found that out of [272 patients who had undergone knee replacement, 107 patients \(almost 40%\), at least one year following the surgery, reported persistent pain.](#)
- In a study on 1,700 knee replacement patients, [researchers discovered that at five or more years after knee replacement, 54% still had knee pain,](#) and in 87% of these patients, this knee pain developed after surgery and during those first five years.

- Another study looked at [pain complaints by 100 patients at four to six months following their hip or knee replacement](#). This is the time that maximum improvement should be achieved according to most surgeons. Regrettably, 67 percent of patients with hip replacements and 89 percent of patients with knee replacements were still in pain. The link above shows a good graph visual of this pain.
- [Chronic kneecap, or patellar, pain, according to one study, is also a common result of knee replacement](#), with 1 in 10 patients reporting this problem. This link also shows many additional studies showing kneecap pain in knee replacement patients.
- Researchers in a study on 2,400 patients with arthritis concluded that [only half of knee or hip replacement patients have significant improvement](#) in not just pain but also mobility one to two years after the surgery. Interestingly, nearly 83% of these patients had at least two problematic joints (knees or hips), and it is estimated that 25% of joint replacement patients will undergo another replacement within two years.
- Another study on nearly 2,000 patients who had undergone [knee replacements one year prior found that 47% began taking analgesic, or pain, medications](#) (e.g., Tylenol, Advil, etc.) within the year following their surgery; 9% began taking nerve medications, and 6% began taking narcotic drugs.
- Expanding on pain medication, [another study showed that patients who have had knee or hip replacement were more likely to develop an addiction to narcotics](#) (e.g., hydrocodone, oxycodone, etc.).

[Severe, persistent joint pain, despite the expectation that joint replacement will fix it, is very common](#), and based on our experience, an inaccurate diagnosis of the pain source prior to surgery seems to be the likely cause.

Conclusion: It's disturbing that we've seen so many patients with pain in the hips and knees who've been told they need joint replacement because their X-rays show arthritis. And as you now know, many times this simply is not the source of their pain—the pain is coming from somewhere else and is being referred to the hip or knee. A knee or hip replacement isn't going to do these patients any good when these joints aren't the source of that pain. This explains the continued pain following a knee or hip replacement. Nonsurgical options are available in regenerative medicine that can often not only help the knee pain but also trace down the true pathology of the problem causing the pain. Referred pain is discussed more in depth in [our book Orthopedics 2.0](#).

## 2. Younger Patients Have More Pain Than Older Patients Following Knee or Hip Replacement

As mentioned in topic 1, the biggest reason patients give for deciding on a knee replacement is pain, yet [pain is the most common complaint following a knee replacement](#). Unfortunately, there are not only patients undergoing joint replacement who are disabled by their knee pain but also those who have only mild symptoms, particularly younger patients. We have many blog posts on our website sharing the issue of [joint replacement device manufacturers targeting their advertising at a younger and more active population that has knee pain](#). TV commercials and magazine ads for these devices show young people living active lives following their knee or hip replacement. In fact, with hip and knee arthritis rates soaring in younger people, these device manufacturers have found a bigger market than in younger people than in the elderly.

On the surface, it may seem that having a knee replacement at a younger age will give you a better chance at less pain; however, the opposite is true. [Younger patients getting a knee replacement are more likely to have more pain after surgery](#). Since these younger patients experience greater pain, [research also shows that younger patients need more drugs \(e.g., narcotics, analgesics, nerve meds\) to relieve the pain](#).

Partial knee replacements fair no better. The advertising promises improved outcomes with a less invasive surgery—a partial rather than a total knee replacement, in which surgeons replace only one part of the knee, typically the outside or inside compartment. [One study showed early failure in some partial-knee-replacement prostheses, bone loss around the device, and, most disturbing, higher revision rates in younger patients, with only 85% lasting five years](#).

Another study compared the [outcome scores and arthritis severity in younger knee replacement patients](#) (age 55 and younger) and older knee replacement patients (age 65–70). More severe arthritis was seen in the older patients; however, lower outcome scores, particularly more pain, was reported in the younger patients. Why? Younger patients are more active and, therefore, put more stress on their knee replacement. These devices are designed for older people who aren't as active, whose heaviest activity may only be a brisk walk. If a younger patient has a need for an early knee replacement, this can also mean that there are [systemic issues that may be causing degeneration of the joint](#). This can predispose these younger patients to a less favorable outcome. Lastly, [the original pain may not have even originated in the knee](#).

What does all of this lead to your younger joint-replacement patients? [High rates of dissatisfaction following joint replacement according to one study](#), which concluded dissatisfaction rates as high as 59%.

Conclusion: [If you are a younger patient experiencing only mild knee pain, seek nonsurgical alternatives to relieve your symptoms](#), such as the Regenexx-SD procedure. At six months following the Regenexx knee procedure, greater than 50% of knee patients who responded reported greater than 50% relief, and the percentage of patients reporting greater than 50% relief increases over time, up to over 60% of patients at 36 months following the Regenexx-SD procedure.

### 3. Activity Levels Lower Than Patients Expect Following Knee or Hip Replacement

Many patients are optimistic that they will achieve high levels of physical activity following a knee or hip replacement. Knee and hip replacement manufacturers place ad after ad showing people biking, climbing mountains, and generally participating in high levels of activity now that they have a new joint. There is a big problem with this: [most patients simply don't experience this level of activity after a knee or hip replacement.](#)

One study compiled the results of 17 studies, analyzing activity levels following hip replacement. The studies that were included looked at [activity levels prior to hip replacement and up to one year following the surgery.](#) Researchers concluded, "There is no statistically significant difference in physical activity levels before and up to one year after unilateral primary total hip replacement."

So, as another study shows, [if you weren't jogging before your hip replacement, you probably won't be jogging after your hip replacement.](#) Reasons patients gave for not being able to increase their activity: pain, decreased range of motion, anxiety, low back or knee pain, and muscle weakness. Interestingly, only 70% of patients who jogged before their hip replacement were able to continue doing so after. Some patients experienced decreased activity levels.

In a study on 80 patients who had undergone knee replacement, researchers recorded the activity-level expectations of these patients prior to their surgery. They followed up with these patients one year following their surgery and found that the [high levels of physical activity expected by the patients prior to surgery never materialized after the knee replacement.](#)

In another study on activity level following these surgeries, researchers used an accelerometer device to measure how active patients were versus how active patients thought they were. The result? [Activity levels didn't increase following their joint replacement.](#) So if you weren't running or climbing mountains before your joint replacement, don't expect you will after your surgery. Perhaps the chronic pain many patients still experience after their surgery is a barrier to activity. Or perhaps patients became accustomed to being sedentary, and without a great deal of effort to change that, they just continue to be inactive. The reasons may vary, but whatever they are, the activity outcomes following joint replacement generally aren't what patients expect and what the ads lead them to believe.

The big eye-opener here is a study that concluded that only [1 in 20 patients who have knee replacement achieve a normal range of activity.](#) This study went a step further, actually having patients wear activity trackers to compare what the patients thought their activity level would be after their joint was replaced to what their activity level actually was. The result was disturbing: only 5% (1 in 20) or less achieved activity levels approaching normal!

Conclusion: Multiple studies show that the medical research does not support the post-joint-replacement activity levels shown in those flashy TV and magazine ads. Amputating a joint and replacing it with an artificial one is a massive surgery. Before you make this decision, research the medical literature. Don't make this decision based on an ad you saw in a magazine while waiting in the grocery-store checkout line.



#### **4. Heart Attack Risk Dramatically Increases Following Knee or Hip Replacement**

There is an increased incidence of [heart attacks seen with knee and hip replacement surgeries](#). The study covered at this link shows that in patients aged 60 and up, during the two weeks following a hip replacement, they were 25.5 times more likely to have a heart attack. Those who had knee replacements were 31 times more likely to experience a heart attack. In addition, [men are at an even greater risk for a heart attack following a joint replacement](#), with one study showing men at a 79% increased risk of a heart attack.

Why are these heart attacks happening? When you completely excise a joint, there is severe trauma to the blood vessels and bone marrow space. This trauma likely leads to a higher risk of blood clots that can travel to the heart and obstruct the arteries. In addition, for some patients the stress of undergoing the joint amputation may be enough to induce a heart attack.

Conclusion: Avoiding a knee or hip replacement lessens your risk of a heart attack, especially if you are a man or over the age of 60.

#### **5. Bleeding Stomach Ulcers Significantly Increase Following Knee or Hip Replacement**

[One study concluded that there is a significant risk for bleeding stomach ulcers after a knee or hip replacement](#). Researchers reviewed a Danish registry of hip and knee replacement patients. They found that stomach bleeding increased six-fold after a hip replacement. They also found a two- to three-times increase in stomach bleeding after a knee replacement. These elevated risks lasted for 6 weeks in patients who had knee replacements and 12 weeks in the patients who had undergone hip replacement.

Conclusion: Avoiding a knee or hip replacement and considering other treatment options eliminates your risk of bleeding stomach ulcers due to a joint replacement.

#### **6. Metal Ions Found in the Blood Following Knee or Hip Replacement**

[Our website shares known knee replacement complications surrounding wear particles](#). Wear particles are microscopic pieces of [metal, ceramic, or plastic that break off the knee or hip prosthesis and irritate the local tissues and/or enter the bloodstream](#).

These issues are more significant now that [new partial or resurfacing knee and hip replacements are becoming popular](#), as these new devices need to be metal to withstand the additional stresses placed on smaller parts. Additionally, despite patients expecting a 15-year lifespan on their smaller metal devices, in 2013 the New York Times reported that it was known by Johnson and Johnson that 40% of the hips DePuy, its orthopedic medical-device company, was making would fail within 5 years! These early failures were discovered by a UK registry.

While the trend toward computer-assisted minimally invasive hip and knee replacements or knee and hip resurfacing may represent smaller surgeries, these hip and knee devices are metal, and this means potentially more metal ions in the blood. The research seems to point in the same direction when looking at what implanted metal does to the body: [knee replacement patients have higher levels of a variety of metals in their blood](#). For example, the following studies support the findings of [metal ions in the blood following joint replacement \(read them in more detail at this link\)](#):

- Austrian researchers discovered that there was a direct correlation between the amount of metal ions found in the blood and the size of the joint replacement device.
- A group of Italian researchers discovered more metal ions in patients whose knee replacement device had become loose. How can this happen? In some patients, the device may not seat tightly enough or may have trouble binding to the bone. This loose device can cause more wear and tear, leading to more shavings of metal particles.
- German researchers discovered a precipitous increase of metal ions in the blood following knee replacement. Another group of German researchers found higher levels of specifically cobalt and chromium in knee replacement patients when compared to patients who never had the surgery.

[What about the other hip replacement device materials?](#) Is it safer to go with a nonmetal-on-metal device instead of metal-on-metal, for example, ceramic-on-metal, for a joint replacement? Not really. [Wear particles are found in all hip replacement devices](#).

[Researchers in one study evaluated the levels of titanium, chromium, and cobalt, in the blood](#) of patients who had undergone hip replacement with the titanium modular neck system device. These devices led to similar increases in titanium, chromium, and cobalt as metal-on-metal devices by the end of the first year following the surgery. Interestingly, by two years postop, the metal-on-metal device had a slightly lower level of titanium in the blood. The nonmetal-on-metal device actually raised metal levels in the blood more than the device it was replacing!

In 2012 Stryker, who manufactures the titanium modular neck system, had to recall their devices as shards of metal had been discovered in patients who received these implants. Patients with these implants have experienced tissue inflammation around the device, failures of the device, bone death, and many other issues, and lawsuits are pending. Many other device manufacturers have had similar recalls.

Polyethylene and ceramic are other joint replacement device options. Cross-linked polyethylene wears more slowly, so it's the polyethylene device of choice; however, when it does wear, [it causes cartilage tissues in the knee to inflame and break down into a much more toxic stew of chemicals](#). [Ceramic-on-metal devices, when compared to other types of joint replacement devices](#), have been shown to have twice as many adverse effects due to the device.



Researchers in another study, over a five-year period, compared [metal ion levels in the bloodstream of patients whose metal-on-metal hip replacement devices](#) had large-diameter femoral heads. They measured titanium, chromium, and cobalt. Disturbingly, the metal ion blood levels, cobalt especially, continued to rise over the five years. Additional findings included adverse reactions attributed to metals found in the tissues surrounding the device, revisions of the joint replacement, and, even a pseudotumor, in one patient, was being followed.

Conclusion: While we don't know the long-term implications of these higher serum metal concentrations in knee and hip replacement patients, obviously, high levels of metal in the blood is not a good thing. And the alternatives being used to attempt to eliminate the wear creating these hazardous metal ions are creating their own toxic mix of wear particles. The bottom line is [there is no true safe hip replacement option right now](#), which should concern anyone considering having this invasive surgery.

## 7. Allergies to Artificial Joint Device Following Knee or Hip Replacement

The past few years, we have seen numerous studies showing that [the materials used in knee replacement devices can cause allergies](#). Now, we're learning that just being an [allergic person \(having an allergy to anything, such as jewelry or pet dander\) can be an indicator that you may have more pain following a knee replacement](#), likely due to an allergy to the metal used in the knee replacement device.

A few years ago, this idea, that patients could possibly be allergic to the metal or other materials used in knee or hip prostheses, began to circulate. These allergies can cause chronic pain, loosening of the device leading to the inability of the device to bond with the bone around it, and even chronic inflammation as the body tries to "fight off" the "foreign" object (the artificial joint).

Another study demonstrated that [two-thirds of patients with hip or knee replacement had allergies to some component of their joint replacement device](#). The most common allergies to metals was the focus of the study. In topic 6 above ("Metal Ions Found in the Blood Following Knee or Hip Replacement"), we explained the problems with wear particles in joint replacement devices and how this is leading to heavy-metal toxicity in the blood as well as reactions in the tissues around the device. Remember, the biggest issue is the [wear particles produced by those metal-on-metal hip or knee implants](#). And this was particularly an issue with those [hip resurfacing surgeries as this is where these devices](#) are most often used. What's surprising in this study is that two out of three patients with hip or knee replacement had positive test results for one or more allergies to the materials used to make the knee or hip device.

Interestingly, it's not just the main knee or hip device you can have allergies to. [There are cement components used to assemble the artificial knee, and we have seen patients with allergies to the cement as well](#).

Conclusion: If you are considering a joint replacement, we highly recommend an allergy test before you sign on the dotted line. We've known for a long time that metal allergies can be a key indicator for the potential for poor results following a hip or knee replacement. But now we're discovering it doesn't stop there. [Having an allergy to anything at all can also be a risk factor for having a joint replacement.](#) Whether you have allergies or not, [there are regenerative medicine options that may be able to help you forego joint replacement surgery](#) all together.

## 8. Hip Fractures Following Knee Replacement

A recent study out of Sweden found that there is a [rise in hip fracture risk throughout the decade following a knee replacement.](#) Researchers followed the “entire Swedish population born between 1902 and 1952.” In those who had knee replacements, the risk for hip fracture before their surgery was low. After knee replacement, there were 3,221 patients who had a hip fracture within 10 years. This reflected a 4% increase in hip fracture risk following knee replacement.

Another recent study showed that [hips are losing bone density after a knee replacement,](#) so could this be causing the increased risk of hip fracture? The study showed that patients who had knee replacement lost more bone on the operated-on side in the head of the femur bone and around the hip in general and lost muscle mass.

Conclusion: We don't yet know if the hip bone loss and fractures are related, and if they are what might be causing it? Poor outcomes, less activity, toxicity from the metals in the knee replacement circulating in the blood, or something else? We don't know, but certainly the bone loss and fracture risks give us yet more reasons to do everything we can to avoid knee replacement.

## 9. Disruption in Hip and Knee Alignment Following Hip Replacement

The artificial parts used in a “new hip” aren't identical to the original parts; therefore, [a hip replacement can disrupt hip and knee alignment.](#) Why? These artificial parts simply don't belong in a hip. The study we reviewed at this link looked at changes in the alignment of the hip and knee following hip replacement. The result? There was an alteration in the tracking of the kneecap following hip replacement, which could lead to a higher risk of knee arthritis. It impacted how the patients walked as well as how the patients functioned in daily activities. Additionally, this could also lead to more chronic issues in the back and the ankle.

Conclusion: Our bodies are originally structured with a finely tuned, millimeter precision. There is no way to perfectly mimic this precision when amputating and removing an original part and replacing it with an artificial part. Even the most minor alignment disruption can cause long-term, lasting effects on other parts of the body.

## 10. Smoking Can Be a Deadly Decision Following Knee or Hip Replacement

[Smokers, according to one study, drastically increase their risks of many different complications following a hip or knee replacement.](#) A large study out of the University of Alabama at Birmingham consisted of 33,336 patients who were cigarette smokers. Researchers assessed the effects of smoking on these patients 30 days after their surgery. Findings included an increased risk of complications at 30 days following hip or knee replacement and a greater risk of death by one year following a hip or knee replacement.

Conclusion: There are many reasons to quit smoking, but if you are considering a major invasive surgery, like a hip or knee replacement, know you could be making a deadly decision if you continue to smoke.

### Conclusion

Knee and hip replacements simply aren't all they're cracked up to be. [With the average cost of \\$50,105 \(in 2014\) for a hip or knee replacement in the United States, this exceeds the average annual income](#) in many states (e.g., Alabama, New Mexico, Pennsylvania—see link for full state list). While ongoing pain, heart attack risks, and other risks and poor outcomes may be your primary concerns, certainly skyrocketing [cost is another big reason to look for a knee or hip replacement alternative.](#)

[Health care, as a whole, in the United States is very expensive, and this is a big problem.](#) With device manufacturers' extreme markups and the state of our medical insurance industry today—high deductibles; outrageous premiums; less and less, it seems, even being covered; and so on—many patients are finding themselves priced out of these surgeries. Even if the surgery is covered by Medicare, the 20% out-of-pocket costs would entirely or, at least, substantially drain the life savings of 60% of retired Americans.

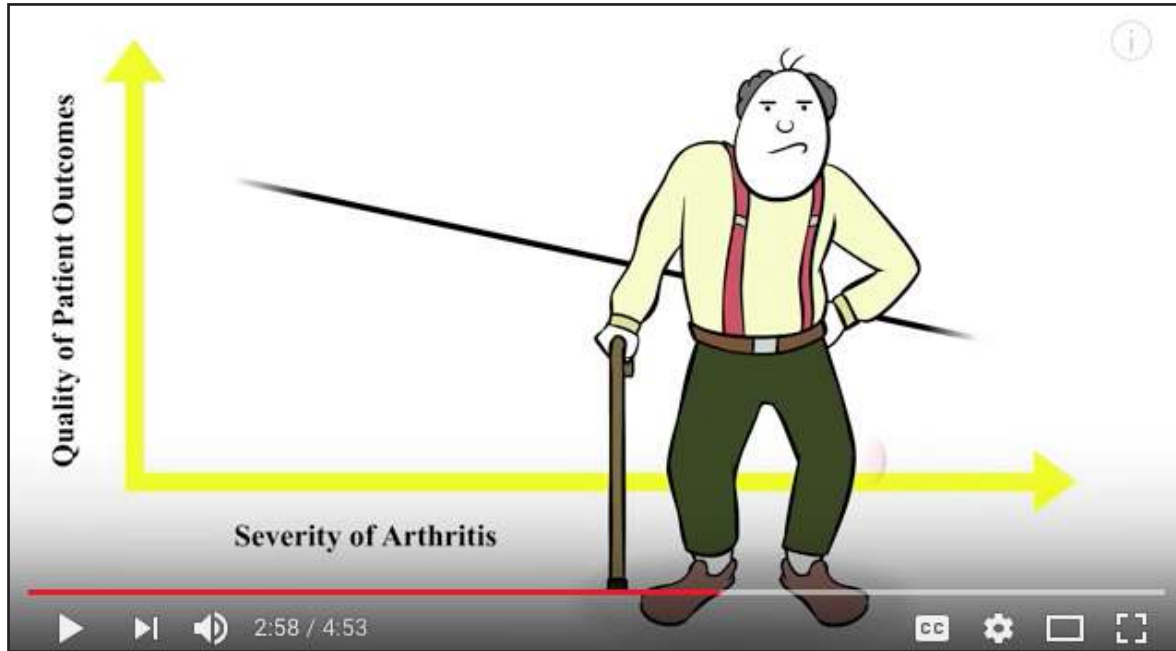
Despite these high costs, patients are undergoing knee or hip replacements that are leaving them not much better off than they were before the surgery. Risks and complications are not only numerous and disturbing (see 1 through 10 above), but just when we think we've uncovered all of them, another study showing an entirely new risk is published. The risks of hip fractures and hip and knee alignment issues (topics 8 and 9), for example, were found in research just published within this past year (as of January 2017). Add these to the risks of hip and knee replacements that we've been covering for many years now—ongoing pain, especially in younger joint replacement patients; activity levels not as expected; wear particles causing metal ions in the blood, allergies to the artificial joint; heart attacks and strokes, and so on—and you can see why it's so important to research other alternatives before making the drastic decision to have your joint amputated and replaced with an artificial one.

With so many possibilities for complications due to joint replacement and costs through the roof, consider Regenexx as an alternative to surgery. Review how the [Regenexx-SD stem cell procedure compares to hip and knee replacements](#). For knees, the same-day stem cell procedure held its own based on the same standardized orthopedic measures used in both groups. For hips, the stem cell procedure, considering it was an injection versus a joint amputation, also did well. We follow our patients in a stem cell registry, and one thing we watch for is how many of our knee stem cell patients must later convert to a knee replacement. The answer? Very, very few. Read more about this in our post [“How Many Stem Cell Patients Convert to Knee Replacement.”](#)

As a hip or knee replacement alternative, the [Regenexx-SD procedure may help alleviate hip or knee pain](#) and the conditions that cause it with an advanced and precise image-guided injection procedure. Patients are encouraged to walk the same day, and most experience little to no downtime from the procedure.

Disclaimer: Like all medical procedures, Regenexx Procedures have a success & failure rate. Not all patients will experience the same results.

**Knee Replacement vs. Stem Cell Therapy - Regenexx**



**Regenexx® is VERY Different - Why Regenexx Stem Cell Treatments are Superior to Other Solutions**







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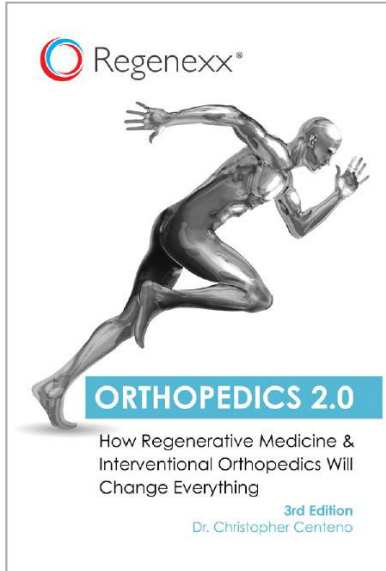
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### Advanced Stem Cell Support Formula, Turmeric Curcumin Complex and Concentrated Pro Omega 3 Fish Oil.

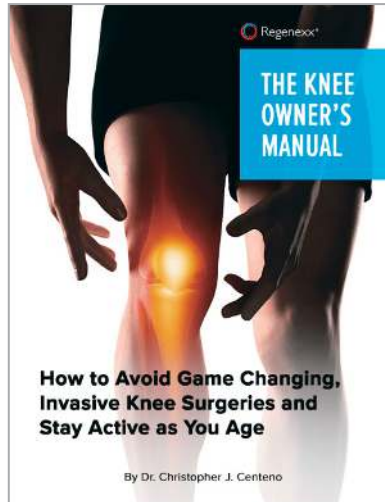


## Orthopedics 2.0

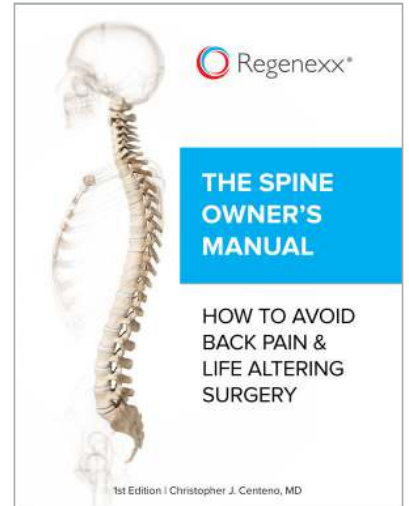
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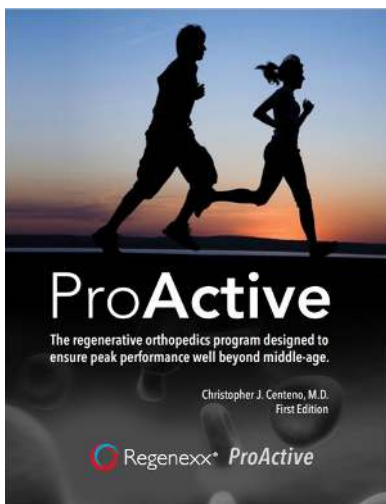
## The Knee Owner's Manual



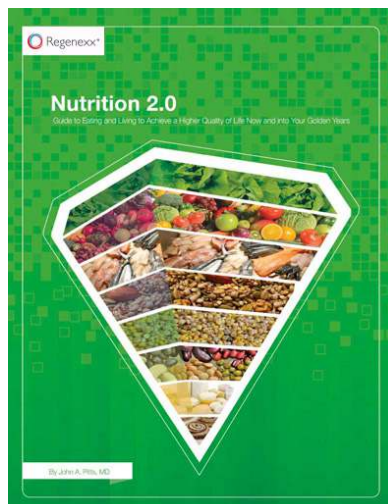
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