Chondroitin sulfate

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Glucosamine and Chondroitin for Osteoarthritis: What You Need To Know  
What is osteoarthritis?  
Osteoarthritis is a degenerative joint disease in which cartilage and other tissues within the joint break down or change in structure. Symptoms can include pain, joint stiffness, swelling, and difficulty in moving the joint. The joints most frequently affected by osteoarthritis include the knees, hips, and hands.  
  
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There is no cure for osteoarthritis, but a variety of treatments and self-management strategies (such as losing weight and increasing physical activity) can help people manage symptoms.  
  
More than 32 million adults in the United States have osteoarthritis. The risk increases with age. Joint injury, obesity, and a family history of osteoarthritis also increase risk.  
  
What are glucosamine and chondroitin?  
Glucosamine and chondroitin are constituents of cartilage, a component of the joints. Glucosamine is a building block for molecules called glycosaminoglycans that are part of the structure of cartilage. Chondroitin is a component of cartilage that plays a role in its resistance to compression.  
  
Glucosamine (as either glucosamine sulfate or glucosamine hydrochloride) and chondroitin (as chondroitin sulfate) are sold in the United States as dietary supplements, separately or together. In some other countries, certain preparations of glucosamine and chondroitin are sold as prescription drugs. In a 2017 U.S. survey, chondroitin (with or without glucosamine) was the dietary supplement most commonly used by people age 35 and older who had been diagnosed with osteoarthritis.  
  
Are glucosamine and chondroitin helpful for symptoms of knee osteoarthritis?  
There has been a substantial amount of research on the use of glucosamine and chondroitin, separately or together, for pain and joint function in people with knee osteoarthritis, but studies have had inconsistent results, and expert evaluations of the evidence have reached conflicting conclusions. It s still uncertain whether glucosamine and chondroitin are helpful for knee osteoarthritis symptoms.  
  
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A 2018 combined analysis of 29 studies in people with knee osteoarthritis (6,120 total participants) showed that global pain was significantly reduced by glucosamine or chondroitin taken separately but not by the combination of the two. The results of individual studies were inconsistent; some pointed to significant benefits, while others did not.  
  
Glucosamine  
  
A 2014 analysis of 25 studies of glucosamine taken alone for knee osteoarthritis (3,458 participants) showed a pattern in the results of individual studies: those who used the prescription drug formulation of glucosamine generally had more favorable results than those who did not. This pattern may reflect genuine differences in the effects of different products, but it could also be a result of bias. Most of the studies of the prescription drug formulation had a high risk of bias because of weaknesses in their study design, were published more than 20 years ago, and were funded by the pharmaceutical company.  
  
Clinical practice guidelines issued by health professional organizations in the United States and other countries differ in their recommendations concerning glucosamine. The guideline published by the American College of Rheumatology (ACR) and the Arthritis Foundation (AF) in 2019 strongly recommended against the use of glucosamine alone or in combination with chondroitin for knee osteoarthritis, stating that the best data do not show any important benefits. Similarly, a 2019 guideline from Osteoarthritis Research Society International (OARSI) strongly recommends against the use of glucosamine for knee osteoarthritis on the grounds of lack of efficacy.  
  
In contrast, the 2021 guideline from the American Academy of Orthopaedic Surgeons (AAOS) includes glucosamine in a list of dietary supplements that may be helpful in reducing pain and improving function in patients with mild-to-moderate knee osteoarthritis, although it cautions that the evidence is inconsistent. A 2019 statement from the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases (ESCEO) strongly recommends prescription crystalline glucosamine sulfate for knee osteoarthritis but discourages the use of other glucosamine formulations.  
  
Chondroitin  
  
A 2019 analysis of 18 studies of chondroitin taken alone for osteoarthritis (3,791 participants), 16 of which were on knee osteoarthritis, showed a significant benefit of chondroitin, but with much inconsistency in the study results. When only studies with a low risk of bias were included in the analysis, there was a significant difference among brands of chondroitin, with a specific pharmaceutical grade preparation showing a greater reduction in pain.  
  
Clinical practice guidelines differ in their recommendations about chondroitin. The 2019 ACR/AF guideline strongly recommends against the use of chondroitin alone or in combination with glucosamine for knee osteoarthritis, and the 2019 OARSI guideline strongly recommends against the use of chondroitin for knee osteoarthritis on the grounds that the evidence is of low quality. However, the 2021 AAOS guideline includes chondroitin in a list of dietary supplements that may be helpful in reducing pain and improving function in patients with mild-to-moderate knee osteoarthritis, although it cautions that the evidence is inconsistent, and the 2019 ESCEO statement strongly recommends prescription chondroitin sulfate for knee osteoarthritis and says that it should be distinguished from other chondroitin products.  
  
Do glucosamine and chondroitin have effects on joint structure in knee osteoarthritis?  
Because glucosamine and chondroitin are components of cartilage, it has been suggested that they might have an impact on joint structure in osteoarthritis, which may be assessed by looking at changes in joint space. Whether glucosamine and chondroitin actually have an effect on joint structure is uncertain. Studies have had inconsistent results.  
  
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Two large 2-year trials of glucosamine and chondroitin for knee osteoarthritis, one in Australia and one in the United States, produced conflicting results for effects on joint space.  
  
The Australian study, published in 2015, included 605 participants who received glucosamine sulfate, chondroitin, both glucosamine and chondroitin, or a placebo for 2 years. The group that received both glucosamine and chondroitin showed a reduction in joint space narrowing. No reduction in joint space narrowing was seen in the groups that received glucosamine alone or chondroitin alone.  
The U.S. study, published in 2008, included 572 participants who received glucosamine hydrochloride, chondroitin, both glucosamine and chondroitin, the drug celecoxib, or a placebo for 2 years. Changes in joint space width did not differ between the placebo group and any of the other groups.  
Two additional 2-year studies that looked at chondroitin alone, one with 622 participants and one with 300 participants, found improvements in joint space in people who were taking chondroitin compared with those taking placebo. However, these findings conflict with those of the Australian and U.S. studies described above, neither of which found a beneficial effect for chondroitin alone.  
  
Are glucosamine and chondroitin helpful for osteoarthritis in other joints?  
There is only a small amount of evidence on glucosamine or chondroitin for osteoarthritis in joints other than the knee. Joints that have been studied include the hip, hand, and temporomandibular joint (the joint that connects the jaw to the side of the head, which is involved in talking, chewing, and yawning).  
  
Hip Osteoarthritis  
  
In 2017, the American Academy of Orthopaedic Surgeons published a clinical practice guideline on management of osteoarthritis of the hip that concluded that moderate strength evidence does not support the use of glucosamine sulfate for hip osteoarthritis. This conclusion was based on the one high-quality study that was identified. This study, published in 2008, included 222 participants, who received 2 years of treatment with glucosamine sulfate or a placebo. Glucosamine was no better than placebo in terms of effects on pain, joint function, or joint structure (assessed as joint space narrowing).  
  
Hand Osteoarthritis  
  
One study with 162 participants has evaluated chondroitin for hand osteoarthritis. In this 6-month trial, hand pain decreased and hand function improved to a greater extent in the chondroitin group than the placebo group.  
  
The 2019 guideline for osteoarthritis management from the American College of Rheumatology and the Arthritis Foundation conditionally recommends chondroitin for patients with hand osteoarthritis.  
  
Temporomandibular Joint Osteoarthritis  
  
A review of 8 studies (538 participants) of glucosamine for temporomandibular joint osteoarthritis was unable to reach definite conclusions about whether glucosamine supplements are helpful for symptoms of this condition. The studies were difficult to compare because they used different methods and different types of glucosamine, and some studies may have been biased. The reviewers did conclude, however, that use of glucosamine for 3 months or more led to reduced pain and improvement in maximum mouth opening.  
  
Are glucosamine and chondroitin safe?  
No major safety problems have been identified in large studies of glucosamine and chondroitin for osteoarthritis. However, glucosamine may cause increases in blood glucose (sugar) levels in some people, and glucosamine and chondroitin have been associated with an increased risk of bleeding in people who are taking the anticoagulant warfarin. Little is known about the safety of using glucosamine and chondroitin during pregnancy or while breastfeeding.  
  
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Acknowledgments  
NCCIH thanks D. Craig Hopp, Ph.D., and David Shurtleff, Ph.D., NCCIH, for their review of the 2023 update of this fact sheet.  
  
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Chondroitin Sulfate  
What is it?  
Chondroitin sulfate is a chemical found in human and animal cartilage. It is commonly used by mouth with glucosamine or other ingredients for osteoarthritis.  
  
Chondroitin sulfate is one of the building blocks of cartilage. In osteoarthritis, the cartilage in the joints breaks down. Taking chondroitin sulfate might slow this breakdown. It is usually manufactured from animal sources, such as shark and cow cartilage. It can also be made in a lab.  
  
Chondroitin sulfate is used for osteoarthritis and cataracts. It is often used together with other ingredients, including manganese ascorbate, hyaluronic acid, collagen peptides, or glucosamine. Chondroitin sulfate is also used for many other conditions, but there is no good scientific evidence to support these uses.  
  
  
How effective is it?  
Natural Medicines Comprehensive Database rates effectiveness based on scientific evidence according to the following scale: Effective, Likely Effective, Possibly Effective, Possibly Ineffective, Likely Ineffective, Ineffective, and Insufficient Evidence to Rate.The effectiveness ratings for CHONDROITIN SULFATE are as follows:Possibly effective for...  
Cataracts. An injectable solution containing chondroitin sulfate and sodium hyaluronate is approved by the FDA to protect the eye during cataract surgery. It is not clear if using it in a different form will help.  
Osteoarthritis. Taking chondroitin sulfate by mouth seems to provide some relief from osteoarthritis pain and improve function. High quality, pharmaceutical-grade products have shown the most benefit. Chondrosulf (IBSA Institut Biochimique SA), Chondrosan (Bioiberica, S.A.) and Structum (Laboratoires Pierre Fabre) are examples of these products.  
  
  
  
There is interest in using chondroitin sulfate for a number of other purposes, but there isn't enough reliable information to say whether it might be helpful.  
  
  
Is it safe?  
When taken by mouth: Chondroitin sulfate is likely safe when used for up to 6 years. It can cause some mild stomach pain and nausea. Other possible side effects include bloating, diarrhea, and constipation.  
When placed into the eye: Chondroitin sulfate is possibly safe when used together with other ingredients in an eye drop.   
  
  
Special precautions & warnings:  
Pregnancy and breast-feeding: There isn't enough reliable information to know if chondroitin sulfate is safe to use when pregnant or breast-feeding. Stay on the safe side and avoid use.  
Asthma: There is some concern that chondroitin sulfate might make asthma worse. If you have asthma, use chondroitin sulfate cautiously.  
Prostate cancer: Early research suggests that chondroitin might cause the spread or recurrence of prostate cancer. This effect has not been shown with chondroitin sulfate supplements. However, until more is known, do not take chondroitin sulfate if you have prostate cancer or are at high risk for developing it (you have a brother or father with prostate cancer).  
  
  
Are there interactions with medications?  
ModerateBe cautious with this combination.Warfarin (Coumadin)Warfarin is used to slow blood clotting. There are several reports showing that taking chondroitin with glucosamine increases the effects of warfarin. This can cause bruising and bleeding that can be serious. Don't take chondroitin if you are taking warfarin.  
  
  
Are there interactions with herbs and supplements?  
GlucosamineTaking chondroitin sulfate together with glucosamine hydrochloride might reduce blood levels of glucosamine. But it's not clear if this will change the effects of glucosamine hydrochloride. It's also not clear if this interaction occurs with other forms of glucosamine, such as glucosamine sulfate.  
  
  
Are there interactions with foods?  
There are no known interactions with foods.  
  
  
How is it typically used?  
Chondroitin sulfate is most commonly used by adults in doses of 800-1200 mg per day, for up to 2 years.   
  
There is concern that some chondroitin sulfate products are not labeled accurately. Some products might contain no chondroitin, while other products might contain more than the amount stated on the product's label. Because of these issues, the effects of different chondroitin products may vary. Speak with a healthcare provider to find out what dose or product might be best.  
  
  
Other names  
Calcium Chondroitin Sulfate, CDS, Chondroitin, Chondroitin Polysulfate, Chondroitin Polysulphate, Chondroitin Sulfate A, Chondroitin Sulfates, Chondroitin Sulfate B, Chondroitin Sulfate C, Chondroitin Sulphates, Chondroitin Sulphate A Sodium, Chondro tine, Chondro tine Sulfate A, Chondro tine Sulfate B, Chondro tine Sulfate C, Chondro tine 4-Sulfate, Chondro tine 4- et 6- Sulfate, Condroitin, CPS, CS, CSA, CSC, GAG, Galactosaminoglucuronoglycan Sulfate, Chondroitin 4-Sulfate, Chondroitin 4- and 6-Sulfate, Poly-(1->3)-N-Aceltyl-2-Amino-2-Deoxy-3-O-Beta-D-Glucopyranurosyl-4-(or 6-), Polysulfate de Chondro tine, Sulfate de Chondro tine, Sulfate de Galactosaminoglucuronoglycane, Sulfates de Chondro tine, Sulfato de Condroitina.  
  
  
Methodology  
  
 To learn more about how this article was written, please see the Natural Medicines Comprehensive Database methodology.   
   
  
  
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