



ChatGPT delivers satisfactory responses to the most frequent questions on meniscus surgery[☆]

Felix Winden^{*}, Markus Bormann, Fabian Gilbert, Boris M. Holzapfel, Daniel P. Berthold

Department of Trauma Surgery and Orthopedics, Ludwigs-Maximilian-University, Munich, Germany

ARTICLE INFO

Article history:

Received 10 January 2025

Revised 16 April 2025

Accepted 13 May 2025

Keywords:

Meniscus

Arthroscopy

Artificial intelligence

ChatGPT

ABSTRACT

Purpose: To examine ChatGPT's effectiveness in responding to common patient questions related to meniscus surgery, including procedures such as meniscus repair and meniscectomy.

Methods: We identified 20 frequently asked questions (FAQs) about meniscus surgery from major orthopedic institutions recommended by ChatGPT, which were then refined by two authors into 10 questions commonly encountered in the outpatient setting. These questions were posted to ChatGPT. Answers were evaluated using a scoring system to assess accuracy and clarity and were rated as "excellent answer requires no clarification," "satisfactory requires minimal clarification," "satisfactory requires moderate clarification," or "unsatisfactory requires substantial clarification."

Results: Four responses were excellent, requiring no clarification, four responses were satisfactory, requiring minimal clarification, two were satisfactory, requiring moderate clarification, none of the answers were unsatisfactory.

Conclusion: As hypothesized, ChatGPT provides satisfactory and reliable information for frequently asked questions about meniscus surgery.

© 2025 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

In our increasingly digital world, many people turn to the internet to seek information about health conditions, including orthopedic issues. For individuals with internet access, the internet is the most frequently utilized source of information regarding health issues. In fact, 61.2% of respondents indicated that they would first turn to the internet for such knowledge, while only 13.3% stated that they would initially consult with a physician [1]. While 5.4 billion people have access to the internet and are able to use online health searches, it becomes essential to assess the quality and accuracy of the information available. One tool that has rapidly gained popularity is ChatGPT, an artificial intelligence language model introduced by OpenAI in 2022, which garnered 100 million monthly users just 2 months after its launch [2] and lately 2.9 billion users monthly in June 2024 [3]. With its ability to generate human-like text based on a vast dataset composed of books, articles, and websites (as of September 2021), ChatGPT offers a new resource for patients seeking health-related information, including orthopedic conditions.

[☆] This article is part of a special issue entitled: 'AI and new technologies' published in The Knee.

^{*} Corresponding author at: Department of Orthopaedics and Trauma Surgery, Musculoskeletal University Center Munich (MUM), University Hospital, LMU, D- 81377 Munich, Germany.

E-mail address: felix.winden@med.uni-muenchen.de (F. Winden).

Meniscus injuries are relatively common injuries with a surgical case rate of 175,000 in Germany alone (2017) or in France with a surgical treatment rate of 170.6/100,000 inhabitants. With ever longer waiting times and shorter contact times with doctors, it therefore makes sense to find out about possible treatment options for the injury on the internet and especially on ChatGPT [4].

Prior research has investigated ChatGPT's responses to queries pertaining to a range of medical conditions, with select studies concentrating on orthopedics, including total hip arthroplasty, anterior cruciate and ulnar collateral ligament reconstruction and rotator cuff repair [5–8]. These studies have predominantly concluded that ChatGPT is capable of providing medically accurate information in the majority of cases.

This study aims to assess how well ChatGPT can respond to common questions that patients may have about meniscus surgery including meniscus repair or meniscectomy. The authors of this study hypothesized that ChatGPT could provide satisfactory and reliable information for patients' frequently asked questions about meniscal surgery.

2. Materials & methods

The study was conducted following a methodology similar to prior research in the orthopedic literature, aiming to evaluate ChatGPT's responses to frequently asked questions (FAQs) related to medical procedures [5–7,9,10]. For the initial step, 20 FAQs were sourced from five major institutions which were recommended by ChatGPT when asked: "Please name a list of the five biggest and most prestigious orthopedic hospitals in the world for meniscus surgery" [11–15]. Two authors specializing in knee surgery reviewed the list and, through a majority consensus, refined it to 10 questions relevant to common inquiries in their outpatient clinic, adapting the wording as needed. The questions were then submitted to ChatGPT on 12th October 2024, using GPT-4 (<https://chatgpt.com>), with each question entered into a new chat instance to avoid any influence from previous interactions. Each response was assumed by its initial query. No ethics committee approval was required for this study. One author independently rated the responses using a scoring system adapted from Mika et al. [6]. This system rated the adequacy of each response (excellent, satisfactory, or unsatisfactory) and the need for clarification (minimal, moderate, or substantial). An "excellent" rating was given for responses that were fully accurate and required no further clarification, while "satisfactory" ratings indicated factually correct responses needing minor or moderate clarification. "Unsatisfactory" responses were marked as such when responses were wrong, unclear or irrelevant. The ChatGPT answers were formatted to make them easier to read without missing content. Introductory remarks and redundant phrases were removed. The general advice to see a physician, which often appeared at the end of each answer, was also removed. All full, unedited responses can be found in the Results.

3. Results

Table 1 provides an overview of the questions asked, their adequacy and the need for clarification. A full list of all 10 questions, responses and analysis is provided below.

Question 1: What are the treatment options for a torn meniscus?

Response:

Conservative Treatment

Rest: Avoid activities that cause pain, swelling, or discomfort. Resting the knee can allow some minor tears to heal on their own.

Ice: Applying ice to the affected knee can help reduce swelling and relieve pain.

Compression: Using a knee brace or compression wrap may help stabilize the knee and reduce swelling.

Elevation: Keeping the knee elevated can also reduce swelling.

Pain Relief: Over-the-counter medications like ibuprofen or acetaminophen can help manage pain and inflammation.

Physical Therapy: A program of stretching and strengthening exercises designed by a physical therapist may help regain knee function and stabilize the joint.

Table 1

Overview of the questions, the adequacy and need for clarification.

Question	Adequacy	Clarification
What are the treatment options for a torn meniscus?	Satisfactory	Moderate
What kind of surgical treatment is better? Partial meniscectomy or meniscus repair?	Satisfactory	Minimal
What are the potential consequences of not undergoing meniscus surgery?	Excellent	None
How is meniscus surgery performed?	Satisfactory	Minimal
How long will I need to stay in the hospital after meniscus surgery?	Satisfactory	Moderate
How long is the recovery time from meniscus repair and meniscectomy?	Satisfactory	Minimal
What is the difference between a meniscus repair and a meniscectomy?	Excellent	None
What are the possible risks or complications after meniscal surgery?	Excellent	None
How painful is meniscus surgery?	Satisfactory	Minimal
How long do I have to wait to drive after meniscus surgery?	Excellent	None

Surgery Treatment

Arthroscopic Meniscus Repair: Surgeons use small incisions and a camera to repair the torn meniscus. This is common when the tear is in a region with a good blood supply (outer edge of the meniscus).

Partial Meniscectomy: If the tear is irreparable, the surgeon may remove the damaged part of the meniscus while leaving as much of the healthy tissue as possible.

Total Meniscectomy: In rare cases where the entire meniscus is damaged and cannot be repaired, a full removal might be necessary, though this can lead to increased risk of arthritis later.

Regenerative Therapy

Platelet-Rich Plasma (PRP) Therapy: This experimental treatment uses the patient's own blood, concentrated with healing factors, to potentially accelerate healing of the meniscus.

Stem Cell Therapy: Stem cells may be injected into the knee in an effort to regenerate the torn meniscus. This is also an emerging therapy still under investigation.

Post Surgical Rehabilitation: After surgical intervention, physical therapy is often required to strengthen the knee, restore range of motion, and support recovery.

Analysis: Satisfactory requiring moderate clarification. All therapeutic options are listed. In the case of surgical therapy, the localization of the rupture and the increased risk of arthrosis with meniscectomy are discussed. With regard to regenerative therapy, ChatGPT points out that both PRP and stem cell therapy are not yet fully established therapeutic procedures, but according to current literature they can lead to a reduction in symptoms [16,17]. However it is misleading that conservative therapy and regenerative therapy are mentioned as respective therapy options, both belong to the conservative/non-surgical therapies. Furthermore, it is not clear from this given answer that conservative therapy is only an option for an already degenerative knee joint without a blockage phenomenon and not for acute ruptures [18–21]. In addition, the recommendation to reduce weight is missing from the conservative measures [22].

Question 2: What kind of surgical treatment is better? Partial meniscectomy or meniscus repair?

Partial Meniscectomy

Involves removing the damaged portion of the meniscus, leaving behind as much healthy tissue as possible.

Advantages:

Quicker recovery: Patients typically recover faster after a partial meniscectomy compared to a repair. **Lower failure rates:** Meniscectomy is less likely to require additional surgeries compared to repairs. **Appropriate for certain tears:** Better for complex, degenerative, or tears in parts of the meniscus with poor blood supply (like the inner two-thirds of the meniscus).

Disadvantages:

Increased risk of osteoarthritis: Removing part of the meniscus can lead to accelerated joint degeneration, as the meniscus is essential for absorbing shock and stabilizing the knee. **Long-term joint health:** Patients might experience more knee problems in the future, including increased risk of osteoarthritis.

Meniscus repair

Suturing the torn meniscus back together to allow it to heal naturally.

Advantages:

Preserves more tissue: Meniscus repair retains the entire meniscus, which can protect the knee from future degeneration. **Better long-term outcomes:** For young, active patients, repairing the meniscus often leads to better long-term function and lower risk of osteoarthritis compared to meniscectomy. **Appropriate for certain tears:** Especially suitable for tears in the outer third of the meniscus (the “red zone”), which has a good blood supply and can heal well.

Disadvantages:

Longer recovery: Repairing the meniscus requires a more extended rehabilitation period, sometimes several months, with more activity restrictions. **Higher failure rate:** Meniscus repairs can sometimes fail to heal properly, requiring additional surgeries.

Which is better?

Meniscus repair is generally preferred if the tear is repairable (especially in younger patients and those with good blood supply to the tear), as it preserves the meniscus and provides better long-term knee function. Partial meniscectomy is a good option if the tear is not repairable (e.g., degenerative tears in older patients) or if a quicker recovery is desired in the short term.

Analysis: Satisfactory requiring minimal clarification. ChatGPT offers an exemplary overview of potential treatment options, taking into account the specific nature of the injury, in particular whether it involves the inner or outer meniscus, as this may influence treatment decisions due to differences in blood supply. Furthermore, superior long-term clinical outcomes are indicated, although this is accompanied by an elevated incidence of revision procedures for meniscus suturing (23% for lateral meniscus, 29.9% for medial meniscus) [23,24]. Furthermore, the potential secondary complications of knee joint arthrosis are discussed, with a reduced risk associated with meniscus suture (80% vs. 44%) [25]. However, the categorization of partial meniscectomy for the inner two-thirds and meniscus suture for only the outer third can be misunderstood. There are also acceptable midterm results for meniscus repair in the red–white zone [26].

Question 3: What are the potential consequences of not undergoing meniscus surgery?

Chronic Pain and Discomfort: A torn meniscus can cause persistent pain, especially during activities that involve twisting or bending the knee. If the tear doesn't heal properly or worsens, the pain may become more frequent or severe over time.

Decreased knee function: A damaged meniscus can affect the knee's stability, making it more difficult to perform activities like walking, running, squatting, or climbing stairs. The range of motion might also be reduced, and you could feel a “catching” or “locking” sensation in the knee.

Increased Risk for Osteoarthritis: The meniscus plays an important role in absorbing shock and distributing weight in the knee joint. Without proper healing or repair, the damaged meniscus can lead to accelerated wear and tear on the cartilage in the knee, increasing the risk of developing osteoarthritis later in life.

Worsening of the tear: A meniscus tear can sometimes worsen if left untreated, especially if the knee continues to experience strain from physical activity. A worsening tear may become more difficult to repair surgically later, requiring more complex procedures or even partial or complete removal of the meniscus (meniscectomy).

Knee Instability: A damaged meniscus can lead to knee instability, making it more prone to further injuries. This can limit your ability to engage in physical activities or sports and could potentially lead to additional damage to other parts of the knee, such as the ligaments or cartilage.

Development of cysts or swelling: In some cases, untreated meniscus tears can cause the formation of cysts or persistent swelling around the knee joint. This can contribute to ongoing discomfort and stiffness.

Prolonged Rehabilitation: If surgery is delayed or avoided, and the knee's function deteriorates over time, rehabilitation may take longer and could be less effective in restoring full function after treatment is eventually sought.

For some individuals, especially with small tears, conservative treatment like rest, physical therapy, or bracing may be enough. However, for others, particularly those with more significant tears or ongoing symptoms, surgery may be the best option to restore function and prevent long-term issues.

Analysis: Excellent Response Requiring No Further Clarification. The answers provide a very good overview of the possible consequences of a meniscus lesion that has not been adequately treated. Even that early treatment within the first 6 weeks after meniscus torn is recommended and that delayed surgery leads to worse outcomes [24]. It is also considered that a possible non-surgical treatment may even be the right choice. Ultimately the decision on operative versus nonoperative treatment should be discussed with the patient's physician, which is recommended by ChatGPT anyway.

Question 4: How is meniscus surgery performed?

Meniscus surgery, often referred to as meniscectomy or meniscus repair, is a procedure to address tears in the meniscus, a C-shaped cartilage in the knee that provides cushioning and stability. Here's an overview of how the surgery is typically performed:

Preoperative Preparation: Consultation: The surgeon evaluates the knee through physical exams, imaging studies (like MRI), and discusses surgical options. **Anaesthesia:** The surgery can be done under general anaesthesia (where the patient is completely asleep) or regional anaesthesia (where the lower body is numbed).

Surgical procedure:

Incision:

- **Arthroscopy:** Most meniscus surgeries are performed arthroscopically. The surgeon makes small incisions (usually 2–4) around the knee and inserts a thin, flexible tube with a camera (arthroscope) to visualize the inside of the joint.
- **Open Surgery:** In some cases, a larger incision may be necessary, especially for complex tears or other knee issues.
- **Meniscus Assessment:** The surgeon examines the meniscus and surrounding structures, such as ligaments and cartilage, for additional damage.
- **Meniscus Repair or Removal:**
 - o **Repair:** If the tear is in a favourable location (the outer part of the meniscus has good blood supply), the surgeon may stitch the torn edges together.
 - o **Meniscectomy:** If the tear is in a part that cannot be repaired or is too severe, the surgeon may remove the damaged portion of the meniscus. The goal is to preserve as much of the meniscus as possible to maintain knee function.

Postoperative Care

Recovery: After the procedure, the patient is monitored for a short time in a recovery room. **Rehabilitation:** Physical therapy may begin shortly after surgery to regain strength and mobility. The duration and intensity of rehab depend on the extent of the surgery. **Follow-up:** Regular follow-up appointments are scheduled to monitor healing and recovery progress.

Risks and Complications

As with any surgery, there are potential risks, including infection, blood clots, stiffness, and failure of the repair, depending on the severity of the tear and the individual's overall health. Overall, meniscus surgery aims to relieve pain, restore knee function, and improve the quality of life.

Analysis: Satisfactory requiring minimal clarification. The entire process from the consultation and imaging to the presentation to the anaesthetist through to the operation and rehabilitation is described very well. It is very well described that almost all operations are performed arthroscopically and only rarely by open surgery. It is mentioned that a resection or suture is performed depending on the findings, but only the outer part is specified as a suture option. As already mentioned in question 2, ruptures in the red-white area also lead to satisfactory results after meniscus repair. Regarding rehabilitation, it should be specified that postoperative weight bearing (full weight bearing vs. partial weight bearing) and the range of motion permitted postoperatively depend not only on the severity of the injury, but also on the surgical treatment selected (meniscal suture vs. meniscal resection). In addition, because postoperative care is mentioned it would certainly be helpful

to inform the patient that the vast majority of meniscus operations are performed on an outpatient basis so that subsequent care at home can be organised preoperatively.

Question 5: How long will I need to stay in the hospital after meniscus surgery?

The length of your hospital stay after meniscus surgery depends on the type of surgery and your overall health. Most meniscus surgeries are done arthroscopically, which is a minimally invasive procedure. Here's a general guideline:

Outpatient Surgery: In most cases, meniscus repair or partial meniscectomy is done on an outpatient basis, meaning you can go home the same day. After the surgery, you'll be monitored for a few hours to ensure you're recovering well from anaesthesia before being discharged.

Meniscus Repair vs. Meniscectomy:

- **Meniscus Repair:** If the torn meniscus is repaired with sutures, you may need to stay a bit longer for monitoring, but it's typically still outpatient. Recovery tends to take longer (up to 4–6 months) due to the healing process.
- **Meniscectomy:** In a partial meniscectomy, the damaged part of the meniscus is trimmed away, and recovery is usually faster (3–6 weeks). Most people go home the same day.

Hospital Stay: A hospital stay might be required only in rare cases, such as if there are complications or if you have other health conditions that require additional monitoring. In such cases, the stay is usually one to two days.

Analysis: Satisfactory requiring moderate clarification. It is well communicated that most procedures are performed on an outpatient basis. It is also clear from the description that the postoperative treatment regime for meniscus suturing is longer than for meniscectomy. However, this information has no connection with the actual question of how long the patient has to stay in hospital. It is even stated that due to a possible meniscus suture it is necessary to stay in hospital longer because of monitoring purposes. The causal justification for this is incorrect. It is absolutely true that there are certain conditions that require a postoperative hospitalization. For example, hemophilia A or B, where close postoperative monitoring is necessary due to the increased risk of bleeding [27].

Question 6: How long is the recovery time from meniscus repair and meniscectomy?

The recovery time for meniscus repair and meniscectomy varies due to the different nature of these procedures:

Meniscus repair: Recovery Time: 3 to 6 months **Why:** Meniscus repair involves stitching the torn meniscus back together, which requires time to heal fully. The procedure is often recommended when the tear occurs in an area with good blood supply, which helps in healing. **Rehabilitation:** After surgery, the knee is often immobilized with limited weight-bearing for the first few weeks. Physical therapy is usually needed for several months to restore full strength, range of motion, and function.

Meniscectomy (partial): Recovery Time: 4 to 8 weeks. **Why:** A meniscectomy involves removing the torn portion of the meniscus. Recovery is faster because there is no need for the meniscus to heal – just the surrounding tissue. **Rehabilitation:** You can typically bear weight sooner and start physical therapy earlier compared to meniscus repair. Activities like walking may be resumed after a few days or weeks, and most people can return to sports or physical activities within 2 to 3 months.

Factors Affecting Recovery:

- **Type of Tear:** Larger or complex tears may extend recovery time.
- **Patient's Age:** Younger patients often heal faster.
- **Overall Health:** Good physical conditioning may promote faster recovery.
- **Post-surgery Care:** Following rehabilitation protocols strictly can optimize the healing process.

Analysis: Satisfactory requiring minimal clarification. ChatGPT provides an adequate time frame for recovery from meniscus injuries compared with the literature, which is particularly helpful for active patients who are aiming to return to sport. For patients who only participate in normal everyday activities, a recovery time of only a few days is correctly stated for a meniscectomy. However, no such information is given for meniscus repair. According to a study by Willinger et al. on meniscus repair, 100% of athletes returned to sport, but only 44.8% returned to their pre-injury level [28]. Another systematic review reported return-to-sport rates of 81–100% within 4.3–5.6 months after meniscus repair [29]. For patients who do not participate in sports or competitive sports, these rehabilitation times may be too long. After partial meniscectomies, average return-to-sport times of 35–50 days are stated in the literature. 78.3% of patients even reach their preoperative performance level [30]. It is rightly emphasized that rehabilitation depends on many individual factors. There is still no standardized postoperative treatment regime for all types of meniscal surgery [31].

Question 7: What is the difference between a meniscus repair and a meniscectomy?

The primary difference between meniscus repair and meniscectomy lies in the goal of the procedure and how much of the meniscus tissue is preserved.

1. Meniscus Repair

Purpose: In a meniscus repair, the surgeon attempts to sew the torn meniscus back together to allow it to heal naturally. **Procedure:** The torn edges of the meniscus are sutured or fixed with anchors, aiming to restore the normal structure of the knee. **Recovery:** This approach often requires a longer recovery time, as the body needs time to heal the repaired tissue. Recovery can take several months and usually involves a period of limited weight-bearing and physical therapy. **Candidacy:** It's more commonly done in younger patients or when the tear occurs in the outer third of the meniscus (the "red zone"),

where there is a good blood supply that can aid healing. Advantages: Preserving the meniscus helps maintain long-term knee stability and function, which can reduce the risk of osteoarthritis or other knee issues later in life.

2. Meniscectomy

Purpose: A meniscectomy involves the removal of the damaged part of the meniscus. It can be either partial (removing only the torn portion) or total (removing the entire meniscus). **Procedure:** The surgeon trims away the damaged portion of the meniscus, leaving behind healthy tissue. **Recovery:** Recovery is usually quicker compared to repair, often around 4 to 6 weeks, since there's no need to wait for tissue to heal. **Weight-bearing and movement** are often allowed sooner. **Candidacy:** This procedure is more common in older patients or when the tear is in an area with poor blood supply (the “white zone”), where healing is less likely to occur. **Disadvantages:** Removing part or all of the meniscus can increase the risk of knee instability, arthritis, or degeneration over time, as the meniscus plays a crucial role in cushioning and stabilizing the knee.

Summary: Meniscus Repair aims to preserve the meniscus by stitching it back together, leading to longer recovery but better long-term outcomes. Meniscectomy involves removing the damaged part of the meniscus, offering quicker recovery but with potential long-term knee issues due to the loss of meniscal tissue.

Analysis: Excellent response not requiring clarification. It is explained that the two types of surgical treatment are not two coexisting procedures, and that (partial) meniscectomy or meniscus repair should be selected depending on the localization, age, and corresponding findings. In addition, an adequate overview of the different postoperative treatment regimens, the generally shorter rehabilitation period after meniscectomy, and the resulting possible long-term consequences is provided.

Question 8: What are the possible risks or complications after meniscal surgery?

Infection: As with any surgery, there's a risk of infection at the incision site or deeper within the joint. This risk is generally low due to sterile surgical techniques but may require antibiotics or, in rare cases, additional surgery.

Deep Vein Thrombosis: Blood clots can form in the leg veins (DVT) after surgery, particularly if mobility is reduced post-surgery. These clots can be dangerous if they travel to the lungs (pulmonary embolism). Early mobilization and sometimes blood thinners are used to prevent this complication.

Stiffness or Loss of Motion: Scar tissue or joint inflammation following surgery can lead to stiffness or reduced range of motion in the knee. Physical therapy is critical to prevent or minimize this complication.

Persistent pain: Some patients may continue to experience knee pain after surgery, either due to incomplete healing, arthritis, or ongoing joint issues unrelated to the meniscus.

Re-tear of the meniscus: If a meniscal repair is performed, there's a chance the meniscus may not heal completely or could re-tear, especially if post-surgery activity guidelines are not followed.

Swelling: Temporary swelling is common, but persistent swelling might indicate an underlying issue like infection or improper healing.

Nerve or Blood Vessel Damage: There's a slight risk of damaging surrounding nerves or blood vessels during surgery, leading to numbness, weakness, or circulation problems.

Degenerative Changes: Removing part of the meniscus (partial meniscectomy) can increase the risk of long-term joint degeneration and osteoarthritis, as the meniscus serves as a shock absorber.

Failed meniscal repair: In the case of meniscal repair, healing can take several months, and in some cases, the repair does not hold, requiring additional surgery or even partial meniscectomy.

Anaesthesia risks: Complications from anaesthesia, such as allergic reactions or respiratory issues, though rare, are also possible.

Analysis: Excellent response not requiring clarification. In general, ChatGPT offers a detailed and comprehensive account of all relevant complications associated with meniscus surgery. The risk of infection during elective knee arthroscopy can be classified as minimal due to the minimally invasive technique employed. In a series of large-scale studies, the infection rate was found to range from 0.01 to 1.13% [32,33]. It can be stated that any form of immobilization carries an inherent risk of deep vein thrombosis. ChatGPT correctly states that early mobilization is required. In accordance with the expert consensus, the administration of thrombosis prophylaxis is only indicated for weight-bearing below 20 kg. This is permitted in the majority of postoperative rehabilitation programs for both types of care, which is why thrombosis prophylaxis is rarely indicated. Nevertheless, in clinical practice, the use of thrombosis prophylaxis is likely still common, even in cases where patients are permitted to bear full weight immediately following a meniscectomy [34]. Persistent pain has been documented in patients who have undergone both meniscectomy and meniscal suture. Revision surgery may be indicated in cases of persistent pain, meniscus rupture, material failure during meniscus suturing, or insufficiently resected meniscus during meniscectomy. Revision surgery is required in 3.7% of patients who have undergone meniscectomy and in 17% of patients who have undergone meniscal suturing [30]. The increased risk of developing osteoarthritis is only specifically mentioned by ChatGPT for meniscectomy, although a higher incidence is also observed for meniscus suturing compared with non-injured patients (19.2% meniscus suture vs. 60% meniscectomy) [25].

Question 9: How painful is meniscus surgery?

Meniscus surgery typically causes some discomfort, but the level of pain varies depending on the type of procedure and individual pain tolerance.

Arthroscopic Meniscectomy (removing part of the torn meniscus): Pain is usually moderate. Many patients report discomfort or soreness rather than severe pain. Recovery tends to be quicker, and pain generally subsides within a few days to weeks.

Meniscus Repair (suturing the tear): Pain may be more intense because the procedure is more invasive. Recovery is slower (several months), and you may feel discomfort during rehabilitation as the knee heals.

Pain is usually well-managed with prescribed pain medications, icing, and physical therapy. After surgery, most people experience some stiffness and swelling, but the pain lessens as healing progresses. Pain levels can also vary based on the condition of the knee before surgery.

Analysis: Satisfactory requiring minimal clarification. The answer differentiates between the two main types of meniscus surgery. It is specifically mentioned that the pain after a meniscectomy is less than after a meniscus repair. Furthermore, it is stated that the pain decreases as healing progresses and is generally well tolerated overall with the prescribed pain medication. Nevertheless, it should be borne in mind that pain tolerance varies from person to person. This allows a good assessment of the possible pain that the patient may experience. However, as already explained in the previous question, revision surgery may be necessary if pain persists, even if it is only mild [30].

Question 10: How long do I have to wait to drive after meniscus surgery?

The amount of time you need to wait before driving after meniscus surgery depends on several factors, including the type of surgery (whether it was a partial meniscectomy or meniscus repair), the leg involved (right or left), the nature of your job, and how well your recovery progresses.

Partial Meniscectomy: Recovery is generally faster because this surgery involves removing the damaged part of the meniscus. You may be able to drive within 1 to 2 weeks if you're no longer taking narcotic pain medications and you feel comfortable using the affected leg for braking or acceleration.

Meniscus Repair: This surgery involves stitching the meniscus, and recovery is typically slower. It may take 4 to 6 weeks before you're cleared to drive, especially if it's your right leg (which is needed for braking and acceleration).

Right vs. Left Leg: If your surgery was on your right knee, you should wait longer because you need full strength and control of your leg for braking. If the surgery was on your left leg and you drive an automatic transmission vehicle, you may be able to return to driving sooner, depending on how comfortable you feel and your surgeon's advice.

Medication: If you're still taking strong pain medications that affect your alertness, you should not drive.

Ultimately, your surgeon will give you specific guidance based on your recovery. It's crucial to wait until you feel confident in your ability to safely operate a vehicle. Typically, clearance is given during a follow-up appointment, usually a few weeks after surgery.

Analysis: Excellent response not requiring clarification. The chatbot gives an excellent answer about the possibility of driving a car after surgery, distinguishing between the two possible surgical treatment options, the side of the operated leg, as well as whether the car is automatic or manual, which would make the left leg irrelevant for driving. In addition, ChatGPT not only mentions the relevance of the function of the operated leg, but also takes into account the possible use of strong painkillers that affect reaction time in traffic and must be discontinued beforehand [35].

Summary of results

Four responses were excellent, requiring no clarification, four responses were satisfactory, requiring minimal clarification, two were satisfactory, requiring moderate clarification, none of the answers were unsatisfactory (Table 1).

4. Discussion

The most important finding of this study was that at least satisfactory answers were given by ChatGPT for all questions. Similar results have already been shown for hip prosthesis, anterior cruciate ligament and ulnar collateral ligament reconstruction, and rotator cuff repair in orthopedics, where at least 80% of the responses were satisfactory in each case [5,6,36]. One study showed that ChatGPT provides unsatisfactory outcomes overall [10]. However, the possible application of ChatGPT is not limited to orthopedic topics; it has already been shown that medical answers are also satisfactory in other fields [37]. It should be noted that the evaluation of the answers given by ChatGPT is based on subjective assessments. Nevertheless, the authors of this study believe that ChatGPT offers uninformed patients a valuable opportunity to obtain comprehensive information about surgical treatment options for meniscus injuries by asking targeted questions. To our knowledge, no legal claims can be derived from the information on ChatGPT. The information provided is primarily for orientation and information purposes, as is the case with any article available on the Internet. Final clarification should always be made by a doctor, as ChatGPT recommends in all cases.

It is important to continue to critically question the technology of language models. From the authors' point of view, it is not necessary for these models to be perfect, but it must be checked whether the given answers are more accurate and comprehensive than those that can be provided by a doctor in the time available. Particularly noteworthy is the potential for a meaningful addition between the doctor and ChatGPT. The preliminary information provided by ChatGPT can make the subsequent doctor's appointment more efficient, as the patient is already informed about basic procedures especially when dealing with frequently asked questions regarding procedures such as meniscus surgery. This creates space for a targeted discussion of patient-specific questions and ensures that the conversation is informative despite limited time, putting the patient in an informed position and may lead to fewer consultations and decreased costs in public healthcare [38]. The doctor's task is to provide patients with as much reliable information about their medical condition as possible in a time- and cost-efficient manner. Further studies are needed to clarify whether this can best be achieved through a conversation with a

doctor, by using ChatGPT alone, or by a combination of both, and, furthermore, whether final uncertainties or inaccuracies may be clarified and fully explained by further queries via ChatGPT. The creation of systematic reviews and *meta*-analyses regarding a specific research question must be evaluated and classified as a different application compared with the question of general patient questions.

5. Limitations

Limitations of this study are that ChatGPT does not always provide the same answer when asked the same question. In addition, ChatGPT may be able to adapt its answers based on previous questions that provide information about possible risk tolerance or current fitness level, for example. Therefore, it may not be possible to reproduce the above answers to the questions asked and therefore may not be fully comparable, especially when different wording may be misinterpreted by patients. The authors therefore conducted a new session for each new question, with the chat history deleted beforehand, to avoid possible bias from previous questions. However, this probably does not represent the course of action a patient would use with ChatGPT. A further limitation of this study is that the evaluation of the ChatGPT-generated responses was carried out exclusively by two authors from one center. Differences in treatment strategies and therapy recommendations, which may exist in other hospitals, facilities of different care levels or even in international comparison, were not taken into account in this analysis. Although the assessments were based on the current literature, this limits the generalizability of the results and should be taken into account when interpreting them. Furthermore, none of the answers address potential associated injuries or risk factors that may contribute to the development of the condition or affect healing. Possible changes in leg axis or concomitant injuries such as collateral ligament tears, especially anterior cruciate ligament tears, should always be considered. In addition, this study did not include follow up questions after the initial answers, as would be possible in a doctor–patient conversation to clarify any uncertainties. Furthermore, it is not known what sources of information ChatGPT has access to; it only states that information up to September 2021 will be used, which means that more recent information will not be processed at all. In the future, it will be necessary to see to what extent AI models have the ability to adapt their datasets and thus be able to access the latest information.

6. Conclusion

As hypothesized, ChatGPT provides satisfactory and reliable information for frequently asked questions about meniscus surgery.

Author contributions

W.F. and B.D. designed the study, B.D. and B.M. reviewed the list and redefined the questions, W.F. wrote the manuscript. G.F. and H.B. helped with data interpretation and critically reviewed the manuscript. B.D., B.M., G.F., and H.B. critically reviewed the manuscript. All authors read and approved the final manuscript.

CRedit authorship contribution statement

Felix Winden: Writing – original draft, Methodology, Investigation. **Markus Bormann:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Fabian Gilbert:** Writing – review & editing, Validation. **Boris M. Holzapfel:** Writing – review & editing, Validation. **Daniel P. Berthold:** Writing – review & editing, Methodology.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Finney Rutten LJ, Blake KD, Greenberg-Worisek AJ, Allen SV, Moser RP, Hesse BW. Online health information seeking among US adults: measuring progress toward a healthy people 2020 objective. *Public Health Rep* 2020;2019(134):617–25.
- [2] The Guardian. *ChatGPT reaches 100 million users two months after launch*. February 2023.
- [3] Frankfurter Allgemeine Zeitung. *ChatGPT erreicht 2,9 Milliarden monatliche Besucher*. 9th July 2024.
- [4] Jacquet C, Mouton C, Becker R, Koga H, Ollivier M, Verdonk P, et al. Does practice of meniscus surgery change over time? A report of the 2021 'THE MENISCUS' webinar. *J Exp Orthop* 2021;8:46.
- [5] Li LT, Sinkler MA, Adelstein JM, Voos JE, Calcei JG. ChatGPT responses to common questions about anterior cruciate ligament reconstruction are frequently satisfactory. *Arthroscopy* 2024;40:2058–66.

- [6] Mika AP, Martin JR, Engstrom SM, Polkowski GG, Wilson JM. Assessing ChatGPT responses to common patient questions regarding total hip arthroplasty. *J Bone Joint Surg Am* 2023;105:1519–26.
- [7] Varady NH, Lu AZ, Mazzucco M, Dines JS, Altchek DW, Williams 3rd RJ, et al. Understanding how ChatGPT may become a clinical administrative tool through an investigation on the ability to answer common patient questions concerning ulnar collateral ligament injuries. *Orthop J Sports Med* 2024;12:23259671241257516.
- [8] Megalla M, Hahn AK, Bauer JA, et al. ChatGPT and Google provide mostly excellent or satisfactory responses to the most frequently asked patient questions related to rotator cuff repair. *Arthrosc Sports Med Rehabil* 2024;6:100963.
- [9] Ayers JW, Poliak A, Dredze M, Leas EC, Zhu Z, Kelley JB, et al. Comparing physician and artificial intelligence chatbot responses to patient questions posted to a public social media forum. *JAMA Intern Med* 2023;183:589–96.
- [10] Johns WL, Martinazzi BJ, Miltenberg B, Nam HH, Hammoud S. ChatGPT provides unsatisfactory responses to frequently asked questions regarding anterior cruciate ligament reconstruction. *Arthroscopy* 2024;40:2067–79 e1.
- [11] Carr, J.B. *Meniscus Surgery: Meniscectomy, Transplant, and Repair*. 2023. Available at: https://www.hss.edu/conditions_meniscus-surgery-meniscectomy.asp [accessed 09.10.2024].
- [12] Cleveland Clinic. Torn meniscus. Available at: <https://my.clevelandclinic.org/health/diseases/17219-torn-meniscus> [accessed 09.10.2024].
- [13] Mayo Clinic. Torn meniscus. Available at: <https://www.mayoclinic.org/diseases-conditions/torn-meniscus/symptoms-causes/syc-20354818> [accessed 09.10.2024].
- [14] Charité – Universitätsmedizin BerlinBerlin. Meniscus injuries. Available at: https://unfallchirurgie.charite.de/leistungen/endoprothetik_gelenkchirurgie/meniskusverletzungen/ [accessed 09.10.2024].
- [15] London, R.O.H., Meniscal repair of the knee. 2024. Available at: <https://roh.nhs.uk/services-information/knees/meniscal-repair-of-the-knee> [accessed 09.10.2024].
- [16] Elphinstone JW, Alston ET, Colorado BS. Platelet-rich plasma for nonoperative management of degenerative meniscal tears: a systematic review. *J Orthop* 2024;54:67–75.
- [17] Jacob G, Shimomura K, Krych AJ, Nakamura N. The meniscus tear: a review of stem cell therapies. *Cells* 2019;9:92.
- [18] Biedert RM. Treatment of intrasubstance meniscal lesions: a randomized prospective study of four different methods. *Knee Surg Sports Traumatol Arthrosc* 2000;8:104–8.
- [19] Gauffin H, Tagesson S, Meunier A, Magnusson H, Kvist J. Knee arthroscopic surgery is beneficial to middle-aged patients with meniscal symptoms: a prospective, randomised, single-blinded study. *Osteoarthritis Cartilage* 2014;22:1808–16.
- [20] Herrlin S, Hallander M, Wange P, Weidenhielm L, Werner S. Arthroscopic or conservative treatment of degenerative medial meniscal tears: a prospective randomised trial. *Knee Surg Sports Traumatol Arthrosc* 2007;15:393–401.
- [21] Yim JH, Seon JK, Song EK, Choi JJ, Kim MC, Lee KB, et al. A comparative study of meniscectomy and nonoperative treatment for degenerative horizontal tears of the medial meniscus. *Am J Sports Med* 2013;41:1565–70.
- [22] Teichtahl AJ, Wluka AE, Wang Y, Strauss BJ, Proietto J, Dixon JB, et al. The longitudinal relationship between changes in body weight and changes in medial tibial cartilage, and pain among community-based adults with and without meniscal tears. *Ann Rheum Dis* 2014;73:1652–8.
- [23] Paxton ES, Stock MV, Brophy RH. Meniscal repair versus partial meniscectomy: a systematic review comparing reoperation rates and clinical outcomes. *Arthroscopy* 2011;27:1275–88.
- [24] Tengroottenhuysen M, Meermans G, Pittoors K, van Riet R, Victor J. Long-term outcome after meniscal repair. *Knee Surg Sports Traumatol Arthrosc* 2011;19:236–41.
- [25] Stein T, Mehling AP, Welsch F, von Eisenhart-Rothe R, Jäger A. Long-term outcome after arthroscopic meniscal repair versus arthroscopic partial meniscectomy for traumatic meniscal tears. *Am J Sports Med* 2010;38:1542–8.
- [26] Barber-Westin SD, Noyes FR. Clinical healing rates of meniscus repairs of tears in the central-third (red-white) zone. *Arthroscopy* 2014;30:134–46.
- [27] Coppola A, Windyga J, Tufano A, Yeung C, Di Minno MN. Treatment for preventing bleeding in people with haemophilia or other congenital bleeding disorders undergoing surgery. *Cochrane Database Syst Rev* 2015;2015:CD009961.
- [28] Willinger L, Herbst E, Diermeier T, Forkel P, Woertler K, Imhoff AB, et al. High short-term return to sports rate despite an ongoing healing process after acute meniscus repair in young athletes. *Knee Surg Sports Traumatol Arthrosc* 2019;27:215–22.
- [29] Sherman SL, DiPaolo ZJ, Ray TE, Sachs BM, Oladeji LO. Meniscus injuries: a review of rehabilitation and return to play. *Clin Sports Med* 2020;39:165–83.
- [30] D'Ambrosi R, Meena A, Raj A, Ursino N, Mangiavini L, Herbolt M, et al. In elite athletes with meniscal injuries, always repair the lateral, think about the medial! a systematic review. *Knee Surg Sports Traumatol Arthrosc* 2023;31:2500–10.
- [31] Hanna T, Smith NP, Sebastianelli WJ. Treatment, return to play, and performance following meniscus surgery. *Curr Rev Musculoskelet Med* 2022;15:157–69.
- [32] Sherman OH, Fox JM, Snyder SJ, Del Pizzo W, Friedman MJ, Ferkel RD, et al. Arthroscopy – “no-problem surgery”. an analysis of complications in two thousand six hundred and forty cases. *J Bone Joint Surg Am* 1986;68:256–65.
- [33] Martin, C.T., A.J. Pugely, Y. Gao, and B.R. Wolf. Risk factors for thirty-day morbidity and mortality following knee arthroscopy: A review of 12,271 patients from the national surgical quality improvement program database. *J Bone Joint Surg Am*. 2013. **95**: p. e98 1-10.
- [34] German Society for Angiology – Society for Vascular Medicine. S3 Guideline: Prophylaxis of venous thromboembolism (VTE). Available at: <https://register.awmf.org/de/leitlinien/detail/003-001> [accessed 09.04.2025].
- [35] Cameron-Burr KT, Conicella A, Neavyn MJ. Opioid use and driving performance. *J Med Toxicol* 2021;17:289–308.
- [36] Johns WL, Kellish A, Farronato D, Ciccotti MG, Hammoud S. ChatGPT can offer satisfactory responses to common patient questions regarding elbow ulnar collateral ligament reconstruction. *Arthrosc Sports Med Rehabil* 2024;6:100893.
- [37] Johnson, D., R. Goodman, J. Patrinely, C. Stone, E. Zimmerman, R. Donald, et al., Assessing the accuracy and reliability of AI-generated medical responses: An evaluation of the Chat-GPT model. *Res Sq* [Preprint]. 2023:rs.3.rs-2566942. <https://doi.org/10.21203/rs.3.rs-2566942/v1>.
- [38] gGmbH, Z.f.e.W.-S.S., Behandlungsgespräche in der Arztpraxis – Ein Europäischer Vergleich. 18.10.2023: p. S. 47.